Practical 5

Part 2: Spatial Mapping

In recent years, ecology, sustainability, and policy have become more important for the management of land and water development. In response, spatial tools have rapidly developed, where these tools are used for investigating landscapes and how those landscapes are changing. Landscape changes can be naturally occurring (such as those changes which affect river flows, vegetation patterns and vegetation health), or these changes can be human induced (otherwise known as anthropogenic changes – such as those relating to urbanization, aquaculture, water resource development, and forestry).

Aim

The aim of this lab is to explore the differences in vegetation, geology, hydrology and urbanization between Centennial Park and Randwick Environment Park (locations where you have completed fieldwork practicals).

- **Software** - We will be using a GIS spatial software called Google Earth Pro. **You will need to download and install this**.
- **Data** – You will find all the data you need on Moodle under the toggle "Week 5 > Google Earth Pro Files > Download folder. Download all the files into one folder on your computer.
- NB/ Some windows may look slightly different on PC vs Mac, but the software is very similar across both operating systems.

Definitions

- **Remote Sensing** – Scanning the earth by satellite or high-flying aircraft to collect data.
- **Geographic Information System (GIS)** – Software system using remote sensing information to manipulate, interpret and present data across all types of ecosystems. GIS can be described as a "smart map" allowing users to create interactive queries (user created searches), analyse the spatial information and edit data (http://en.wikipedia.org/wiki/Gis).

Application

To analyze ecosystems, land, and water changes over a range of spatial (space) and temporal (time) scales, many environmental scientists use remote sensing and Geographical Information Systems (GIS). The exercises conducted in this class will form part of your assignment (part 2 of Assignment 1).

Here are some examples of how environmental scientists at UNSW have used remote sensing and GIS:

1. Mangrove death in Northern Australia

Mangroves play a crucial role in coastal protection, carbon storage, water purification, and supporting diverse ecosystems. In 2015, a fisherman in Burketown, northern Australia, reported widespread mangrove die-off. UNSW scientists used remote sensing, drones, and GIS mapping to assess the damage, identifying 2,470 ha of complete loss in Kakadu National Park. The analysis linked this to a strong El Niño, which caused lower sea levels, drought, and extreme heat, pushing mangroves past their survival threshold. These insights help guide conservation efforts to protect wetlands, biodiversity, and local communities dependent on fisheries.

2. Threats and conservation priorities for migratory shorebirds

Over 26 species of shorebirds migrate 20,000 km annually between Arctic breeding grounds and southern feeding areas, but their populations are declining. UNSW environmental scientists used remote sensing to reveal significant habitat loss in East Asia's Yellow Sea, a key stopover site. GIS mapping showed that nearly two-thirds of tidal flats have disappeared since the 1950s. Further habitat mapping in Australia and New Zealand helped strengthen connections between these vital areas and shorebird populations, informing conservation efforts.

Let's get Started!

Follow the steps below to begin your analysis:

- Install and open the Google Earth Pro program
  - To open Google Earth go to **Start** > **All Programs > Google Earth Pro.** Or for Mac go to **Applications > Google Earth Pro**

Exercise 1

1.1 Types of Data

There are two main types of data that can be added to GIS: Vector and Raster.

- **Vector data** is like a digital map with points, lines, and shapes. It's used to show things like roads, rivers, or city locations.

- **Raster data** is like a photo made of tiny squares (pixels), where each square has information, such as temperature or elevation.

Both types help scientists and mapmakers analyse and understand different features of a place.

1.2 Types of Vectors

There are three shapes that we can import into our environment. You can find the shapes at the top right corner of your map:

