Greater Sydney SkySat Basemap

Mapping of Greater Sydney with high resolution 50cm satellite imagery

Contents

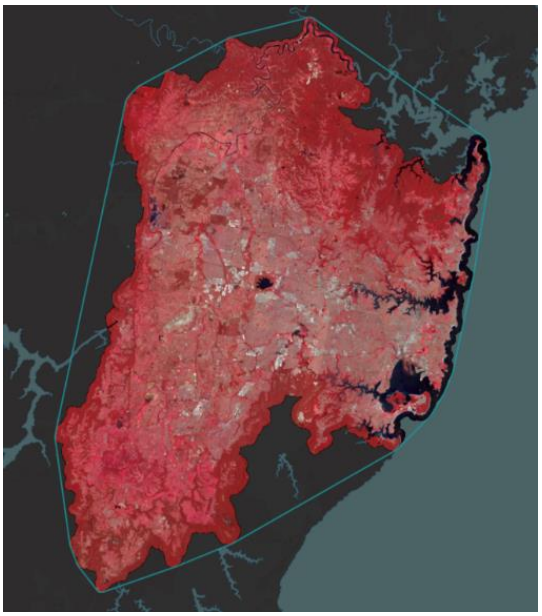


Figure 1: Snapshot of Greater Sydney SkySat Basemap displaying the near infrared band as red.

Purpose

The Greater Sydney SkySat Surface Reflectance Mosaic was procured by the NSW Department of Climate Change, Energy, Environment & Water (DCCEEW) in response to a request from the NSW Department of Planning, Housing and Infrastructure to capture high resolution satellite imagery over the Cumberland Plains Conservation Area. Given the opportunity available, the area of capture was extended to incorporate areas of Greater Sydney and surrounds. The resulting mosaic has been made available via the NSW Spatial Imagery Hub for all Government of NSW Planet subscribers.

Western Sydney is an important area for many threatened and iconic species such as the koala, Nodding Geebung and Cumberland Plain Land Snail. The CPCP's (Cumberland Plains Conservation Plan) vision is to 'support Western Sydney's biodiversity and growth'. This means it will support the planned and strategic delivery of housing, infrastructure and jobs for Western Sydney while protecting and maintaining important biodiversity areas. These include commitments and actions to conserve flora, fauna and associated habitat, avoid and minimise impacts from development and manage landscape treats. The CPCP is committed to delivering new conservation lands to offset impacts to threatened plants and animals from development, which include new reserves, additions to existing reserves, and biodiversity stewardship sites. Securing land with healthy native vegetation, connectivity or potential for ecological restoration will help protect Western Sydney's plants and animals in the future.

Technical background

The Greater Sydney SkySat Surface Reflectance Mosaic is made up of multiple Planet SkySat satellite images of 50cm resolution, rendered into a single, complete composite, comprising the best scenes over a specific time period, from 1 December 2023 to 13 January 2024. The Greater Sydney SkySat mosaic is a Normalised Surface Reflectance mosaic generated from Planet's basemap generation pipeline.

This document provides information on how to use the Greater Sydney SkySat Basemap product.

Further information

The Spatial Imagery Services Team, Science Division, are responsible for the administration and management of Planet in NSW. For enquiries please email: spatial.imagery@environment.nsw.gov.au

We acknowledge and pay our respect to the traditional custodians of the lands and waters of Australia, and all Aboriginal Elders past and present.

Frequently Asked Questions – Product specifications

What is the Greater Sydney Area of Interest (Basemap Coverage)?
The Basemap mosaic includes an approximate 5,000km^2 area of interest covering the priority Cumberland Plains Conservation Area and Sydney city. To check if your area is in the basemap's coverage, please use the following web search app: https://arcg.is/14nyLr2

The following Local Government Areas are covered:

- Bayside
- Blacktown
- Blue Mountains (partial coverage)
- Burwood
- Camden
- Campbelltown (partial coverage)
- Canada Bay
- Canterbury-Bankstown
- Central Coast (partial coverage)
- Cumberland
- Georges River
- Hawkesbury (partial coverage)
- Hornsby
- Hunters Hill
- Inner West
- Ku-ring-gai
- Lane Cove
- Liverpool
- Mosman
- Northern Beaches
- Parramatta
- Ryde
- Strathfield
- Sutherland Shire (partial coverage)
- Sydney
- The Hills Shire
- Waverley
- Willoughby
- Wingecarribee (partial coverage)
- Wollondilly (partial coverage)
- Woolahra

If you have a Planet account, you can view the Basemap here:
https://www.planet.com/explorer/?s=Cgf1h1-QRnuxy8G07vFeDw

If you are outside of the AOI, please reach out to the NSW Imagery Hub team:
spatial.imagery@environment.nsw.gov.au

When was the Area of Interest captured by Planet's SkySat constellation?
The imagery capture period took place between 1 December 2023 and 13 January 2024. The mosaic is made up of different imagery from the window of capture. Planet provide a tool to identify the date of capture for each pixel, using the Inspector tool when using Planet Add-in for ArcGIS Pro & Plugin for QGIS and in Planet's Basemap Viewer UI. This tool allows you to identify the source contributing scene image used in that part of the mosaic and view the scene's metadata. For help, please contact: spatial.imagery@environment.nsw.gov.au

What is the Basemap Name in Planet Explorer?
New South Wales SkySat Normalized SR

What is the full mosaic name?
nsw_skysat_normalized_analytic_2023-12-01_to_2024-01-13_v2_mosaic

What is the Basemap Projection?
WGS84 Web Mercator (EPSG:3857).

What is the pixel size?
59.6 cm at the Equator (Zoom level 18 in Planet Explorer). This equates to 49.6 cm at the far latitudes of the area of interest.

What is the Image Bit Depth?
The underlying data is 16-bit, for a downloaded quad the data will be 16-bit GeoTIFF. However, please note that web browsers will not display 16-bit images, only 8-bit data is available through the Basemap web service and Planet Explorer web viewer.

What is the source imagery that is used in the mosaic and what processing steps have been applied?
SkySat mosaics are generated using the Ortho Analytic Surface Reflectance asset (ortho_analytic_sr). These assets are orthorectified, multispectral (blue, green, red, near-infrared) and are corrected for effects of the Earth's atmosphere by using external data sources like MODIS.

Additional empirical corrections have been applied to approximately match the spectral response and radiometry to PlanetScope and avoid scene to scene inconsistencies due to varying acquisition geometry and uncertainty in atmospheric correction parameters. More information about the SkySat source imagery used in the creation of the mosaic is available in Planet Developer Centre.

How are the scenes used in the mosaic selected?
Planet employs a proprietary automated mosaicing process using a "best scene on top" methodology to select the highest quality scenes for use in a mosaic, for example images that contain the lowest fraction of cloud coverage or have the highest acutance (sharpness). For SkySat mosaics, sun angle and off-nadir angle are additional factors in determining the best available scene.

What is the geolocational accuracy of the mosaic?
Imagery product specifications for the SkySat source scenes (ortho analytic surface reflectance) is 90% of all scenes will be within 10m RMSE absolute positional accuracy. When creating this mosaic, the geolocational information from the source imagery is used as is.

I am viewing the mosaic using RGB (Red, Green, Blue) true colour visualisation band combination, but there are some areas that look strange, why is this?
The mosaic generated is a Surface Reflectance 16-bit mosaic. While it is possible to view the mosaic in true colour combination the processing has not been optimised for visual performance, it has been optimised for radiometric consistency.

