

ENVI EX Tutorial: Thematic Change Detection

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Thematic Change Detection Workflow

In this tutorial, you will use the Thematic Change Detection workflow. Thematic change detection takes two classification images of the same scene at different times and identifies differences between them. The data used in this tutorial are the classification images created from land cover analysis, produced by NOAA Coastal Services Center according to Coastal Change Analysis Program (C-CAP) standards. The data was produced using 30-meter-resolution Landsat Thematic Mapper and Landsat Enhanced Thematic Mapper satellite imagery. In this tutorial, you will use two images of the Gulf of Mexico region.

Files Used in this Tutorial

ENVI Resource DVD: Data\change_detection

File	Description
pre_katrina_05.img	Classification image from ERDAS data of the Gulf of Mexico impacted by hurricane Katrina
Post_Katrina_06.img	Classification image from ERDAS data of Gulf of Mexico impacted by hurricane Katrina
Post_Katrina_06.met	C-CAP Zone 37/46 Area post-hurricane Katrina land cover metadata
Pre_Katrina_z37_2005.met	C-CAP zone 37 pre-hurricane Katrina 2005-era land cover metadata
Pre_Katrina_z46_2005.met	C-CAP zone 46 pre-hurricane Katrina 2005-era land cover metadata


Selecting Files for Thematic Change Detection

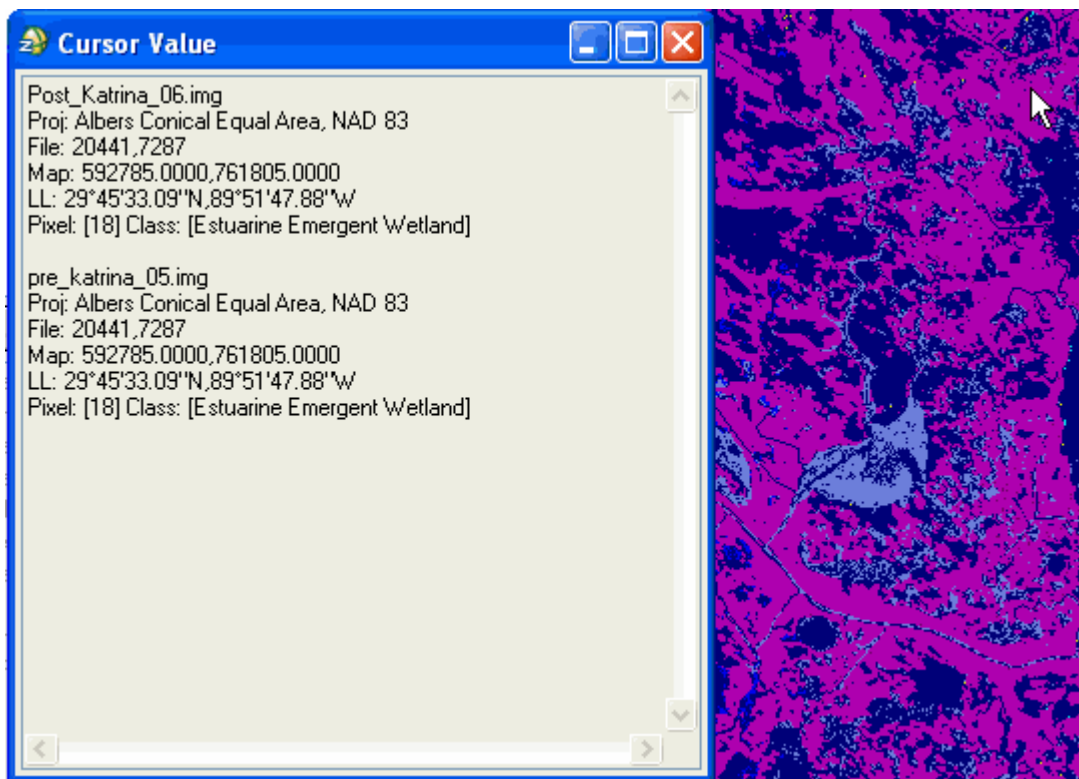
In the File Selection panel, you choose the two classification images to include in thematic change detection. You will apply a spatial subset to the first image you select.

