

# Obtaining and Importing Landsat Data

This document describes how to locate free, high quality Landsat imagery and how to import these data into the ERMapper format. It assumes the user has a basic understanding of the Landsat program; including features such as the sensors used in the program, their spatial, spectral and temporal resolutions, when each of the sensors has operated, etc. A detailed description of the Landsat program is beyond the scope of this document. Users are encouraged to learn this background information before proceeding with this guide. A few suggested sites are the [USGS Landsat Program](#) site, the [NASA Landsat Tutorial](#), and the [CEO User Guide](#). This document will describe the process of obtaining free high-quality images from the GLCF site.

## ***Worldwide Reference System***

The Worldwide Reference System (WRS) is used to identify the path and row of each Landsat image. The path is the descending orbit of the satellite. Each path is segmented into 119 rows, from north to south. The Landsat MSS sensor had a swath width of 180 km and global coverage required 251 paths. The Landsat TM and ETM sensors have a swath width of 185 km and require only 233 paths for complete coverage. MSS and TM scenes share common rows, but in most cases the paths will be different. Because of this difference, MSS scenes are identified using WRS I while TM and ETM scenes use WRS II path/row designations. The data archive section of the CEO web site uses the WRS II designation for all path/row images.

It is generally much easier to find images on the Internet when you know the path/row designation of the region you wish to work in. First, you should check out the [CEO data archive](#). We may already have data for your area of interest. Even if we do not have data for your specific site, you may find WRS II paths and rows displayed on the archive maps of neighboring areas. We have an ArcGIS map on the CEO server that displays all of the WRS II paths and rows. You can view this by double clicking on the file N:\Landsat\PathRow.mxd. Navigate to your area of interest and zoom in until you can see the black grid of paths and rows. Use the ArcGIS "Inquire" tool to display the path and row of the cell you click on. Finally, the lab has a collection of 26 WRS index maps covering the earth. WRS I designations are on one side of these maps and WRS II designations are on the reverse side.

## ***Image Sources***

There are many sites that you can use to locate and obtain Landsat satellite imagery. Three recommended sites are EarthExplorer, GLOVIS, and the Global Land Cover Facility (GLCF). More information about each is listed below.

## **USGS**

The most complete collection of Landsat data can be found at two USGS sites; GLOVIS and EarthExplorer. You will find a broad collection of Landsat data spanning the entire time of the program, beginning in the early 1970's. These images have recently had

standard processing and terrain correction applied to the images, making them very easy to use. The user interface and download processes are a bit different for each site.

The [GLOVIS](#) site has Landsat data as well as ASTER and some MODIS satellite images. Users can select several images at once. These are placed in a “cart” and ordered. When the data are available the user will get an email with the FTP link to retrieve the data. This may take a few hours to a few days.

The [Earth Explorer](#) site includes many types of data in addition to Landsat images. Users are limited to one download at a time, but this can be retrieved immediately.

Landsat data from either site are distributed as a series of compressed (zipped) data files, one for each layer. These will need to be assembled into a multi-band image for display and subsequent processing. Instructions on how to accomplish this in ERMMapper can be found in the [Layer Stack](#) FAQ on the CEO web site.

There are several international sources of Landsat images which typically charge \$1,000 or more per scene. You may also find various government or non-profit organizations that maintain an archive of images for their regions which can be shared with the public, or at least with research collaborators. Locating and accessing these sites is beyond the scope of this document.

## GLCF Landsat Images

The [Global Land Cover Facility](#) (GLCF), at the University of Maryland, is a source of free high-quality satellite images and many satellite-derived products. You should take time to explore the documentation on this site, especially information regarding image citations in your work. This paper will focus on the Landsat imagery.

The “[GeoCover](#)” images are highest quality Landsat images that are generally available anywhere. These have been selected minimal cloud cover, during peak greenness, and have been precisely ortho-georeferenced. When searching for Landsat data on this site, favor data that have this attribute. There will be one MSS, TM, and ETM scene for each Landsat path/row.

Once you have identified the path and row of your region of interest, go to the GLCF Data & Products page, select the “Earth Science Data Interface” link, and then click on the “Path/Row Search” icon.

Now define your search criteria on this page. Enter the start path and row for a single scene. If you are searching for a range of data include an end path/row as well.

The screenshot shows the "GLCF: Earth Science Data Interface" in a Mozilla Firefox browser. The page has a navigation bar with links: Home, Map Search, Product Search, Path/Row Search, Workspace, Login, Help, Contact Us, and GLCF. Below the navigation bar is a search form with the following sections:

- Sensor:** WRS-1 (selected)
- Date:** Start Date: [Months] ago, End Date: [ ]
- Require:** GeoCover Level 1G, Orthorectified, Terrain Corrected, Not Validated
- Exclude:** GeoCover Level 1G, Orthorectified, Terrain Corrected, Not Validated

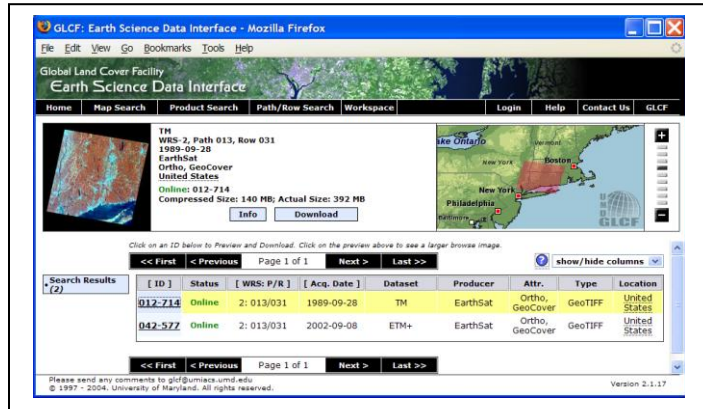
Below the search form is a table for path and row search:

Start Path	Start Row	End Path	End Row	Status
13	31			

At the bottom of the page, there is a status bar that says "No scenes in selection" and buttons for "Clear", "Process and Download", and "Submit Query".