If you have a visual use case, it may be more suitable for you to view or obtain the original source SkySat imagery as a visual product in Planet Explorer, Planet Integrations or by a web tile service such as XYZ. The SkySat visual asset is orthorectified, colour-corrected and optimised for direct visual inspection. Please reach out to the Spatial Imagery Hub to discuss the SkySat assets that may be more suitable to use in your project: spatial.imagery@environment.nsw.gov.au

Why does water look churned or turbid?
You may occasionally see areas where water looks churned or turbid when viewing the mosaic in the RGB true visualisation band combination. This is likely an example of sunglint, where sunlight is reflected off a surface such as water and was captured by the sensor.

Why am I seeing cloud shadow when there are no clouds nearby?
When the mosaic was created the algorithm uses a 'best on top' approach to mask out contributing scenes with clouds, however the mask doesn't incorporate shadow detection. It is expected that you may see occasional cloud shadows in the mosaic.

Where can I find out more about the Surface Reflectance mosaic processing steps?
Planet's Surface Reflectance Basemap Technical Datasheet provides more information about the processing applied to the SkySat mosaic, including normalisation for radiometric consistency and seamline removal. One note of difference, this specific SkySat mosaic was normalised using a monthly PlanetScope SR mosaic as its normalisation target.

Is it possible to find out exactly what date/time a particular location was captured?
Yes, during the mosaic generation process a record of each individual SkySat image used is retained. It is possible to find out when a location was captured and the contributing scene, by using the Inspector tool when using Planet Add-in for ArcGIS Pro & Plugin for QGIS and in Planet's Basemap Viewer UI. Furthermore, a sourcetrace vector file is also available for the entire Greater Sydney mosaic. Please reach out to the Spatial Imagery Hub for more information: spatial.imagery@environment.nsw.gov.au

What tools are available for delivery methods?
The Greater Sydney SkySat Basemap is available streamed online, as a web service, or in Planet's application viewers, and integrations. GeoTIFFs of the mosaics and raw scenes are available on request to: Spatial.imagery@environment.nsw.gov.au. Please see the following pages of this document for further instructions. A list of tools include:

- Planet Explorer: https://www.planet.com/explorer/
- Planet Basemap Viewer: https://www.planet.com/basemaps
- Planet ArcGIS Pro Add-in: https://learn.planet.com/download-arcgis-pro-add-in
- Planet QGIS Plugin: https://learn.planet.com/QGIS-Download-Now

- Planet Basemap Web Tile Service Web Page: https://api.planet.com/basemaps/v1/services?api_key={APIKEY}
- Planet Account Page (for API Key): https://www.planet.com/account/#/

All Planet delivery methods and tools require a NSW Planet user account. Request an account by contacting: Spatial.imagery@environment.nsw.gov.au

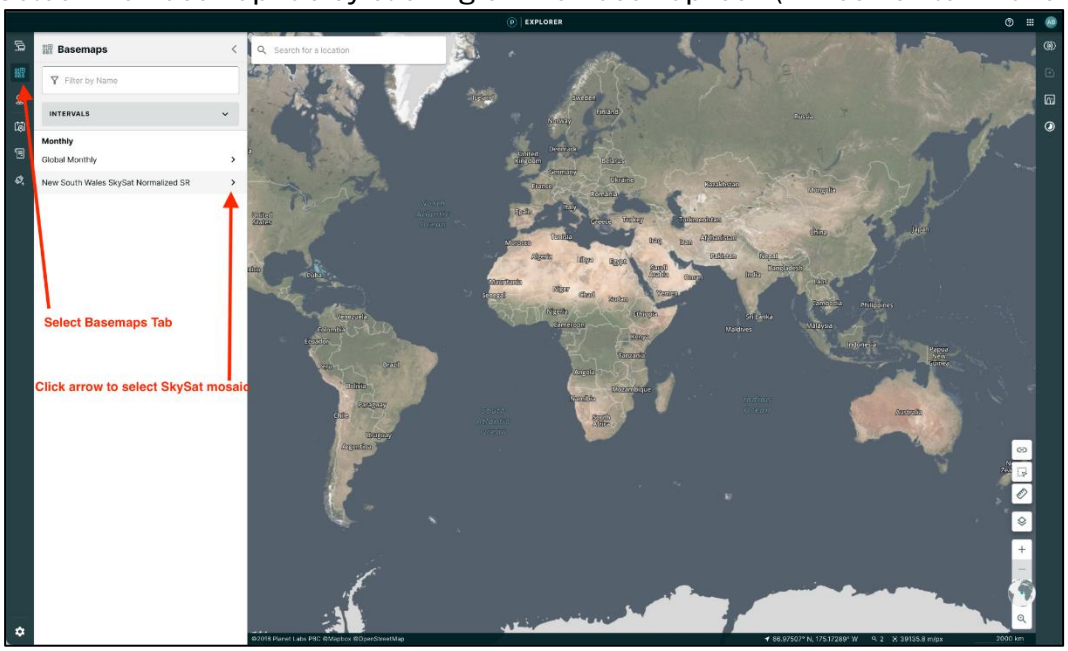
The Spatial Imagery Services Team, Science Division, are responsible for the administration and management of Planet in NSW. For further questions please email: spatial.imagery@environment.nsw.gov.au

Delivery methods

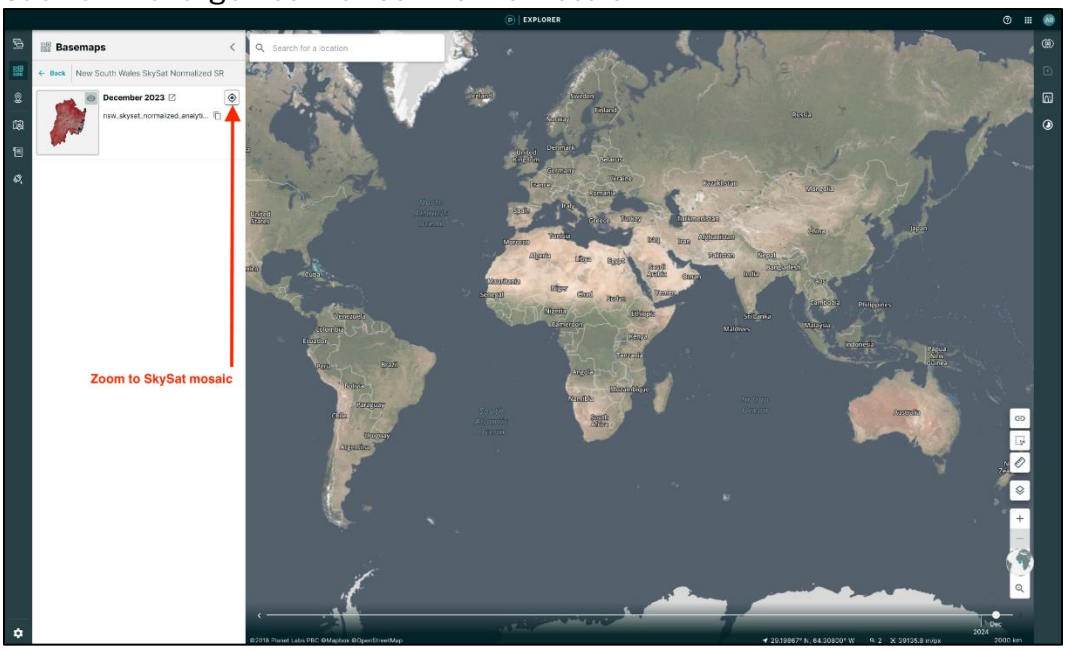
Planet Explorer

Planet Explorer provides an ability to view the basemap online in a web application.