*Go to Question 1 in the Workbook*

1.2 Raster Data

The satellite images and aerial photographs you see in Google Earth are raster data because they are made up of pixels, just like a digital photo. Each pixel represents a specific area on the Earth's surface and contains visual information like colour and brightness.
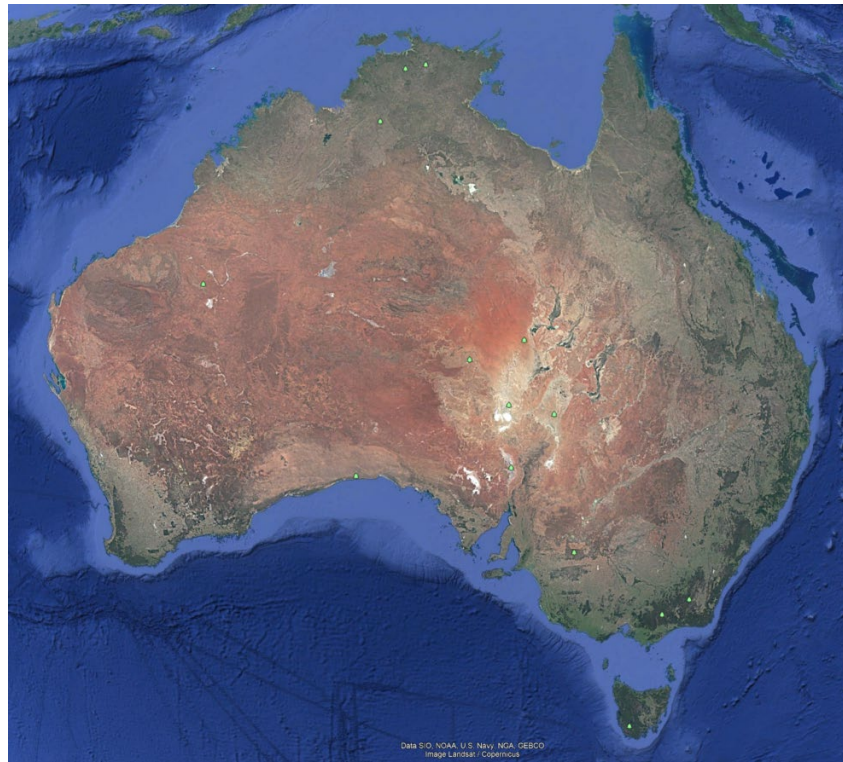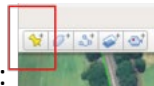

Exercise 2

2.1 Locating our study sites

- In the search bar type in Centennial Park, NSW:
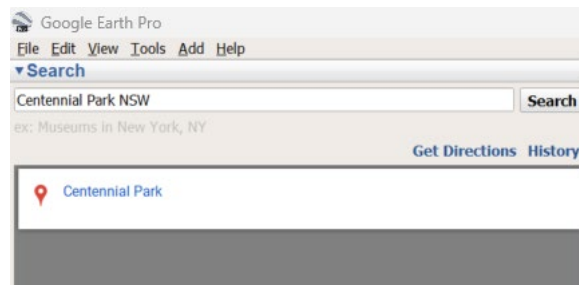
Zoom in until you can see Lachlan Swamp and placemarker in the area:

- You can find the placemarker here:
- Drag the placemarker and place the marker in Lachlan Swamp and be sure to name it!
- You can also change the colour of the pin and font by going to "Style, Color"
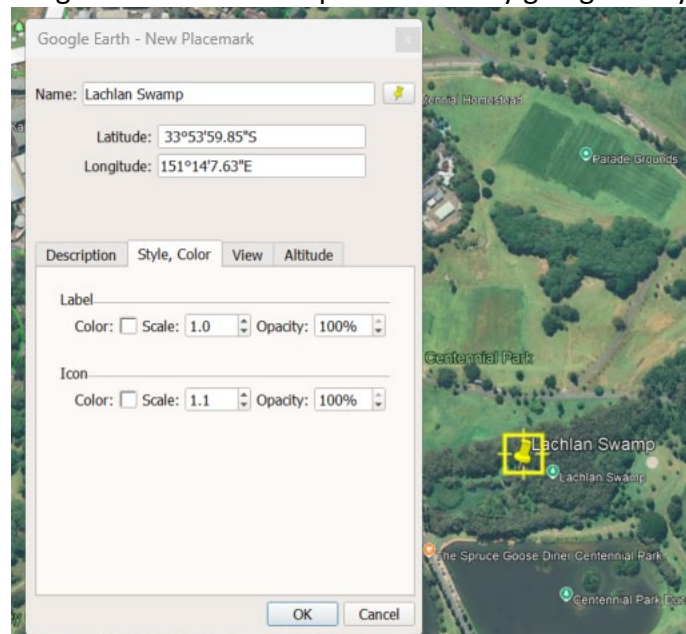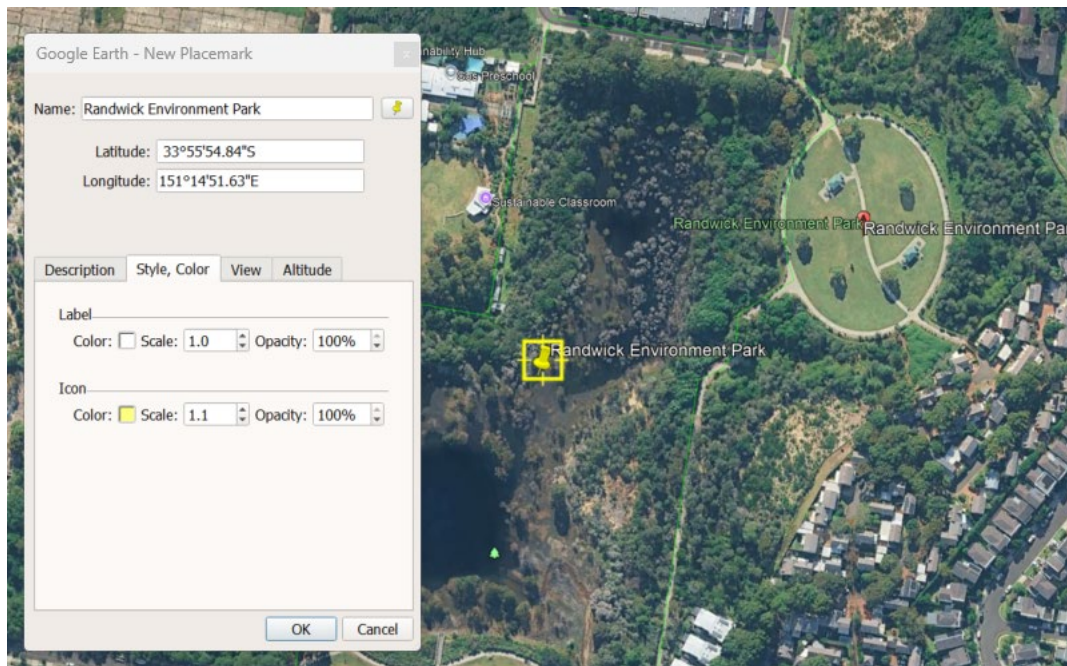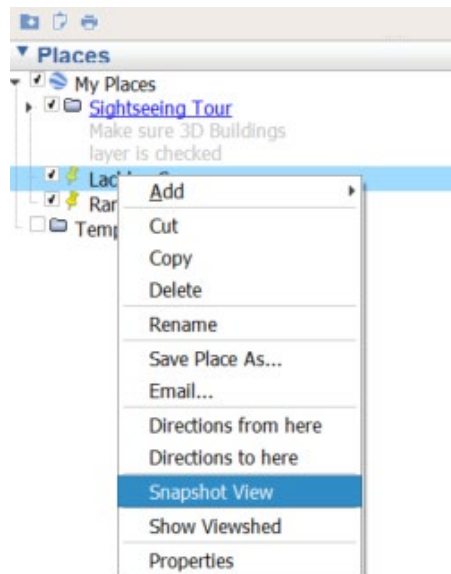

Let's do the same for Randwick Environment Park:

- In the search bar type in Randwick Environment Park:
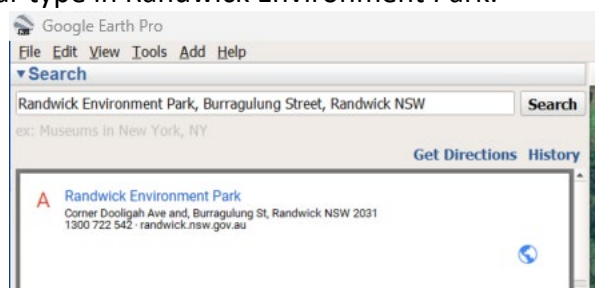
- And add a placemarker:

- Now zoom out so you can see both of you pins right click on Lachlan swamp in the "Places" panel and pick "Snapshot View" – now if you navigate away from the area of interested you can double click your pin and automatically get navigated back
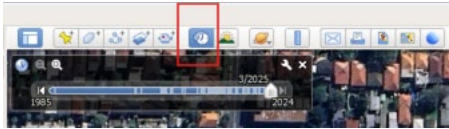

2.2 Landscape changes

The landscape has changed in both Centennial Park and Randwick Environment Park (recall the history videos week 1 & 2). We can visualize some of these landscape changes on our map.

