

Remotely sensed images are widely available and have countless potential applications. However, analyzing these images used to be a difficult and expensive process. Now, Esri's ArcGIS 10.x with Image Analysis extension provides tools that can be used by novice and experienced ArcGIS users alike. In this manual, we provide a series of easy-to-understand tutorials to guide you through image analysis processes.

By completing our series of tutorials, you will be able to:

- Manipulate data in ArcGIS
- Obtain and display Landsat imagery
- Enhance and analyze Landsat imagery

With links to online videos and additional resources, this manual will help you develop the skills to apply remote sensing image analysis to your own research questions.

ISBN 9781549796111



9 781549 796111



90000

Contents

Chapter 1. Opening an Existing Map Document/Creating a New Map Document.....	8
Opening an Existing Map Document.....	8
Creating a New Map Document	9
Chapter 2. Adding Data to a Map Document	11
Introduction: Types of Data Files	11
Adding a Basemap in ArcMap.....	13
Adding Vector and Raster Data to a Map Document	15
Chapter 3. Connecting to a Drive in ArcMap and ArcCatalog Connecting to a GIS Server.....	18
Introduction.....	18
Connecting to a Drive	18
GIS Server Connections.....	18
Connecting to a Drive in ArcMap.....	18
Connecting to a Drive in ArcCatalog.....	19
Connecting to a GIS Server in ArcCatalog and Displaying the Connection in ArcMap.....	20
Connecting to ArcGIS Online server.....	24
Chapter 4. Saving and Exporting Map Documents	26
Introduction.....	26
Saving your Map Document	26
Saving your Map Document to Use as a Figure in Another Document	26
Chapter 5. Repairing a Data Address.....	29
Introduction.....	29
Repairing the Data Address	29
Chapter 6. Displaying Data.....	34
Introduction.....	34
Default Settings.....	34
Changing Symbology on Vector Files	35
Changing Symbology on Raster Datasets.....	40
Chapter 7. Metadata in ArcGIS Desktop	48
Introduction.....	48
Metadata in ArcMap™	48
Metadata in ArcCatalog™	54
Chapter 8. Remotely Sensed Imagery Available from the U.S. Geological Survey	60
Introduction.....	60

Landsat Imagery.....	60
Sentinel	62
Aerial Imagery	64
Commercial Images available for purchase	66
Lidar	67
Other Remotely Sensed Images	67
Chapter 9. Downloading Landsat Imagery Using EarthExplorer	68
Introduction.....	68
Navigating to Your Desired Scene	68
Selecting the image date & related criteria	70
Interpreting the search results	72
Directly downloading a Landsat Scene.....	73
Chapter 10. Information about Your Downloaded Landsat Imagery	78
Introduction.....	78
Others files that came with your download	82
Chapter 11. Displaying your Landsat Imagery	85
Introduction.....	85
Adding your Landsat files to ArcMap	85
Setting up Image Analysis in ArcMap.....	92
Notes on Landsat 8 digital numbers.....	95
Chapter 12. Streaming and Displaying Landsat Imagery	96
Introduction to ESRI's Landsat Community	96
Accessing the ESRI Landsat Data	96
Accessing ESRI's Landsat Imagery Dataset through ArcGIS Desktop	98
Examining an ESRI Landsat 8 Map Document	103
Adding Multiple ESRI Landsat 8 Datasets to the Same Map Document	108
ESRI Landsat 8 Services.....	111
Additional Landsat Map Document Details	116
Saving an ESRI Landsat 8 Map Document	119
Additional Help for using ArcMap or ArcGIS On-Line.....	120
Chapter 13. Creating a Composite Image from Landsat Imagery	121
Introduction.....	121
Creating One Composite Image for Seven Bands	121
Saving Your New Composite Image	125

Chapter 14. Band Combinations Using Landsat Imagery	129
Introduction.....	129
Creating Different Band Combinations	129
Additional Notes	141
Chapter 15. Sub-setting Landsat Imagery.....	145
Introduction.....	145
Limiting the number of bands.....	145
Sub-setting by Spatial Extent.....	148
Chapter 16. Radiometric Enhancement of Landsat Imagery	157
Introduction to Image Enhancement.....	157
Using ArcGIS as a Viewer for Radiometric Enhancement	158
Histograms	161
Chapter 17. Spatial Enhancement of Landsat Imagery.....	167
Introduction.....	167
Spatial Enhancement Using Image Analysis Window	167
Spatial Enhancement Using Spatial Analyst Tools	170
Convolution Filtering in ArcGIS	172
Chapter 18. Spectral Enhancement of Landsat Imagery.....	180
Introduction.....	180
Band Ratios - Landsat Thematic Mapper (TM).....	180
Creating Band Ratios	181
Vegetation Indices	187
NDVI for Landsat 8 Images.....	195
Tasseled Cap Transformation	196
Chapter 19. Change Detection using Landsat Imagery	197
Introduction.....	197
Change Detection using Image Analysis in ArcGIS.....	198
Change Detection using Thematic Mapper (TM) and Operational Land Imager (OLI)	206
Conclusions.....	213
Chapter 20. Classification of a Landsat Image (Unsupervised)	214
Introduction.....	214
Conducting Unsupervised Classification.....	214
Determining the Number of Classes	216
Reclassing Spectral Classes into Informational Classes	225

Calculating the Percent of Total Area for Each Informational Class	230
Chapter 21. Classification of a Landsat Image (Supervised).....	235
Introduction.....	235
Conducting Supervised Classification	236
Creating Training Samples	237
Evaluating Normality, Separability, and Partitioning.....	240
Preparing the Signature File.....	249
Performing a Supervised Classification.....	249
Calculating the Percent of Total Area for Each Informational Class	251
Chapter 22. Accuracy Assessment.....	253
Introduction.....	253
Generating a Set of Random Points	253
Identifying Each Random Point's Value from Aerial Imagery	256
Adding the reference value to your Random Points shapefile.....	260
Calculating Overall Accuracy	266
Calculation of Cohen's Kappa	266