1. Sign into your Planet user account (email and password) here: planet.com/explorer
2. Select the Basemap tab by clicking on the Basemap icon (2nd icon on left-hand side):

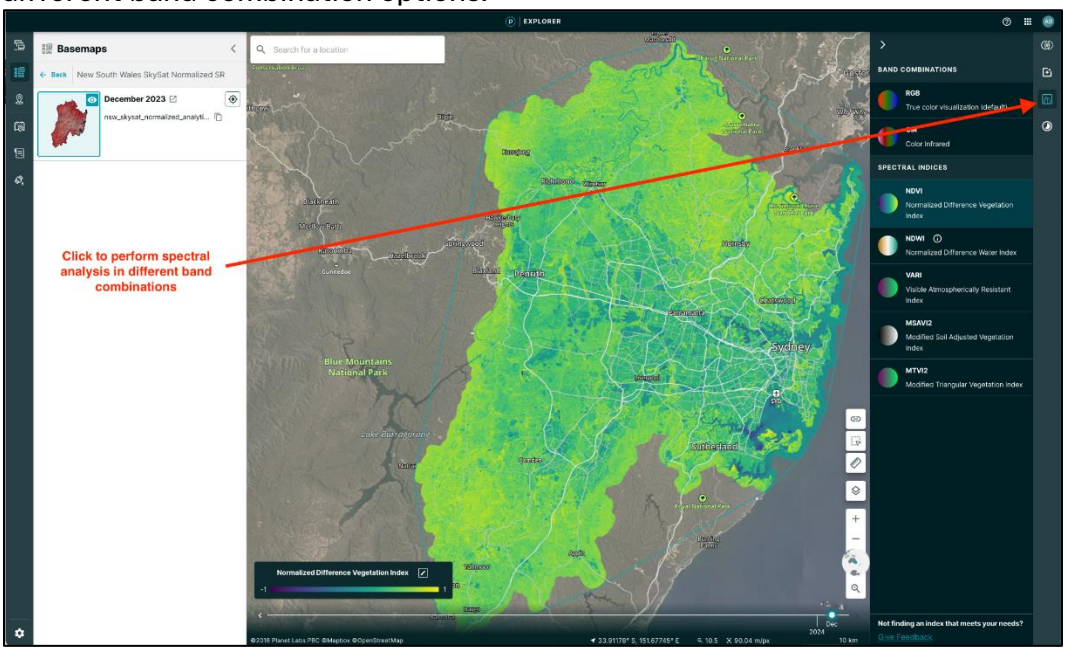


3. Click on arrow next to basemap name New South Wales SkySat Normalised SR.
4. Click on the target icon to zoom to the mosaic:



5. Click on the eye icon to see the basemap tiles:

6. Navigate to the right-hand side of the page and click on the Perform Spectral Analysis icon (3rd button down, right-hand side), to perform spectral indices and view different band combination options:

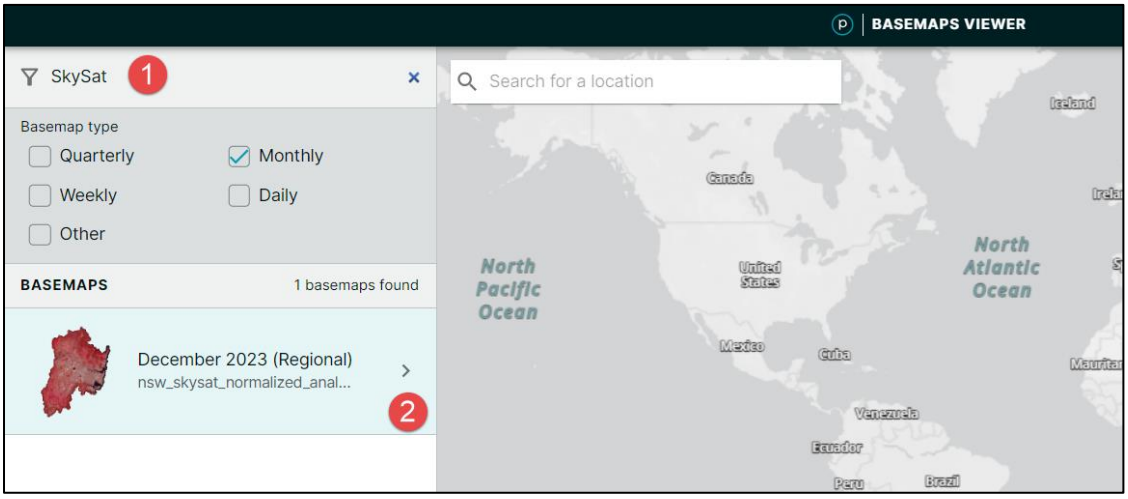


7. Select RGB to see a true colour visualisation. Try out the other tools available.
8. If you wish to undertake further analysis or require the GeoTIFF files, please contact: spatial.imagery@environment.nsw.gov.au

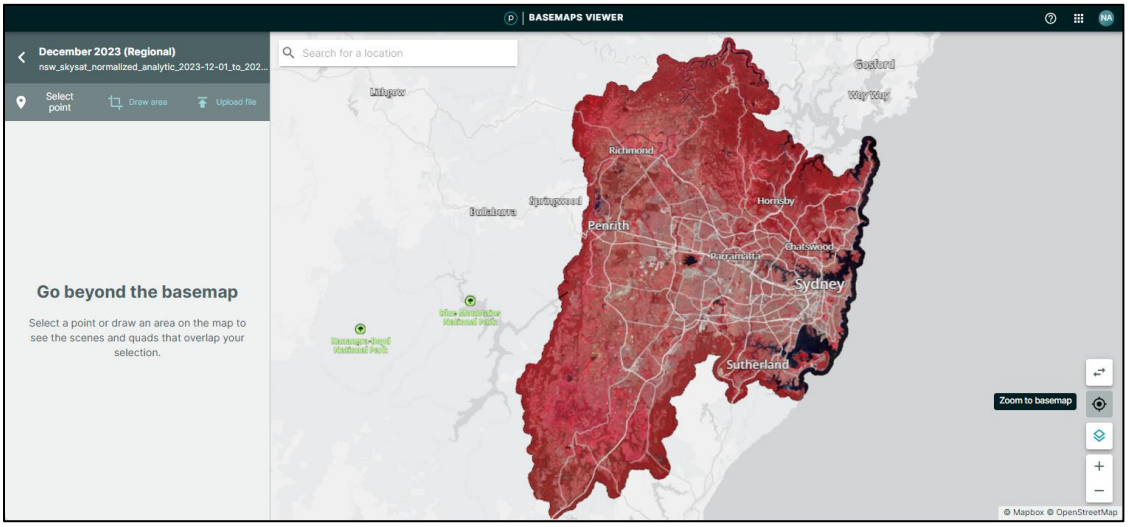
Planet Basemap Viewer

The Basemap Viewer provides the ability to view the basemap and inspect source images and associated metadata.