1. Start ENVI EX.
2. In the Toolbox, double-click **Thematic Change**. The Select File panel appears.
3. Click **Browse** next to the **Time 1 Classification Image File** field. The Select Time 1 Classification Image File dialog appears.
4. Click **Open File**. The Open dialog appears.
5. Navigate to Data\change_detection, select pre_katrina_05.img, and click **Open**, then click **OK**.
6. In the Select Time 1 Classification Image File dialog, click **Spatial Subset**. The Spatial Subset dialog appears.
7. Enter the **Samples** values as 18177 and 23896.
8. Enter the **Lines** values as 5022 and 10291.
9. Click **OK**, then click **OK** again.
10. Click **Browse** next to the **Time 2 Classification Image File** field. The Select Time 2 Classification Image File dialog appears.
11. Click **Open File**. The Open dialog appears.

12. Navigate to `Data\change_detection`, select `Post_Katrina_06.img`, and click **Open**, then click **OK**.
13. Click **Next**. The Thematic Change panel displays.

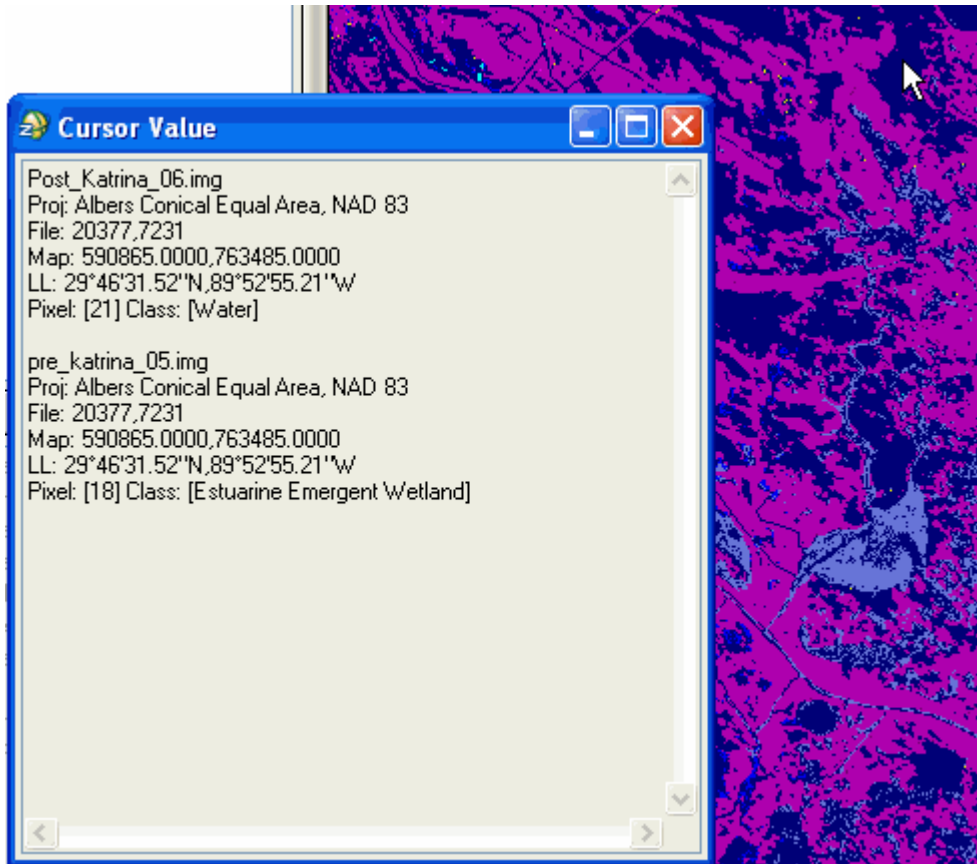
Applying Thematic Change Analysis

1. Because the two input classification images have the same number of classes that use the same class name, the **Only Include Areas That Have Changed** check box is available, and is enabled by default. Keep the default setting. The thematic change analysis will group those classes into a class named `no change` if no difference is detected in those classes during processing. The output is a new classification image that only includes areas that have changed. When you uncheck this option, it includes all class transition information.
2. Move to an area that is included in the subset. In the **Go To** field, enter `594865.735,761937.370`. The Image window centers over that area.
3. Open the Cursor Value window with the  toolbar button.
4. Move the cursor around in the Image window. The Cursor Value window provides information about the two input layers and the classes that are identified at the cursor location. In the example below, the Cursor Value shows that the pixel under the cursor in the pre- and post-Katrina layers are in the same class (`Estuarine Emergent Wetland`). This is an area that did not change classes.