Select WRS-1 for MSS scenes or WRS-2 (the default) for TM and ETM scenes. You can restrict your search to GeoCover scenes only by selecting this in the “Require” section.

After entering this information click on the “Submit Query” button. The window will display the number of scenes found that meet your criteria. Click on the “Preview and Download” button to explore the defined images.



Within the preview window you can select each image by clicking the ID number in the first column. This will display a small browse image.

Click in the browse image to see a larger view in a new window. If you wish to use this image, click on the “Download” button to open a download window.

Before downloading any data create a unique directory on your U:\ drive for each image. Now right click on each file and save all of the files to your new directory. You can download up to three files at one time.

## ***ERMMapper Import***

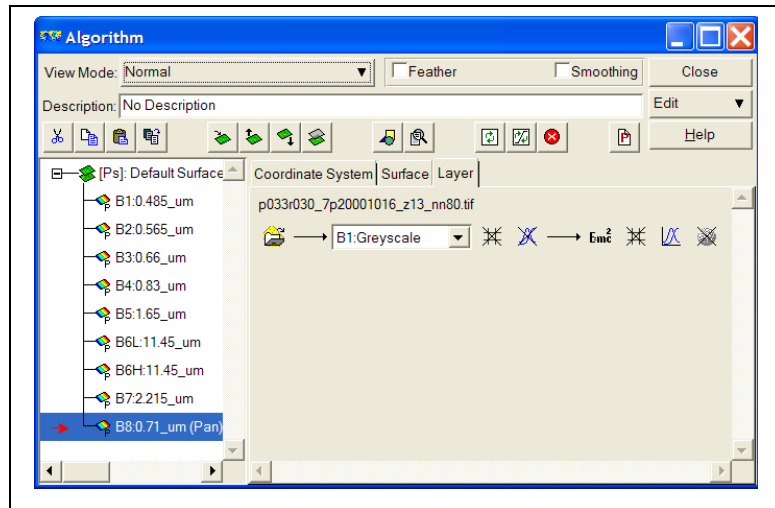
There is a toolbar in ERMMapper specifically designed to import GeoCover images from the GLCF. Select *GLCF Landsat Wizards* from the Toolbars menu. This toolbar contains three wizards. You will use each in order, starting from the left.

The first wizard will uncompress the “.GZ” files for each data layer you downloaded. It also removes the “.GZ” files. You will be prompted to select the *directory* that your data have been downloaded into, *not* an actual file. It will process all files in the directory. The second wizard will create “.ERS” ERMMapper header files for each TIF image. It also requires a directory as input.

The third wizard creates a virtual dataset of the multiple data layers. While it is not a multi-band image file, it can be used in ERMMapper as one. You will select any single file in your directory as input. You are given the option of displaying the dataset and can select any three bands for the RGB display. After viewing the dataset close all ERMMapper windows except the main menu. *See the note below for special handling for MSS scenes.*

The virtual dataset created by the third wizard is an artificial construct of ERMMapper. You need to save this as an ERMMapper raster dataset. From the main menu select: **File | Open from Virtual Dataset...** This opens a stack of pseudo layers, one for each individual data layer, but displaying only the top data layer of the stack. Open the *Algorithm* window to view the layers used. The final step in this process is to save the layer stack as a single ERMMapper *raster* dataset.

For Landsat MSS or TM images, *not ETM*, all data layers have the same spatial resolution. For these images select **File | Save As...** and enter a new file name. We recommend using the image date as the filename, in the format YYMMDD. For example, an image for 12 September 1991 would have a filename 910912. Make sure that the option to “Delete Output Transforms” is checked when you save the image.



As you know, Landsat ETM images have three spatial resolutions. The two thermal bands have a resolution of 57 m, the six reflective bands have 28.5 m, and the single panchromatic band has a resolution of 14.25 m. You need to save each of these as separate files by resolution. This can be accomplished by turning off the data layers in the algorithm window for the layers you do not wish to save. To save the six reflective bands, right click on the panchromatic (B80) layer and select “Turn Off”. Turn off the two thermal layers (B6L and B6H) as well. Now select **File | Save As...** and enter a file name as above.

In this case you will save three files for the same date so you need to append a suffix to the name to identify the file. For the reflective bands of an image dated 23 November 2000 you should use 20001123\_ref. Use the suffix “tir” for the thermal bands and “pan” for the panchromatic image.

**MSS Processing Note** – The third wizard was not designed to process four-band MSS scenes. Rather than create a virtual dataset and then save this as an image file, you can save the file as a multi-band image in a single step. Stack four pseudo layers, labeling them bands 1 through 4 in the left section of the algorithm window. Point each layer to MSS bands created by the second wizard, bands one through four respectively, and save this as an ERMapper raster dataset.

## ***Final Steps***

You now have a high quality Landsat image in ERMapper format. Explore the scene using various RGB combinations. When you are satisfied with the image, remove all of the intermediate files created during this process. This will include the “tif” data layers and their “.ers” header files. Remember that ERMapper data sets consist of two files. For the example above this would include both **20001123\_ref** and **20001123\_ref.ers**. Do not delete either of these! Also retain the original metadata files downloaded from the GLCF site.

These images should be added to the CEO data archive. This way you can always go back to the original dataset if needed at some time in the future. The images will also be available for other researchers at the Center that wish to work in the same region. Please send an email to Larry Bonneau notifying him what you have downloaded and where they are located on the CEO server.