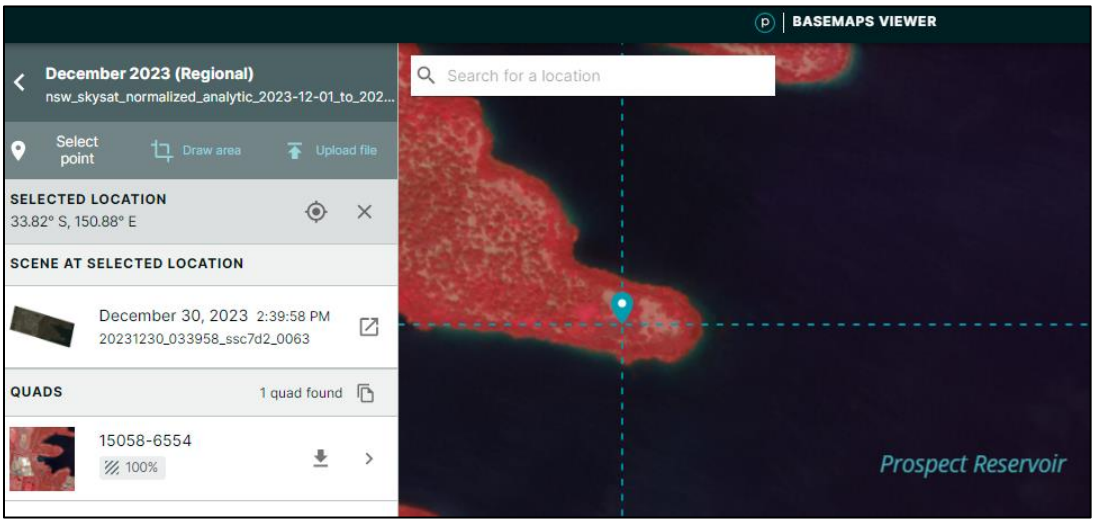
1. Sign into your Planet user account here: planet.com/basemaps
2. Type “SkySat” to find the NSW SkySat Normalised SR basemap, and click on the arrow next to the basemap.



3. Use the zoom tools in the lower right to zoom to the mosaic:

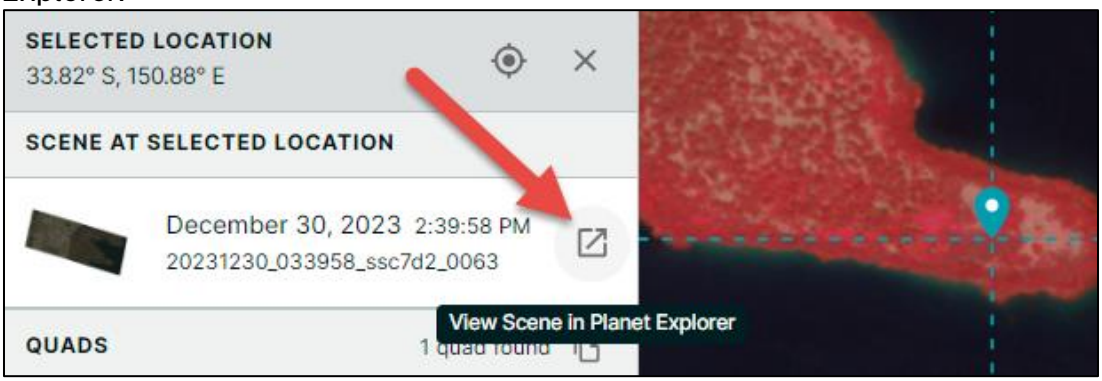


4. To view quads and inspect contributing SkySat source scenes, click on any point (pixel) on the screen. This will load the panel on the left-hand side to display the name of the quad and scene at the selected location, displaying the Longitude and Latitude of the point selected, and the exact date of capture for the pixel selected.

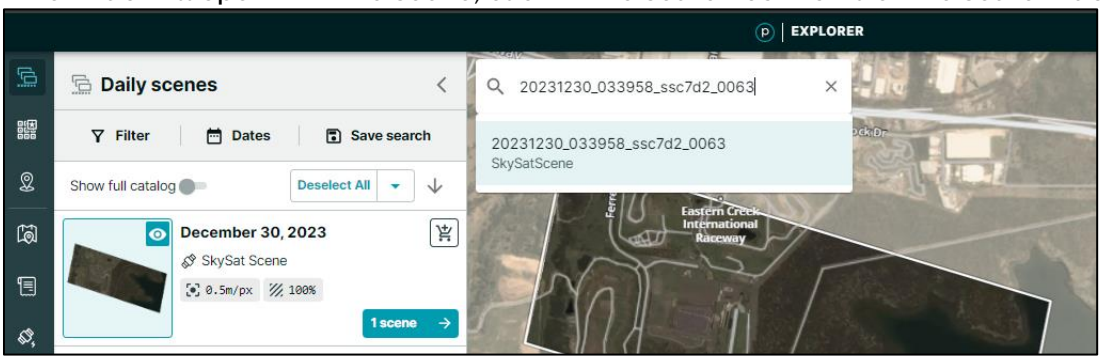


5. Users with download access will see “order” arrow button to download quads. This is only available for administrators. If you wish to have the quads or source scenes downloaded for you, please contact: spatial.imagery@environment.nsw.gov.au

6. Place your cursor over scene information to see preview of contributing original scene’s footprint on the map. Click on the button to view the original scene in Planet Explorer.



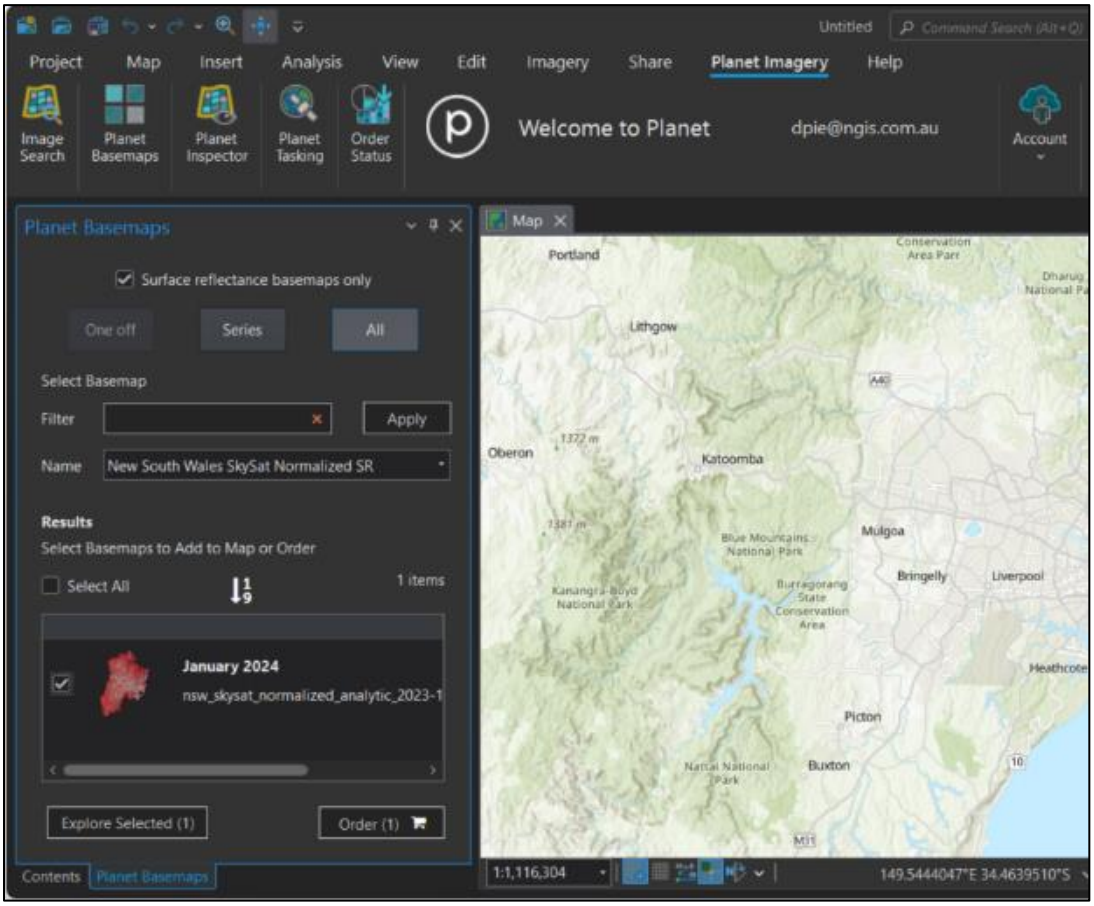
A new tab will open with the scene, click in the search box to filter the search tab.



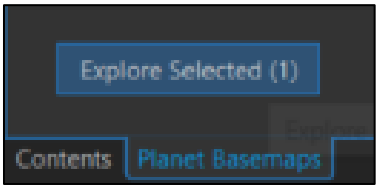
Planet Integrations – ArcGIS Add-in

The Planet ArcGIS Pro add-in provides an ability to view the basemap in a Desktop application, as a basemap for your data, or further analysis using Planet's tools.

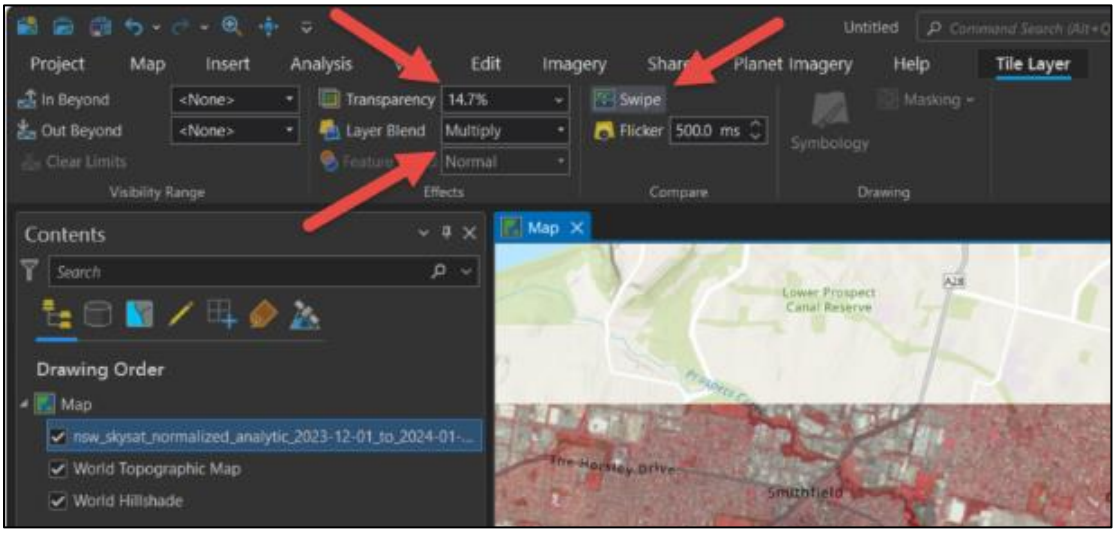
1. Open ArcGIS Pro. Please note that you will need to have a license for this software.
2. Download the Add-in from the website, and install (if not already installed): https://learn.planet.com/download-arcgis-pro-add-in. Please contact your IT team if required for installation.
3. Open a Map, and click on the new "Planet Imagery" Add-in tab.
4. Click on Account > Sign in. Sign into your Planet account.
5. Click on the Planet Basemap button on the tab, to launch the side panel.

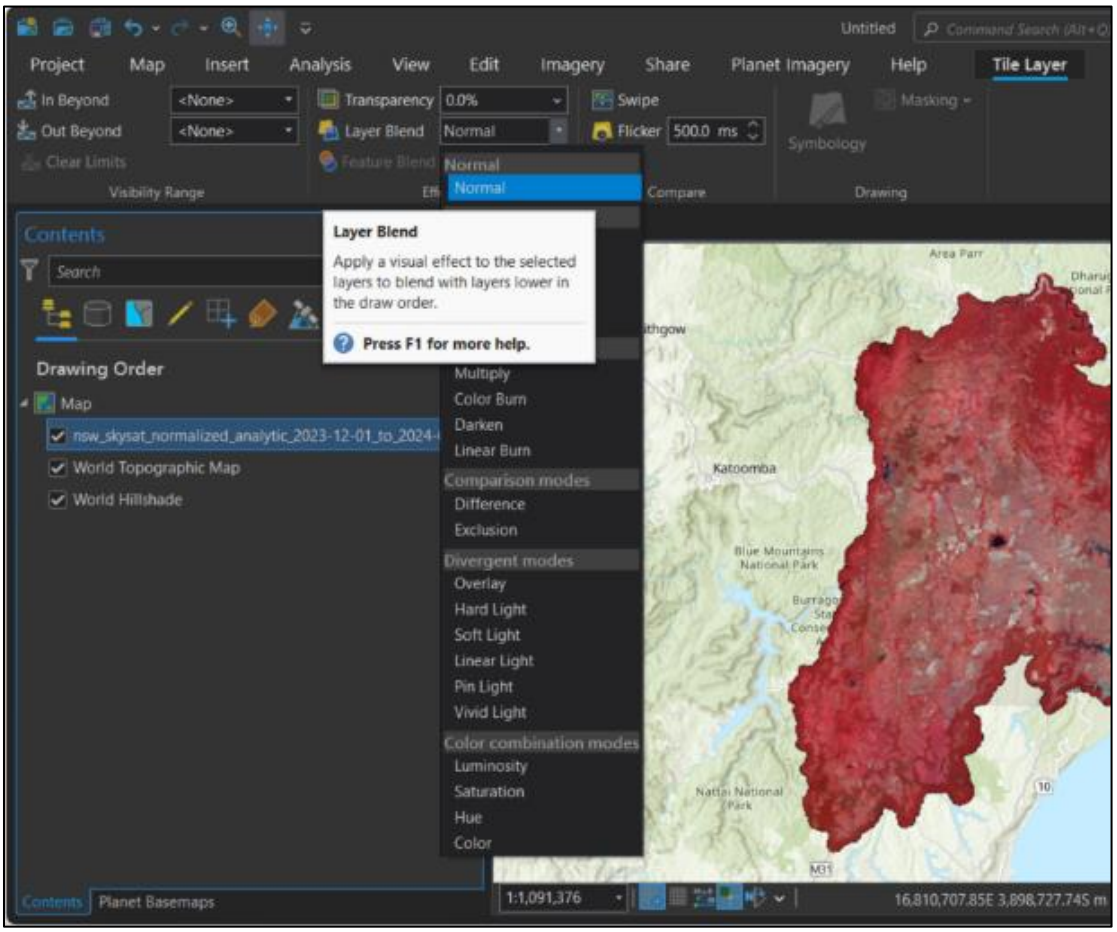


6. Tick the SR box at the top of the panel, and select the Basemap from the name drop down, to find basemap listed. Click on the Basemap record, then "Explore Selected".

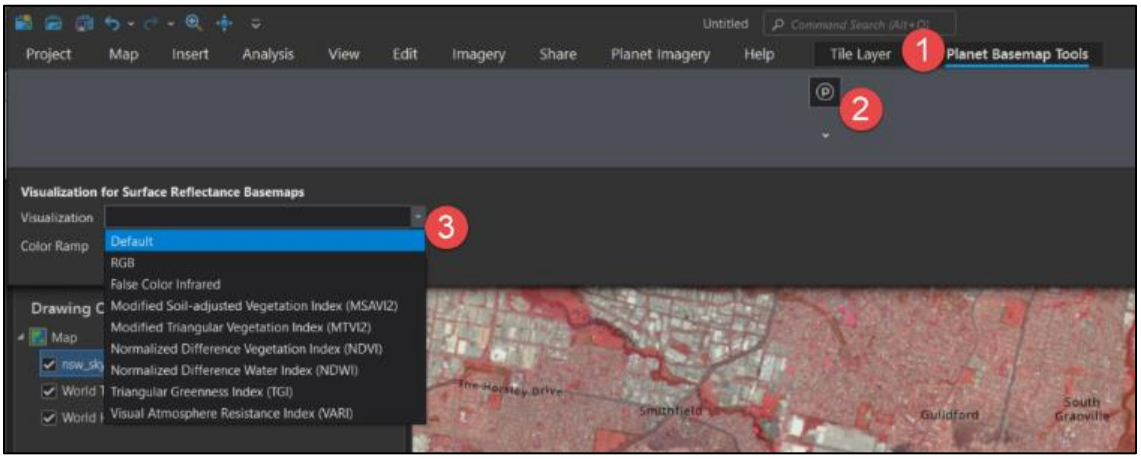


7. Click the tile layer to see display options including transparency, layer blend and swipe:

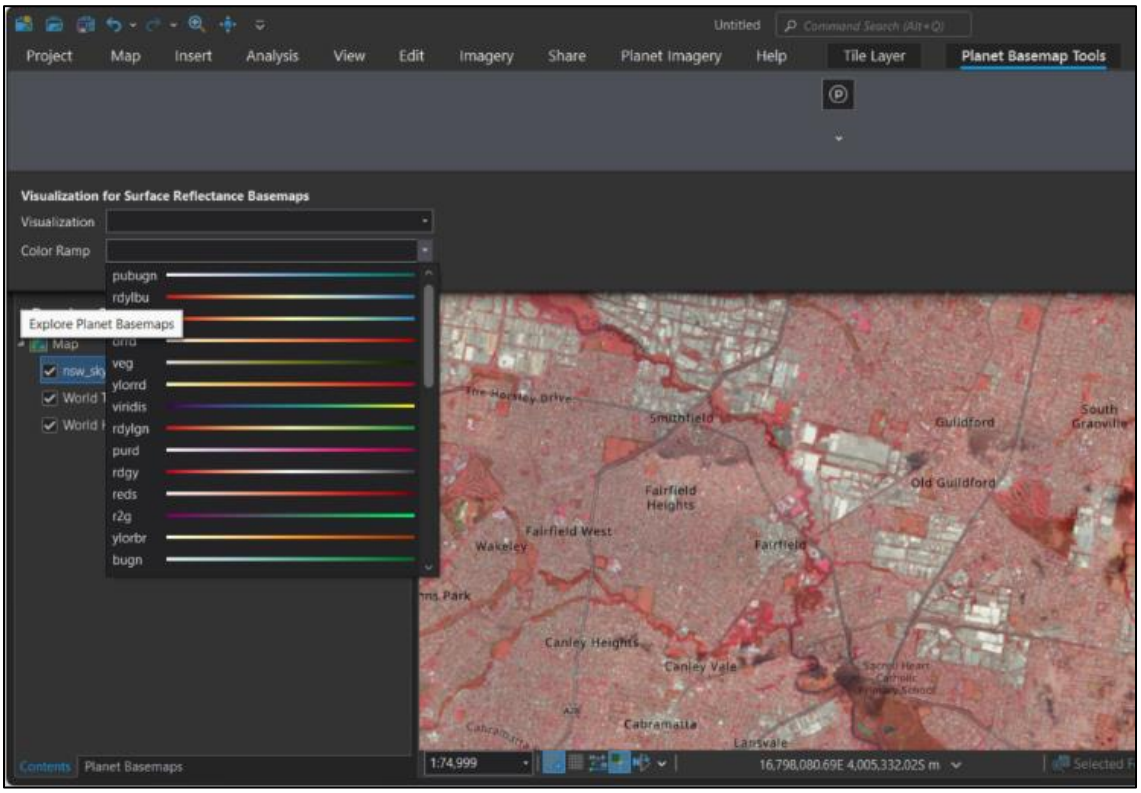




8. Click Planet basemap tools and the “P” button in toolbar to launch a drop-down panel for spectral indices visualisations and colour ramps:



9. Select index and colour required, see tiles update on Map:



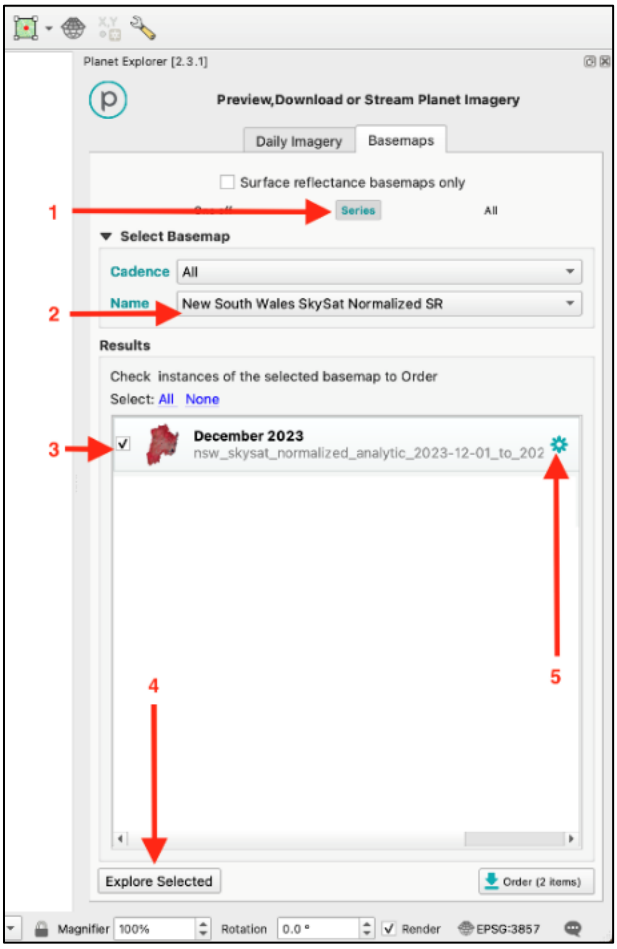
10. Those with download access will see “order” button to download tiles. This is only available for administrators. If you wish to have the quads or source scenes downloaded for you, please contact: spatial.imagery@environment.nsw.gov.au

Planet Integrations – QGIS Plugin

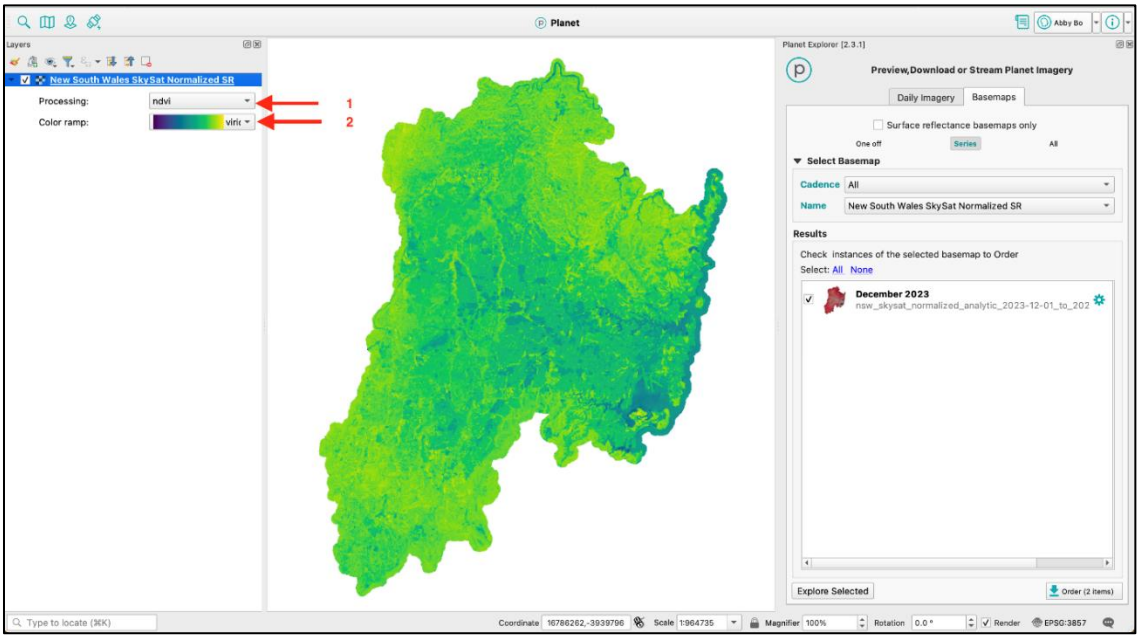
The Planet QGIS Plugin provides an ability to view the basemap in a Desktop application, as a basemap for your data, or further analysis using Planet's tools.

1. Open QGIS. If required, ensure you have access through your IT team.
2. Download the Plugin from the website, and install (if not already installed): https://learn.planet.com/QGIS-Download-Now. Please contact your IT team if required for plugin installation.
3. Open the Planet Panel using the Plugin button from your toolbar.
4. Click on Login. Sign into your Planet account.

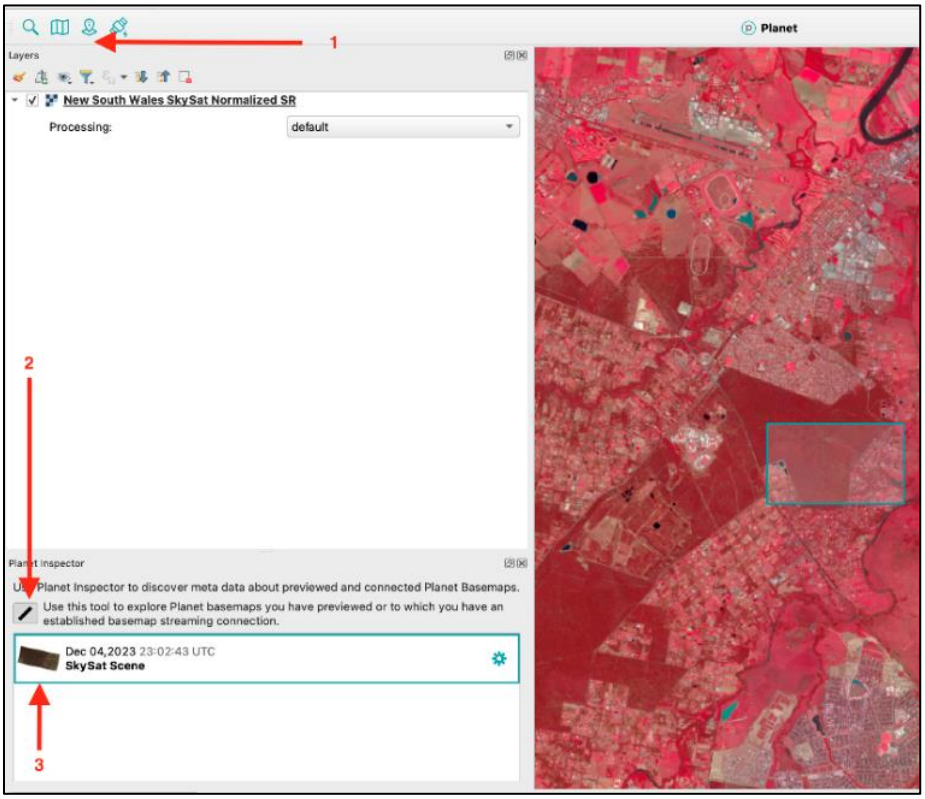
5. Click on the Basemaps tab > select the 'series' button.
6. Select from drop down Name 'New South Wales SkySat Normalized SR'
7. Tick box next to 'Dec 2023 nsw_skysat_normailzed_analytic_2023...'
8. Click on 'Explore Selected':



9. Right click on current item to zoom to extent.
10. In the Layers Panel, click the processing drop box to choose an alternate index or band combination and colour ramp options:



11. Select Inspector tool click on area of interest to identify source imagery capture date and view scene and footprint:

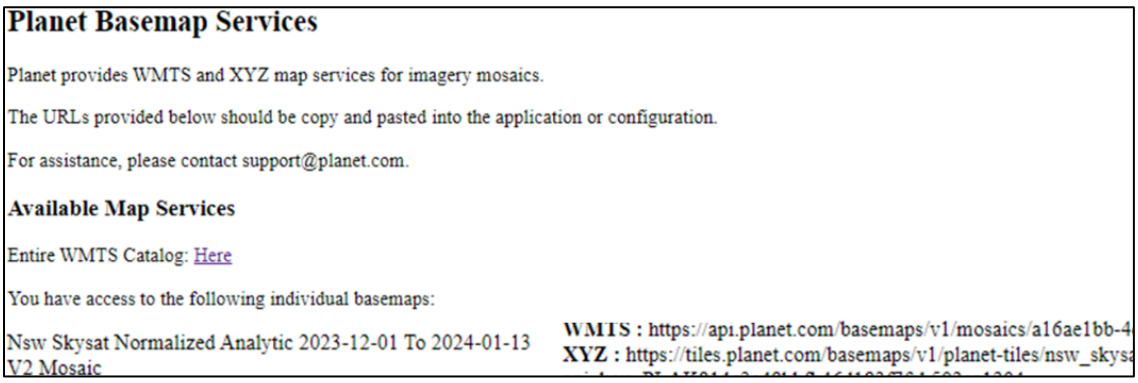


Web Tile Services (WMTS & XYZ)

Web tile services allow you to stream the basemap in different formats within online web applications and online GIS programs, such as ArcGIS Online, and other GIS programs without integration, such as ArcMap or MapInfo. Planet allows for both Web Mapping Tile Service (WMTS) and XYZ tile protocols. Both require an API Key from your account. We have included instructions on finding your API Key below.

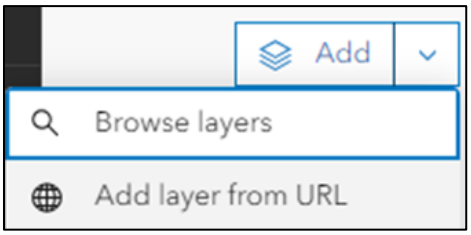
1. Open a browser and navigate to the Account page: https://www.planet.com/account/. Login with your Planet account.
2. Navigate to My Settings > Copy API key.

3. Add the API Key to the end of the following URL (after the "="): https://api.planet.com/basemaps/v1/services?api_key=
4. Paste the full completed URL in a new tab in your browser. The webpage will list all Basemap WMTS and XYZ available:

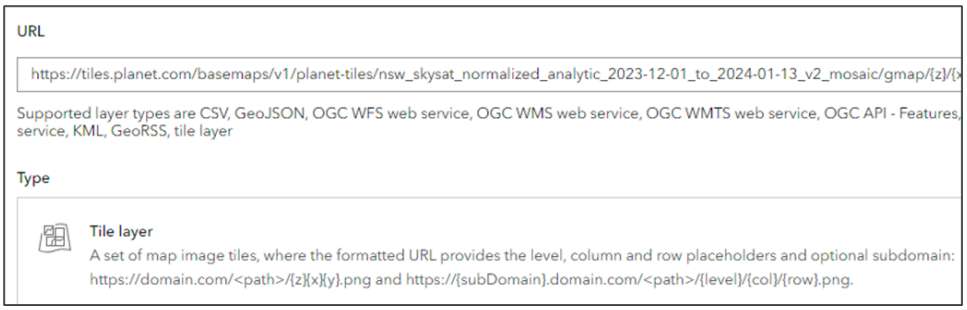


5. Find the SkySat Basemap record, and copy from this list. Example formats available for the Greater Sydney SkySat Basemap:
   - Example WMTS: https://api.planet.com/basemaps/v1/mosaics/a16ae1bb-4ee6-4e31-bcd4-bfc518f42b36/wmts?api_key=
   - Example XYZ: https://tiles.planet.com/basemaps/v1/planet-tiles/nsw_skysat_normalized_analytic_2023-12-01_to_2024-01-13_v2_mosaic/gmap/{z}/{x}/{y}.png?api_key=
   - Google Maps compatible: https://tiles.planet.com/basemaps/v1/latest-series/ebaeba95-de40-4ca2-a0dc-a48767e55546/gmap/{TileMatrix}/{TileCol}/{TileRow}.png?api_key=
6. Paste into a program that accepts WMTS or XYZ tiles.
   For example, this can be used in ArcGIS Online.

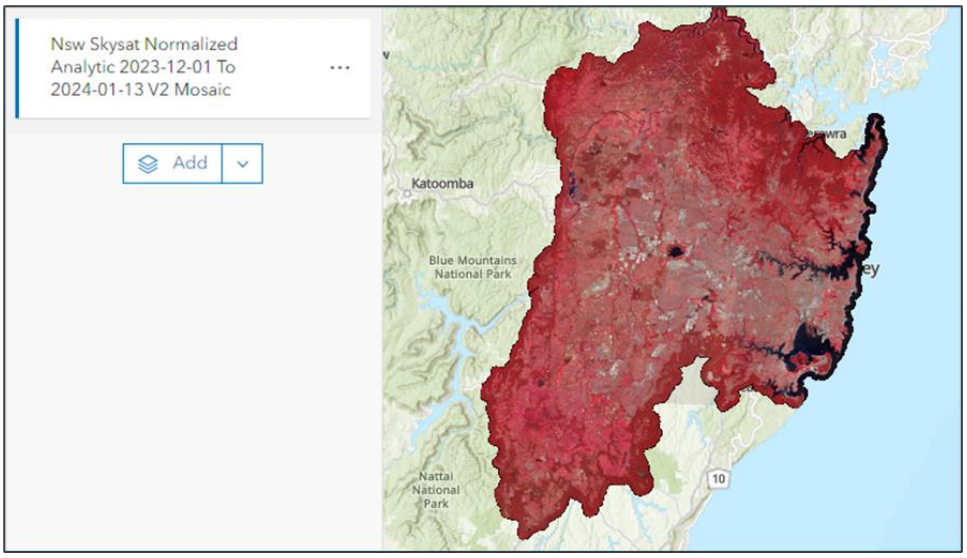
Login to ArcGIS Online and open a Web map. Add a new layer from URL:



Select Tile Layer for XYZ, or WMTS for WMTS:

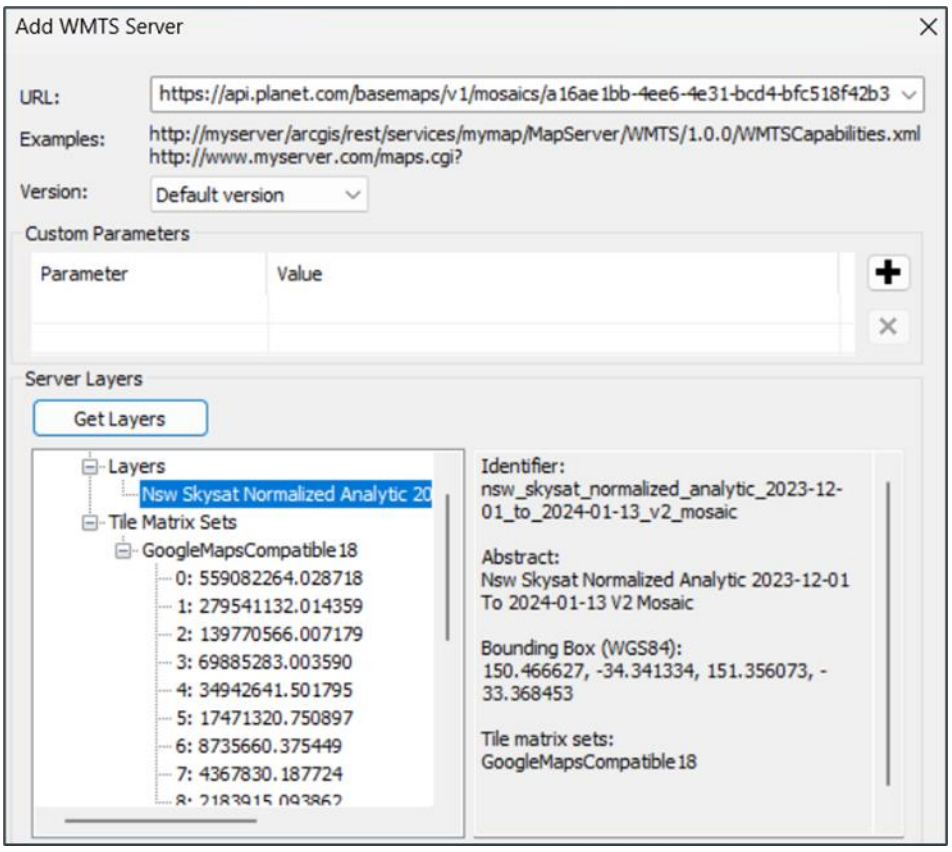


Follow the prompts and zoom in to see the Basemap:

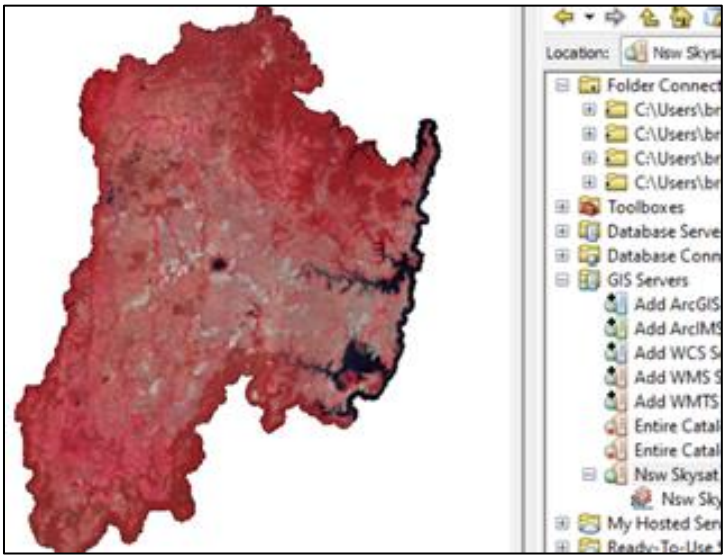


7. Lastly, you will also have access to the "Entire WMTS catalog", which can be pasted into a Desktop GIS program (e.g., ArcMap or MapInfo) to display the entire WMTS Catalogue available with the current subscription. The URL for this should be as follows (with your API Key at the end):
   https://api.planet.com/basemaps/v1/mosaics/wmts?api_key={api-key}

   For example, launch ArcMap and open the tool to Add WMTS Server:



Paste in the URL and load. This will display the basemap in the map window:



Please contact the team if you have any further requirements or questions: spatial.imagery@environment.nsw.gov.au