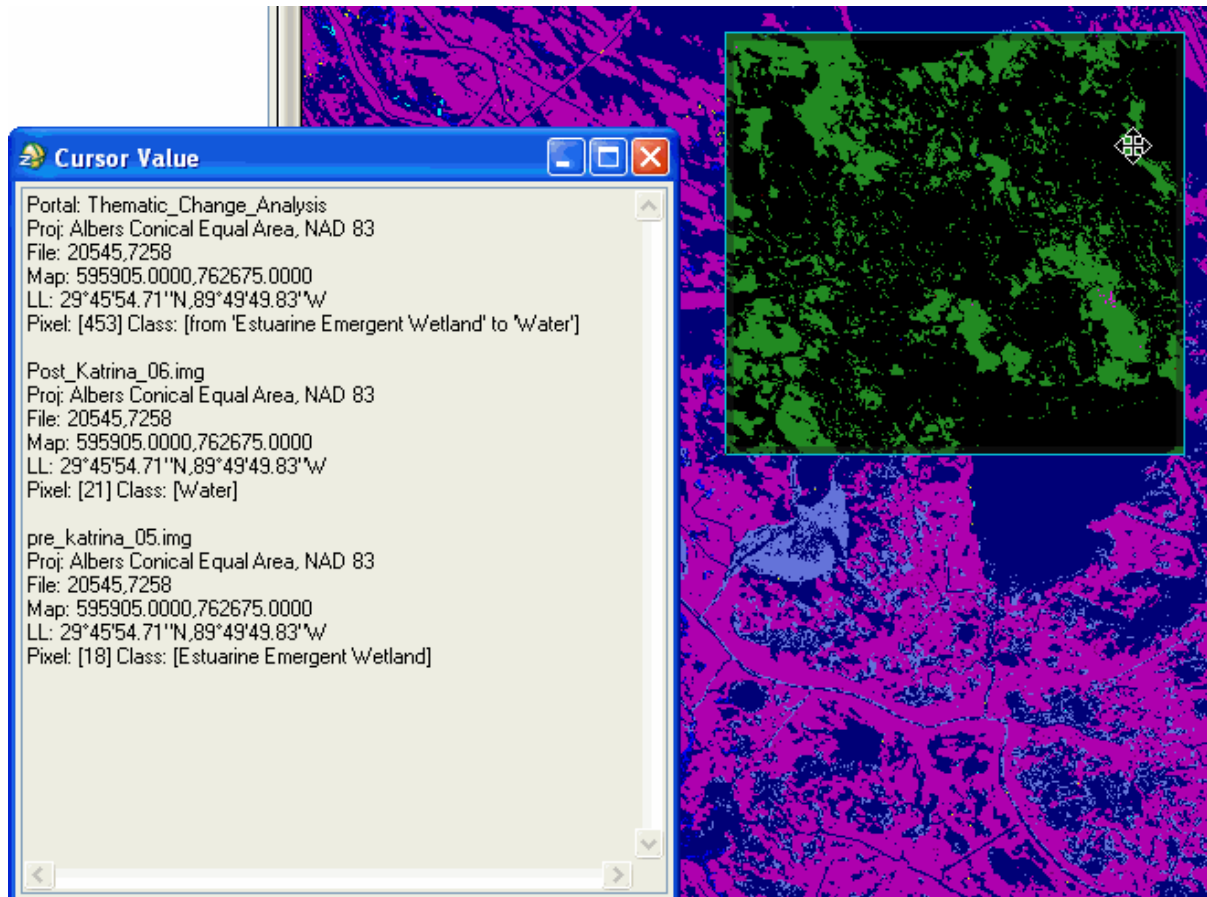


5. Now move the cursor to a different location, such as blue area closer to a lake. In the next example, the pixel under the cursor is in one class in the pre-Katrina image (`Estuarine`

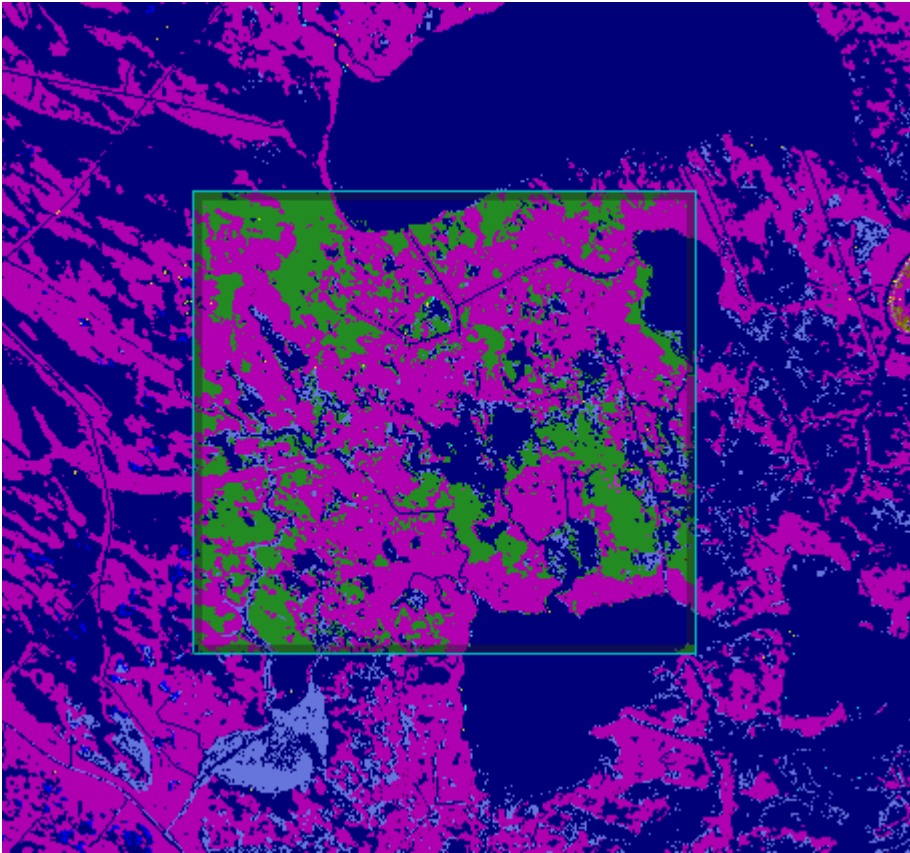
Emergent Wetland), and is in a different class in the post-Katrina image (Water).



6. Now enable the **Preview** check box. A Preview Portal appears. As you move the cursor around in the Preview Portal, the Cursor Value window not only updates the pixel information for the pre- and post-Katrina images, it also provides analysis information about the pixel under the cursor. In the example below, it shows that the pixel has changed from 'Estuarine Emergent Wetland' to 'Water'.



7. Before you begin processing, disable the **Only Include Areas That Have Changed** check box, to see a preview of the same area when this option is turned off. The result includes areas that have changed, and also areas that have not changed (for example, from 'Water' to 'Water'). An example follows:

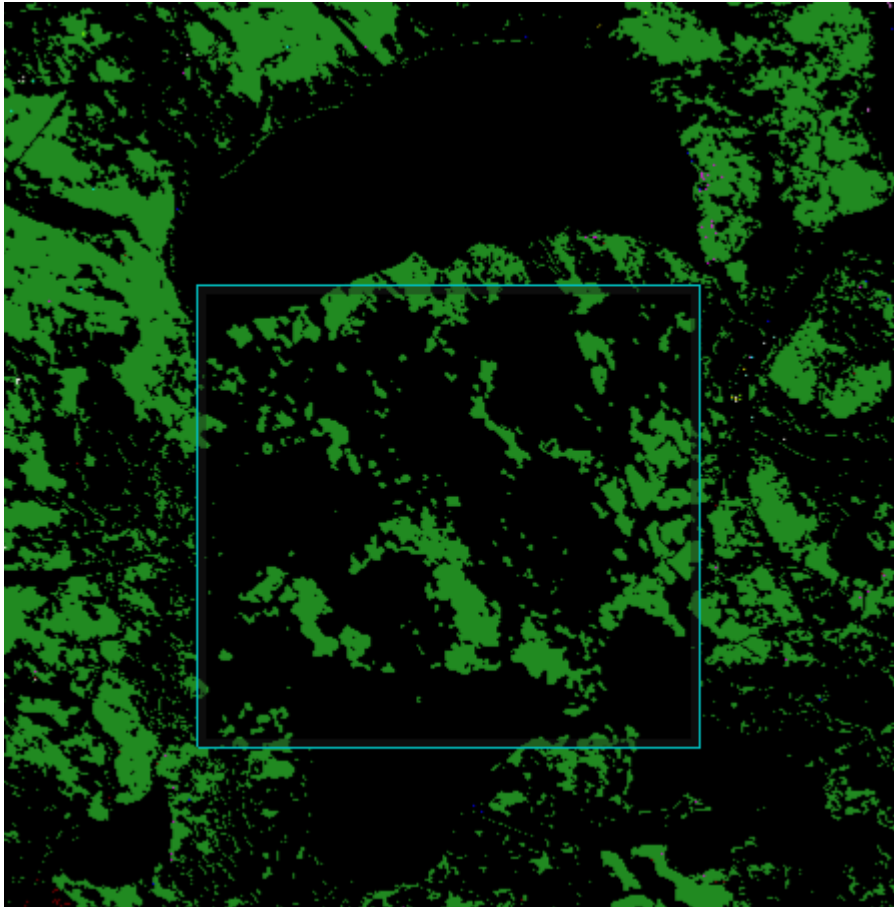


8. Enable the **Only Include Areas That Have Changed** check box again.
9. Click **Next**. Thematic change processing begins. When thematic change processing is complete, the Cleanup panel appears.

Cleaning Up Thematic Change Detection Results

The cleanup step refines the result. You can preview what the refinement will look before you apply the settings. The cleanup options are:

- **Enable Smoothing** removes salt and pepper noise.
 - **Enable Aggregation** removes small regions.
1. Use the default setting for thematic change cleanup. The default is **Enable Smoothing**, where the square kernel's center pixel will be replaced with the majority class value of the kernel. Keep the default value of **3**.
 2. Preview the cleanup result before processing in the Preview Portal.



You can change the cleanup settings and preview the results again, if desired.

3. Click **Next**. The Export panel appears.

Exporting Thematic Change Detection Results

To export results:

1. In the **Export Files** tab, enable the check boxes for the exports you want to output. The following are available:
 - **Export Thematic Change Image** saves the classification result to a raster file.
 - **Export Thematic Change Vectors** saves the vectors created during classification to a shapefile.
2. Use the default paths and filenames.
3. To save statistics on thematic change, enable the **Export Thematic Change Statistics** check box in the **Export Statistic** tab,
4. Use the default paths and filenames.
5. Click **Finish**. ENVI EX creates the output, opens the layers in the Image window, and saves the files to the directory you specified.

6. Navigate to the statistics file and open it in a spreadsheet application, such as Microsoft Excel. As you can see in the statistics below, the most significant changes were classes that changed to Water.

	A	B	C	D
1	CLASS_T1	CLASS_T2	AREA	PERCENT
2	no change	no change	26869920300	99.0415
3	Estuarine Emergent Wetland	Water	158473800	0.584128
4	Palustrine Emergent Wetland	Water	48216600	0.177725
5	Unconsolidated Shore	Water	16864200	0.062161
6	Estuarine Aquatic Bed	Water	9747900	0.03593
7	Bare Land	Water	5157000	0.019009
8	Evergreen Forest	Scrub/Shrub	2883600	0.010629
9	Palustrine Forested Wetland	Palustrine Emergent Wetland	2520900	0.009292
10	Water	Unconsolidated Shore	2405700	0.008867
11	Palustrine Scrub/Shrub Wetland	Palustrine Emergent Wetland	1656900	0.006107
12	Evergreen Forest	Grassland	1386000	0.005109
13	High Intensity Developed	Low Intensity Developed	1152900	0.00425
14	Water	Estuarine Emergent Wetland	978300	0.003606
15	Palustrine Scrub/Shrub Wetland	Water	904500	0.003334
16	Water	Palustrine Emergent Wetland	760500	0.002803
17	Medium Intensity Developed	Low Intensity Developed	631800	0.002329
18	Low Intensity Developed	High Intensity Developed	454500	0.001675
19	Scrub/Shrub	Grassland	403200	0.001486
20	Palustrine Aquatic Bed	Water	396900	0.001463
21	Unconsolidated Shore	Estuarine Aquatic Bed	390600	0.00144
22	Palustrine Emergent Wetland	Palustrine Scrub/Shrub Wetland	383400	0.001413
23	Estuarine Aquatic Bed	Unconsolidated Shore	360000	0.001327
24	Palustrine Scrub/Shrub Wetland	Palustrine Forested Wetland	306900	0.001131
25	Medium Intensity Developed	High Intensity Developed	296100	0.001091
26	Water	Bare Land	279000	0.001028
27	Unconsolidated Shore	Bare Land	243000	0.000896
28	Palustrine Forested Wetland	Palustrine Scrub/Shrub Wetland	201600	0.000743
29	Grassland	Scrub/Shrub	198900	0.000733
30	Low Intensity Developed	Medium Intensity Developed	191700	0.000707
31	Evergreen Forest	Palustrine Forested Wetland	166500	0.000614
32	Water	Estuarine Aquatic Bed	164700	0.000607
33	Palustrine Forested Wetland	Grassland	143100	0.000527
34	Evergreen Forest	Estuarine Emergent Wetland	117000	0.000431
35	Estuarine Scrub/Shrub Wetland	Estuarine Emergent Wetland	104400	0.000385
36	Evergreen Forest	Palustrine Emergent Wetland	87300	0.000322
37	Low Intensity Developed	Water	86400	0.000318
38	Cultivated	Pasture/Hay	85500	0.000315
39	Scrub/Shrub	Estuarine Emergent Wetland	81000	0.000299
40	Cultivated	Palustrine Emergent Wetland	75600	0.000279
41	Grassland	Evergreen Forest	75600	0.000279
42	Grassland	Estuarine Emergent Wetland	71100	0.000262
43	Unconsolidated Shore	Palustrine Emergent Wetland	68400	0.000252
44	Bare Land	Unconsolidated Shore	66600	0.000245
45	Palustrine Forested Wetland	Bare Land	62100	0.000229
46	Palustrine Forested Wetland	Low Intensity Developed	60300	0.000222
47	Palustrine Scrub/Shrub Wetland	Cultivated	57600	0.000212
48	Palustrine Emergent Wetland	Estuarine Aquatic Bed	53100	0.000196

pre_katrina_05_change_stats/

7. Select **File > Exit** to exit ENVI EX.