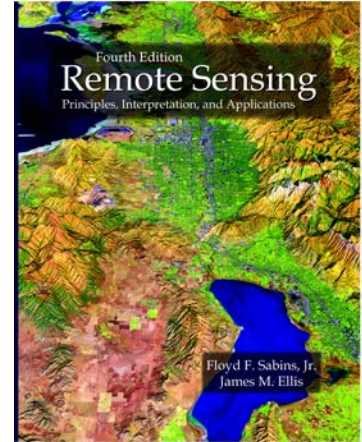


Image Processing Lab Manual for ArcGIS Pro and Desktop

Supplemental Material for:

Floyd F. Sabins and James M. Ellis, April 2020,

Remote Sensing Principles, Interpretation, and Applications, 4th Edition, Waveland Press, 524 pages.



This lab manual is designed for GIS instructors who want to use this textbook and ESRI's ArcGIS *Pro* or ArcGIS *Desktop* for their remote sensing course. This lab manual provides step-by-step instructions for using *Pro* and *Desktop* software to process, enhance, and extract information from images and DEMs. The labs use examples discussed in the textbook and shown on figures and plates, thereby helping students gain additional understanding about specific remote sensing principles and technology as they complete the image-processing exercises.

The topics covered in the twelve labs are listed below:

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| Lab 1A | Interpretation of Remote Sensing Images |
| Lab 1B | ArcGIS <i>Pro</i> and <i>Desktop</i> Overview |
| Lab 2 | Image Enhancement and Plotting |
| Lab 3 | Landsat Multispectral Images |
| Lab 4 | Vegetation Maps, Density Slice, and Masks |
| Lab 5 | Heads-up Interpretation |
| Lab 6 | Principal Components, Mosaicking, and Pan-Sharpening |
| Lab 7 | Georeferencing |
| Lab 8 | DEMs |
| Lab 9 | Unsupervised Classification |
| Lab 10 | Supervised Classification |
| Lab 11 | Change Detection |
| Lab 12 | National Land Cover Database (NLCD) Overview |

The labs include remote sensing data of Wyoming, Afghanistan, California, New York, Missouri, and Japan that cover urban, suburban, industrial, agricultural, wetland, geologic outcrop, and cirque glacier landscapes. Data types include multispectral Landsat, WorldView-3, and USDA NAIP imagery, color drone and manned aircraft images, Space Shuttle (SRTM) and Lidar DEMs, and USGS NLCD landcover and impervious maps. The labs are in .pdf format and average 18 pages each. Geospatial data is included in each lab's folder, along with a list of questions and lab-generated files to be uploaded to the instructor. Many of the examples have more extensive coverage and geospatial layers in the textbook's downloadable Remote Sensing Digital Database.

The labs require ArcGIS *Pro* or ArcGIS *Desktop* with the *Spatial Analyst* extension. One lab has optional exercises using the *3D Analyst* extension. Students with some ArcGIS experience will progress more rapidly through ArcGIS's many tools and menus, but hands-on experience with *Pro* or *Desktop* is not a requirement as the labs contain numerous graphics of menus and tool locations along with step-by-step instructions. The lab exercises are pdfs that can be displayed on a smartphone or tablet so there is more space on smaller computer screens for the *Pro* and *Desktop* windows and menus.

Instructor-led and self-taught GIS students will be better prepared for understanding, critically evaluating, and implementing raster imagery and DEMs for leading-edge opportunities such as drones, visualization, cloud-based solutions, AI, machine learning, and programming after completing the lab manual exercises. In addition, the foundation provided by the ArcGIS-focused lab exercises will prepare students for understanding and implementing advanced image processing with *Pro's* new *Image Analyst* extension.

ArcGIS students and users who want to implement more powerful and sophisticated image-processing software are encouraged to start hands-on education with professional, commercial remote sensing software (for example, L3Harris ENVI, ERDAS Imagine, Catalyst [formerly PCI], and TNTMips). The textbook provides a comprehensive, remote sensing lab manual for ENVI software (see www.waveland/Sabins-Ellis.com website).

Instructors are provided with an answer key and examples of files to be uploaded by students for each lab. In addition, the labs are provided as Microsoft Word documents to facilitate modifications by the instructor. Instructors can pick and choose labs that are of interest or fit within the course schedule as each lab is a stand-alone module within the manual. Instructors can easily shorten or focus labs by assigning fewer topics or examples from the list included at the beginning of each lab. Many of the labs provide additional sections that teach students how to generate value-added GIS products from their processed raster data, including conversion of pixels to vector polygons, output of GIS-ready permanent images, importing to GoogleEarth, building basic map layouts, adding fields and characteristics to attribute tables, and calculating area.

The lab manual does not include lidar processing, object-oriented classification, segmentation, hyperspectral or thermal IR data, extensive coding, or online resources.

The lab manual was created with ArcGIS *Pro* 2.6.1 Professional Basic and ArcGIS *Desktop* Basic 10.6.1 (with .mxd and .lyr files saved as 10.6 and 10.2 files) on a Windows 10 operating system. The tasks, data, and assignments (questions and uploads) in each lab exercise are essentially identical for the *Pro* and *Desktop* exercises. Contact James Ellis at jellis@ellis-geospatial.com for questions, recommendations and comments.