- Zoom into a park
- Use the Historical Imagery tool (looks like a clock) to see how the park has

changed in the last 20 years by moving the pointer along the timeline:

Go to Question 2 in the Workbook

- Make sure that you've clicked the Historical Imagery tool to reset the map to present day

Exercise 3

## 3.1 Importing Vector Data

- First let's clean up your map a bit. In the Layers panel make sure the following options are ticked (and the rest are unticked):
    - Places
    - Trees
   - Parks/Recreation Area
    - Water Body Outlines
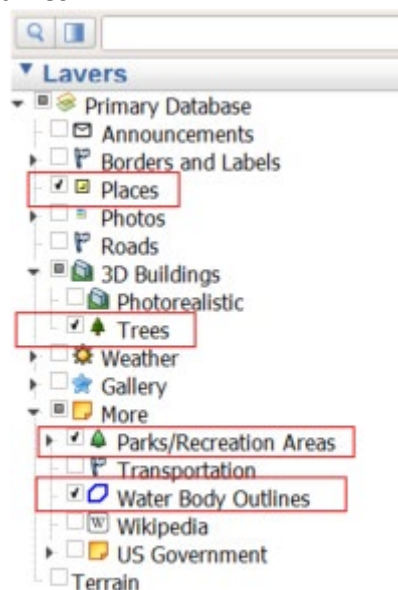
- Download the vector data from moodle onto your computer. Navigate to moodle Week 5 > Google Earth Pro Data > download
- Load the "UrbanAreas.kml" file into your map by navigating to File > Open > UrbanAreas.kml
    - It should now appear in the "Places" panel
    - Right click UrbanAreas.kml, select properties, and Style,Color tab, then click "Share Style" to change the colour, outline, and opacity of this vector (avoid colours like green and blue):
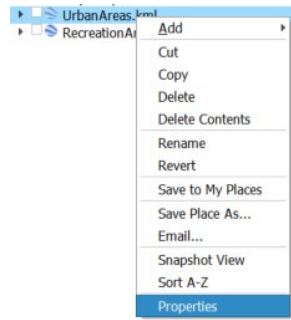
- Feel free to copy my settings:
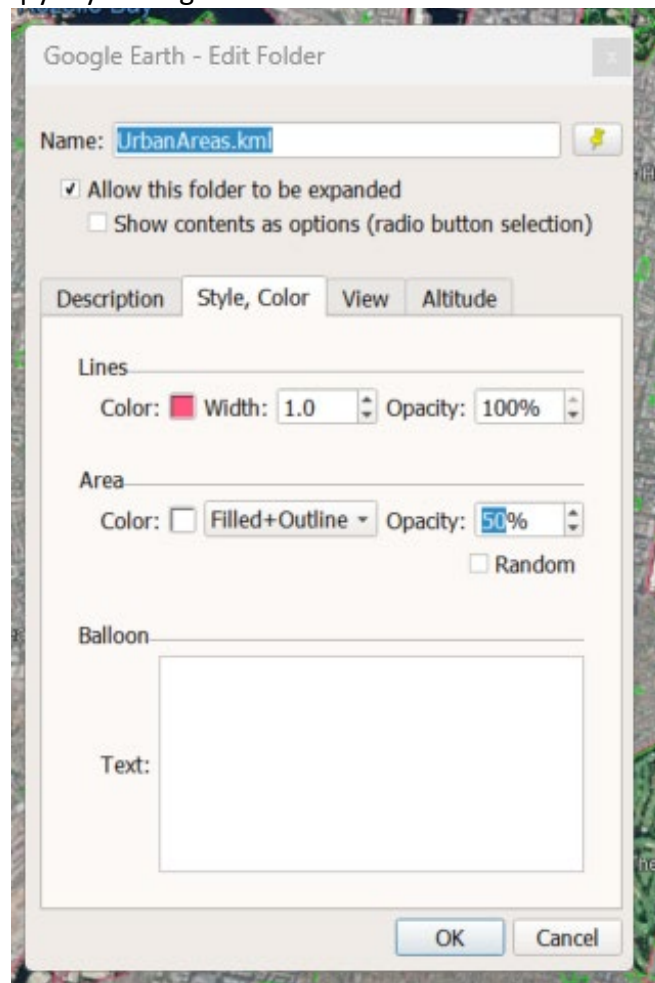
- Now let's do the same for the entitled "RecreationAreas.kml"
- Here are my colour and style settings:
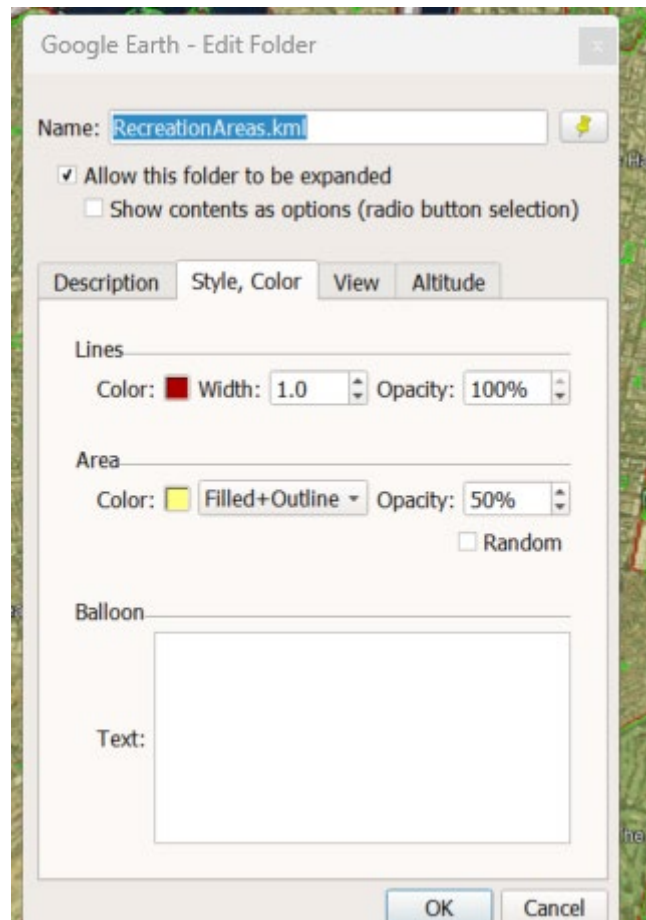
- Now toggle through the two files via the checkboxes in the Places panel
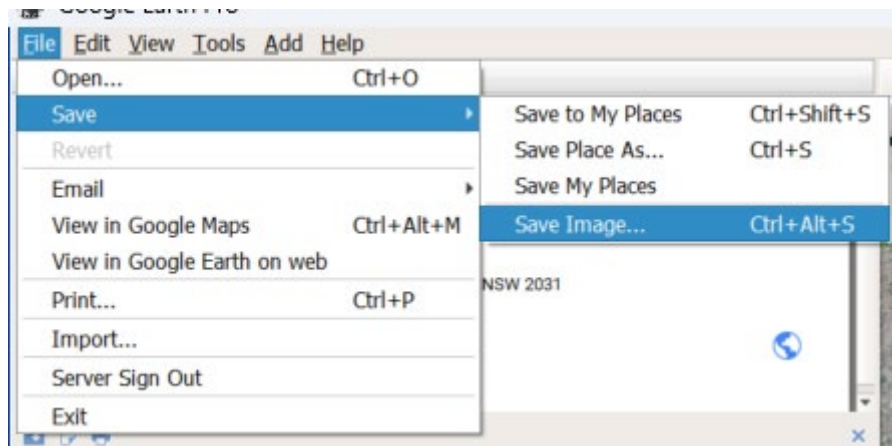
Go to Question 3 in the Workbook
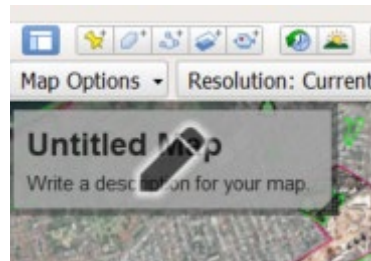
Exercise 4

4.1 Save your map

Let's save our map so that we can include it in our methods section of the report

- Zoom out so that both parks are visible in your map
- File > Save > Save Image

- Name your map:

- Toggle the legend setting to only include things you are interested in
- Save your image: