

**ERDAS IMAGINE 2015**

**RASTER BASED CHANGE DETECTION**

**TIPS AND TRICKS**

**USFWS WORKSHOP**



# Change Detection

## Section Objective

In this section, you will learn how to compare imagery, identify change, and report results.

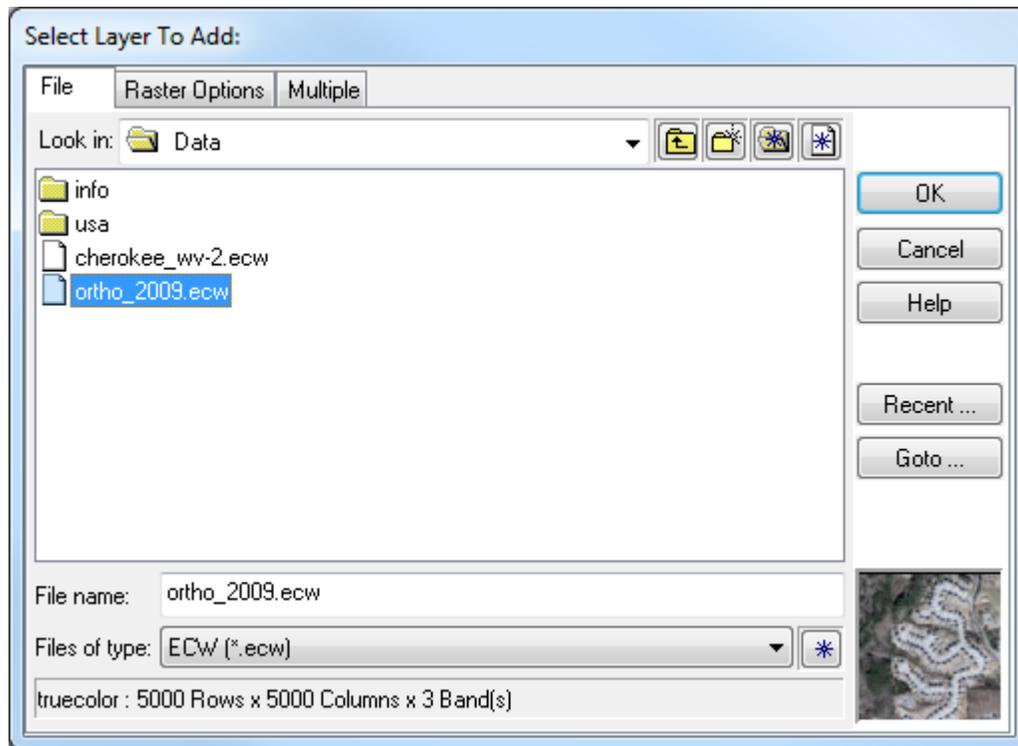
### Exercise 1: Basic Change Detection Using the Swipe Tool

#### Objective:

Students will perform visual change detection by loading multiple images into a View and use the swipe tool to view the underlying image.

#### Task 1.1: Using Swipe to Examine the Images

1. In a new View, open *ortho\_2006.img* and *ortho\_2009.ecw*. Ensure that *ortho\_2006.img* is on top in the Contents pane. Note the difference in file extensions. You will have to change the "files of type" option to view *ortho\_2009.ecw*.

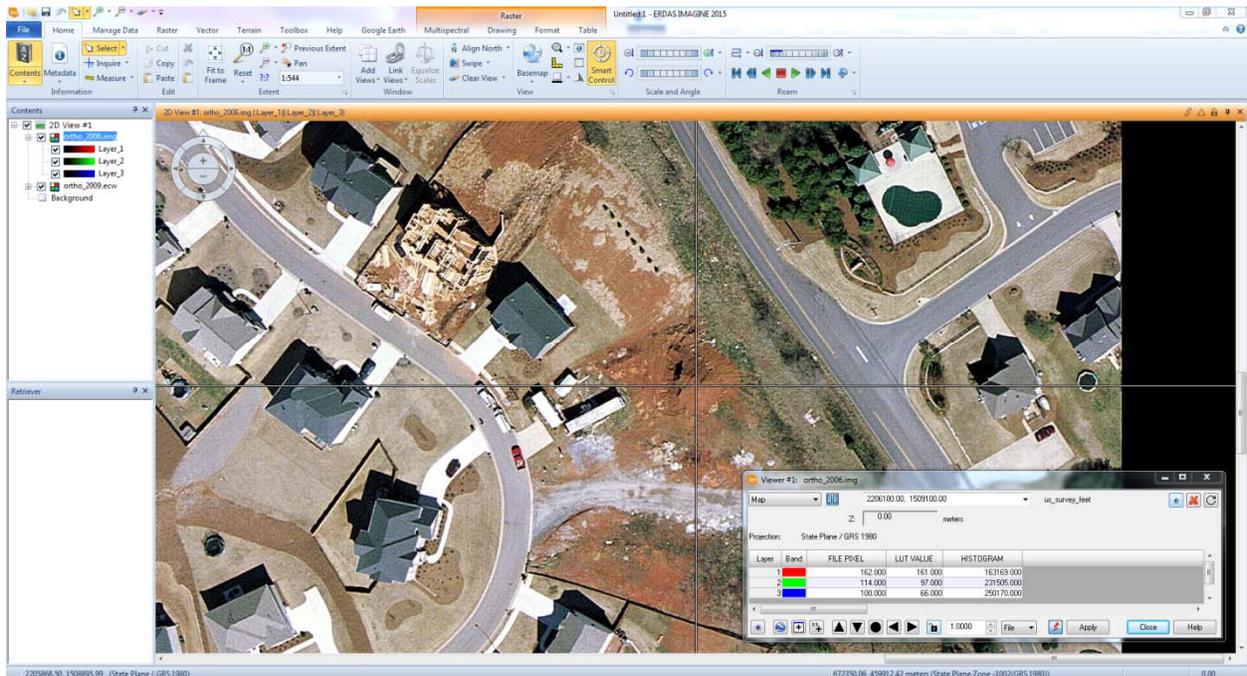
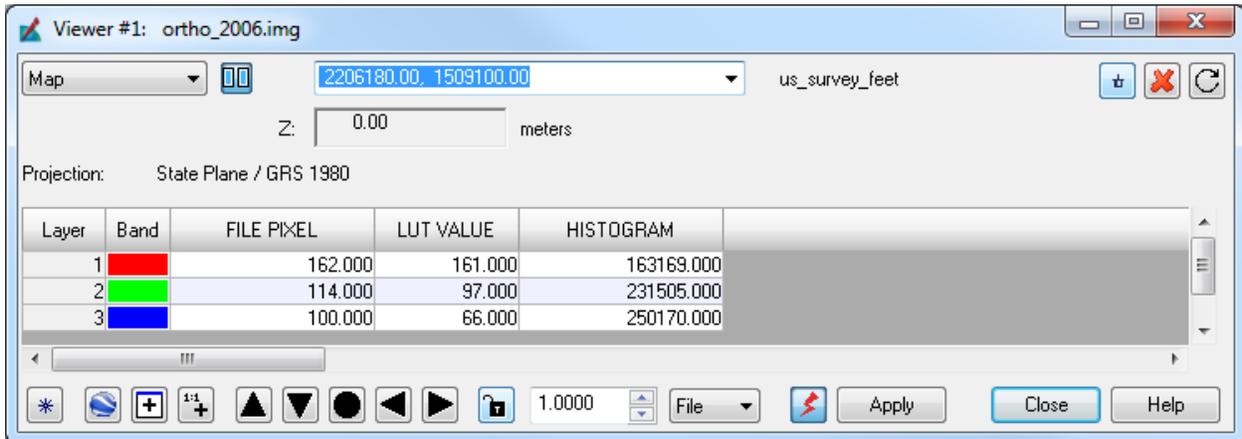


2. On the **Home** tab, **Extent** group Select the Reset button .



Reset sets the display scale of the current view such that one image pixel of the uppermost image is represented by one screen pixel and grid north is oriented up on the screen.

3. Select the **Inquire Cursor**. Enter the coordinates **2206180.00, 1509100.00** select **Apply** and **Close**. The view should center on a construction site.



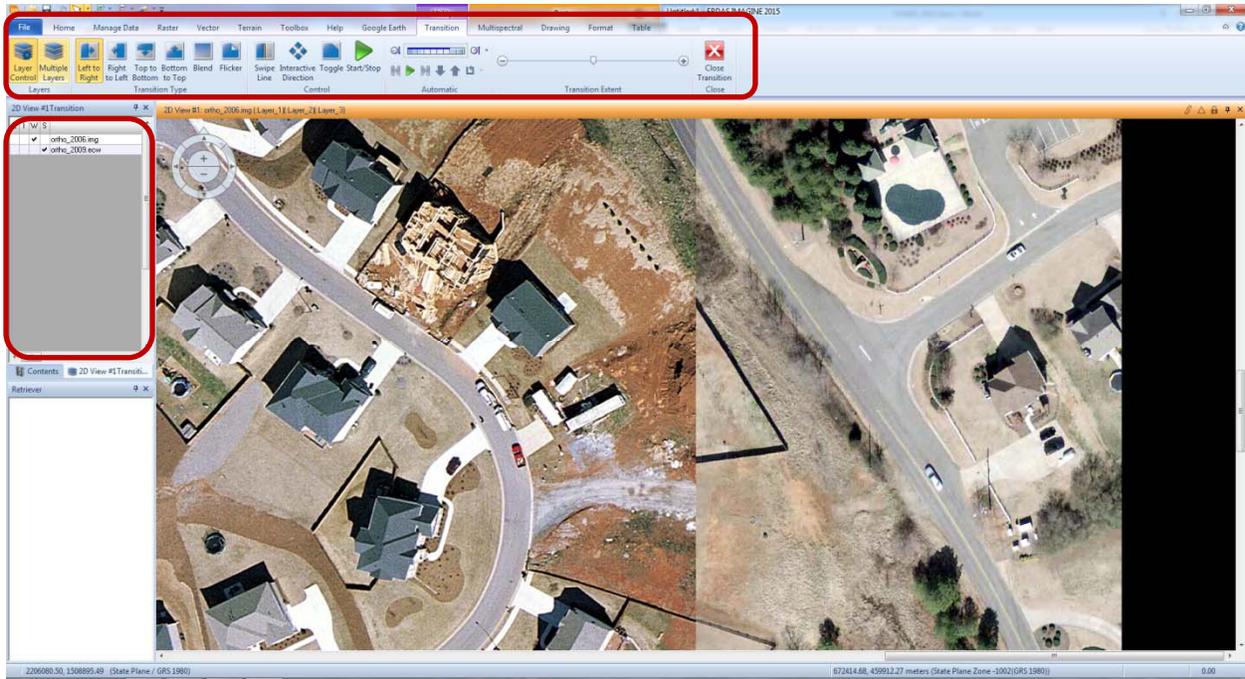
4. Now we will use the **Swipe** function to see the changes. Start the **Swipe Transition layer** by clicking



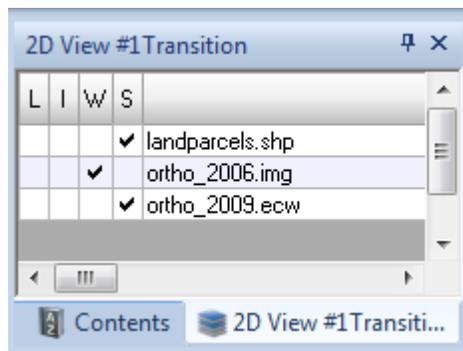
**Swipe** button from the **View** group of the **Home** tab. The **Transition tab** is added to the ribbon and the **Transition Pane** is added to the left of the viewer.



You can also right-click in the 2D View and select **Swipe** from the Quick View functions. **Blend** and **Flicker** are also available options.



5. Use the slider in the **Transition Extent** group to swipe the top layer back and forth and examine the change.
6. Right-click in the View, select **Open Vector Layer**, and add *landparcels.shp* to the same View. You will now have three files and the Layer Control group updates accordingly.



<b>L - Locked</b>	The status of the selected image is locked. During a movie the status of the image remains unchanged.
<b>I - Invisible</b>	The selected image is always invisible.
<b>W - Working</b>	The selected image is visible and is affected by the <b>Swipe status</b> . There must be at least one working layer. The last layer in the list cannot be the working layer since there is no layer beneath it.

**S - Static**

The selected image is visible but it is unaffected by the **Swipe status**.

7. In the Layer Control, move the check for ***ortho\_2006.img*** to the **W** column to make this a Working layer. Use the Transition Extent slider to swipe two layers.
8. Move the check for ***landparcels.shp*** to the **S** column to leave it displayed. Swipe only ***ortho\_2006.img***.
9. Use this time to switch between modes, start / pause / stop the movie, and become familiar with the Swipe Multilayer functionality.
10. Zoom and pan around the imagery and analyze the difference between the datasets using Swipe.
11. **Close** the Transition  and **Clear** the View.

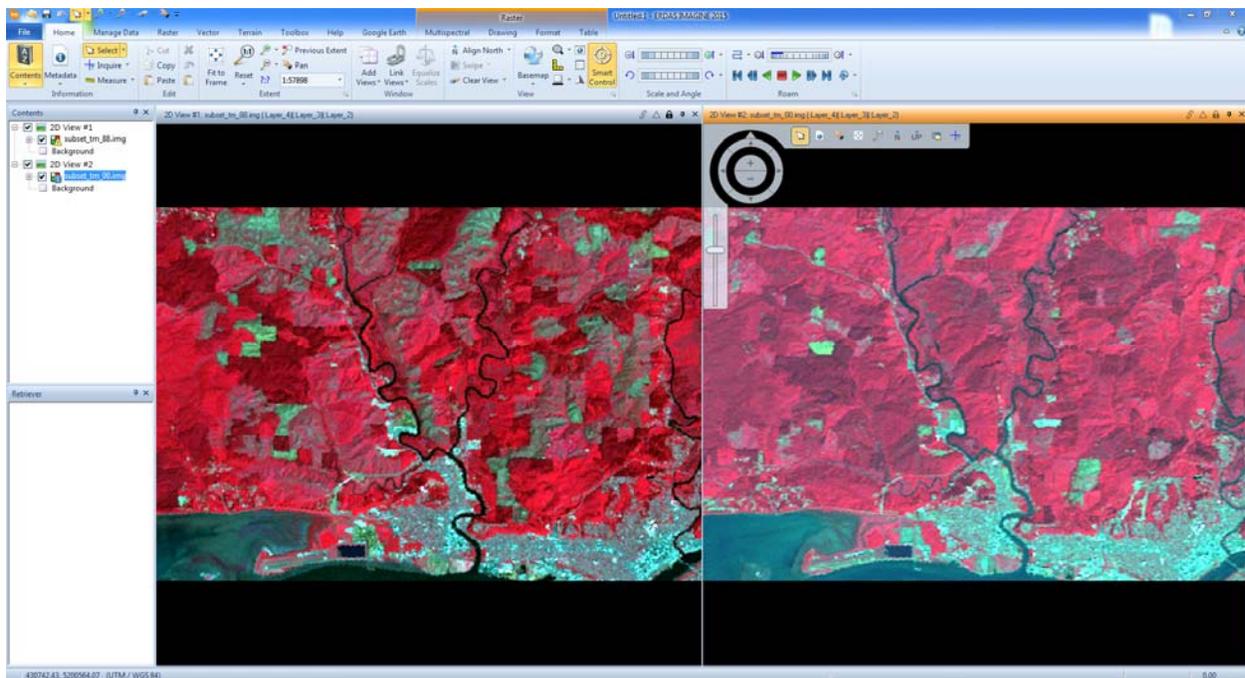
## Exercise 2: Identifying and Extracting Changes

### Objective:

Students will identify and measure the changes in clear-cuts and urban development between two periods. This will provide an indication of the rate of change within this area.

### Task 2.1: Change Detection

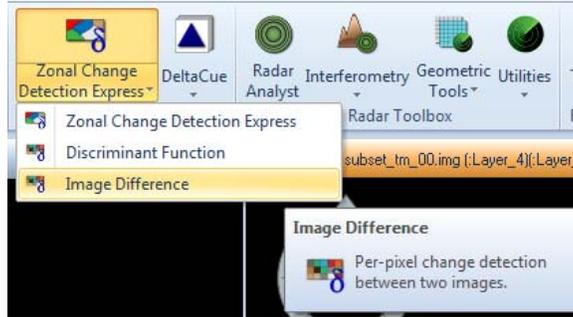
1. Open two **2D Views**.
2. Open **subset\_tm\_88.img** (a subset portion of a TM image taken in July 1988) in the first View.
3. Open **subset\_tm\_00.img** (a subset portion of a TM image taken in July 2000) in the second View.



4. Link these two Viewers and study the differences between these two images.

The Change Detection tool can assist in identifying these features.

5. On the **Raster** tab, in the **Change Detection** group, select  **Zonal Change** ->  **Image Difference**.



6. Input **subset\_tm\_88.img** as the **Before Image** and **subset\_tm\_00.img** as the **After Image**.
7. Change the Layer for both images to **4**.

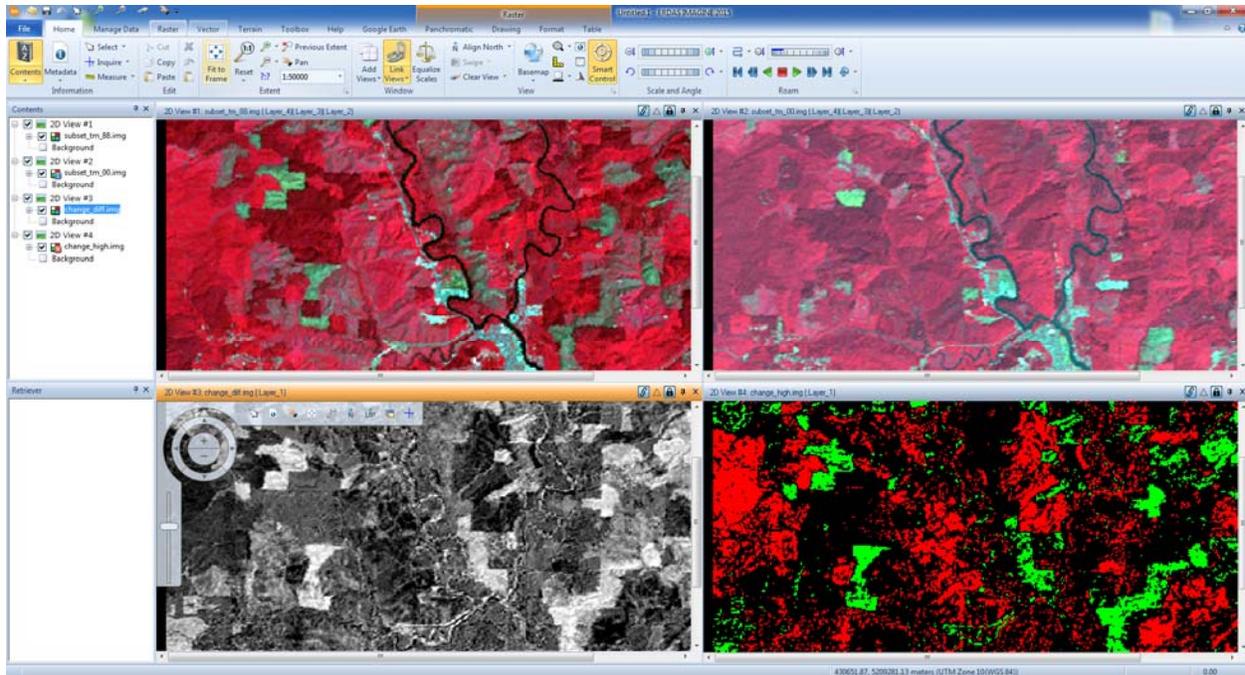


Layer 4 is the Near Infrared band and will provide significant contrast in vegetated and clear-cut areas.

8. Type **change\_diff.img** as the **Image Difference File** and **change\_high.img** as the **Highlight Change File**.
9. In the **Highlight Changes**, with the **As Percent** radio button selected, change the **Increases More Than** percent value to **25.0** and the **Decreases More Than** to **25.0**.



10. Click **OK**. When the Modeler Job State reads **Done – Click Dismiss to Remove**, click **Close** to complete the process.
1. Open two additional 2D Views in the [eWorkspace](#).
11. Display **change\_diff.img** and **change\_high.img** in the third and fourth Viewers, respectively.
12. Link and Sync these Viewers and change the scale for all to **1:50000**.



13. Pan around and study the areas highlighted in green and red in the *change\_high.img* file.

14. Use the Inquire Cursor to determine:

***What changed at: 47 00 16 N 123 56 27 W***

***What is the red at: 47 00 12 N 123 52 14 W***

## Task 2.2: Identify and Measure the Changes

1. There are a few areas of change between these dates. Use the  **Measure** tool (on the **Home** tab) to determine the area of each.
2. Clear all Viewers.

## Zonal Change Detection

### Section Objective

Students will learn to use the Zonal Change Detection tools in ERDAS IMAGINE to perform smarter change detection through automation.

### Tools Used

<b>Layout</b>	<i>Used to change in and out of the Zonal Change user interface.</i>
<b>Viewer</b>	<i>Used to visualize two different dates of imagery with polygon zones.</i>
<b>Zonal Change Process Tab</b>	<i>Tools to set up a change project, set changes sensitivities, and run change likelihood process.</i>
<b>Zonal Change Review Tab</b>	<i>Tools to use change likelihood to define what has and what has not changed.</i>

## Exercise 1: Creating the Project

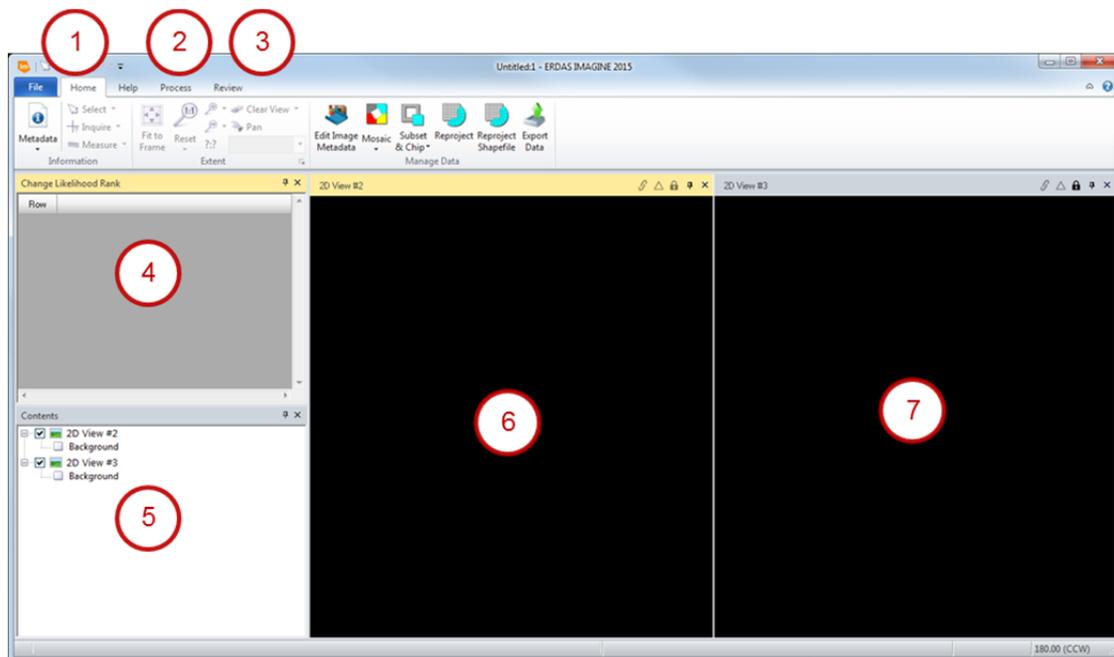
### Objective:

Students will setup the Change Detection project.

### Task 1.1: Layout the Project

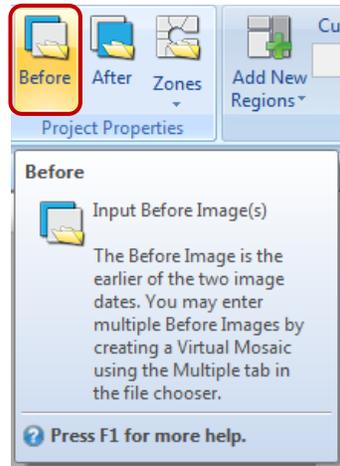
Students will setup the project in the Zonal Change Detection Layout.

1. From the eWorkspace, click the File Menu.
2. From the menu, select **Layout > Zonal Change Layout**. The Layout changes from the Standard Layout to the **Zonal Change Layout**.

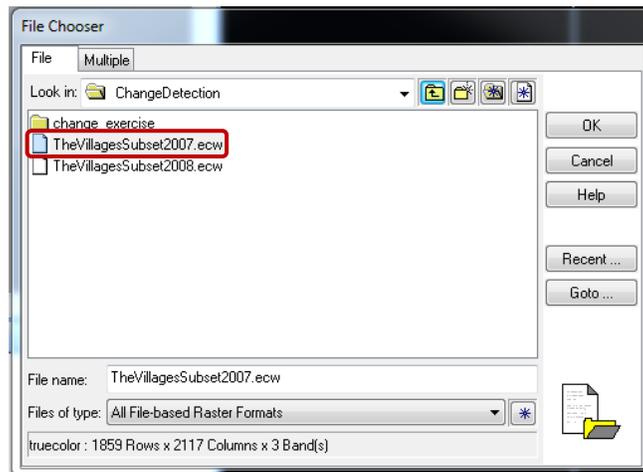


<b>1 Simplified Home Tab</b>	<i>The standard Home ribbon tab was simplified to deliver only the most typical functions needed for zonal change.</i>
<b>2 Process Tab</b>	<i>Provides the tools needed to set up a change project and run the change likelihood process.</i>
<b>3 Review Tab</b>	<i>Provides the tools needed to review the results of a change likelihood process.</i>
<b>4 Change Likelihood Panel</b>	<i>Provides the tools needed to drive the change likelihood review, and define which zones have changed.</i>
<b>5 Table of Contents Panel</b>	<i>Presents the layers viewed. Selecting these layers will display context sensitive tabs, such as multispectral.</i>
<b>6 Before Image Viewer</b>	<i>Presents the before image and zone layers.</i>
<b>7 After Image Viewer</b>	<i>Presents the after image and zone layers.</i>

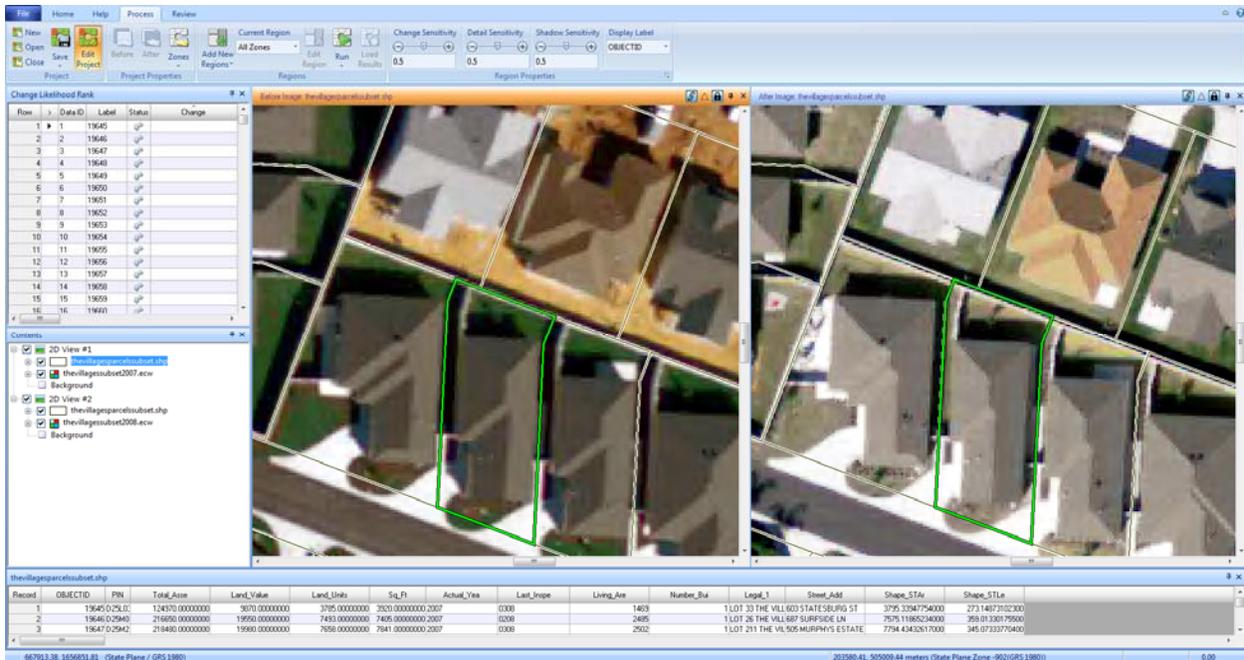
3. Open the **Process** tab > **Project** group > **New** to create a new project.
4. Save the project as **Change\_Exercise** in the **Change Detection** folder or in the **Outputs** folder.
5. Working across the **Process** tab, select **Before** in the **Project Properties** group.



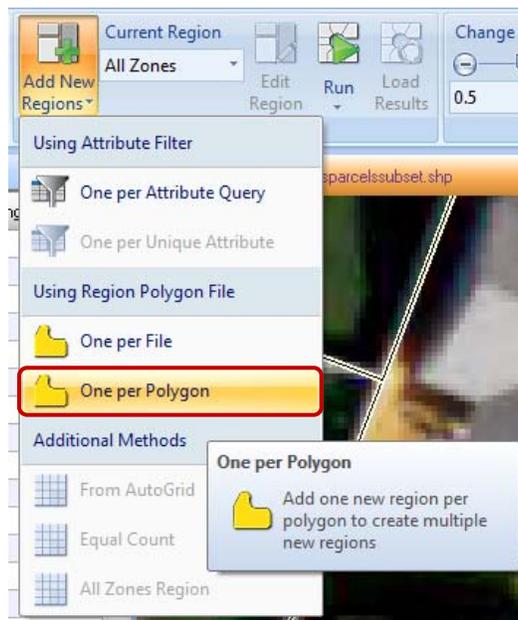
6. Open **TheVillagesSubset2007.ecw**. Click OK.



7. Select **Process** tab > **Project Properties** > **After**. Open **TheVillagesSubset2008.ecw**.
8. Open the **Zone** drop-down menu and select **Zone File**. Set the zone file as **TheVillagesParcelsSubset.shp**.



9. Open the **Add New Regions** drop-down menu. In the **Using Region Polygon File**, select **One Per Polygon**.



10. Select **TheVillagesParcelsSubsetsResgions.shp**.

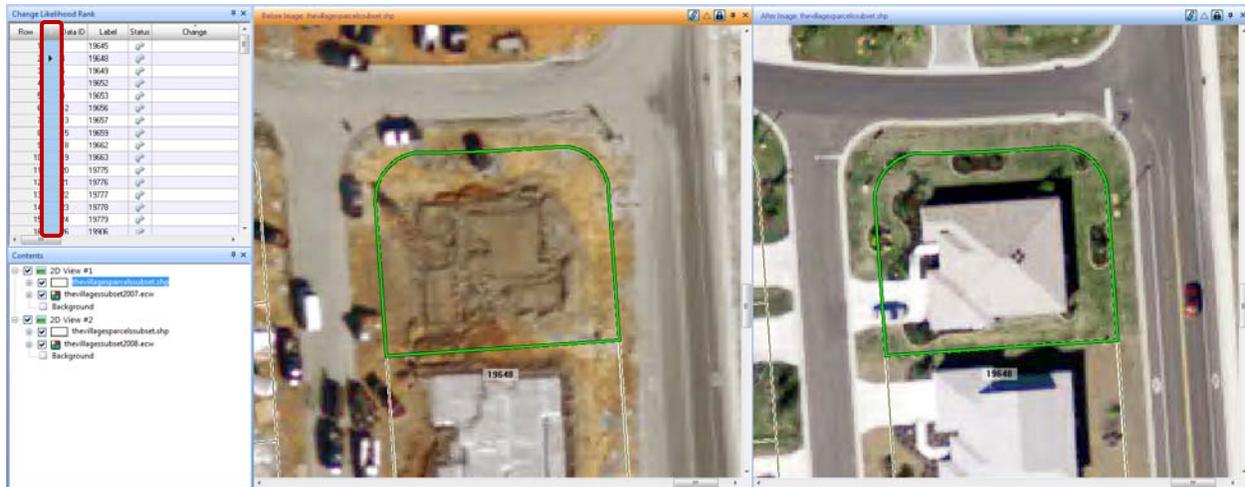
11. Do NOT save nor run the project!

## Task 1.2: Define the Region Properties

Students will set the properties for the regions, including the Change, Detail, and Shadow Sensitivity.

In order to understand the impact of each sensitivity rating, the instructor will assign different settings for different regions.

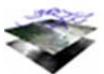
1. Use the **Change Likelihood Panel** caret > column to review multiple zones in several regions as a sample of the change that you are measuring. Look at samples from each region. You want to get an idea of how the image texture, tonal differences, shadows, and features size will impact the changes detection process. This will also help set the change, detail, and shadow sensitivities.



2. Set the **Change Sensitivity**, located in the **Region Properties** group, based on the images differences in seasons, texture, image graininess, as well as tonal and color differences.



The two images were taken during different periods of the same season and different times of day. The image from 2007 was taken in mid-spring. The image from 2008 was taken in early spring. The image from 2007 was taken in the morning before 12 PM. The image from 2008 was taken in the afternoon.



A **low setting** means features with subtle differences in texture, color and tone will have little weight in the change likelihood calculation.

A **setting of 1** means very subtle differences will have a significant effect in the change likelihood calculation.

**Q:**

*How will modifying the Change Sensitivity affect the change likelihood calculation?*

3. Set the **Detail Sensitivity** based on the smallest feature that you want to use in the likelihood calculation.



A **setting of 0** means features smaller than 100 pixels will have little weight in the change likelihood calculation.

A **setting of 0** means features as small as 4 pixels will have a significant effect in the change likelihood calculation.

**Q:**

*How will changing the Detail Sensitivity affect the change likelihood calculation?*

4. Set the **Shadow Sensitivity** based on the value the shadow provides to the change likelihood calculation. Change the **Shadow Sensitivity** from 0.5 to 0.1.



Shadows can provide meaningful information, but they can also cause problems. Shadows from different solar elevations caused by differences in image capture times, such as different times of day or year, can have a negative effect on change detection.



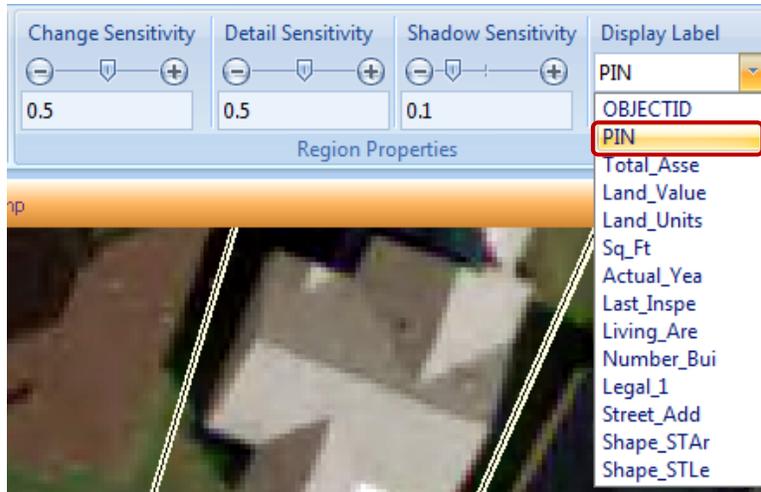
A **low setting** means shadow will have little weight in the change likelihood calculation.

A **high setting** means shadow will have a significant effect in the change likelihood calculation.

**Q:**

*How will changing the Detail Sensitivity affect the change likelihood calculation?*

5. In the **Region Properties** group, set the **Display Label** based on the attribute in the zone file that contains the most meaningful information. In this case, we are working with zones based on parcels so set the **Display Label** to the **PIN (Parcel Identification Number)**.



6. The **Advanced Properties** button in the LR corner of the **Region Properties** group can be used to select layers to be used in the change process. In some cases, all using all layers may not be desirable. In our case, all layers are preferable.
7. The properties for each region must be set individually. Specify the Region Properties for the remaining regions.



The Region Properties process must be done for every region before saving. In many cases, the same setting can be used for all regions.

8. Once all settings for all regions are at the desired level, click Save. Once you save, you cannot go back!



Why can I not go back? The design of the project is so that the project can be traced back to all settings. Once saved, the settings are set. If you want to change settings, you have to create a new project.

### Task 1.3: Run the Project

Students will run the project in a batch.

1. From the **Regions** group, open the **Run** pull-down menu. Select **Batch Regions** so that we can set up all of the regions to run simultaneously.



Selecting **Run Region** will run the process immediately from the workspace. **Batch Regions** offers several options:

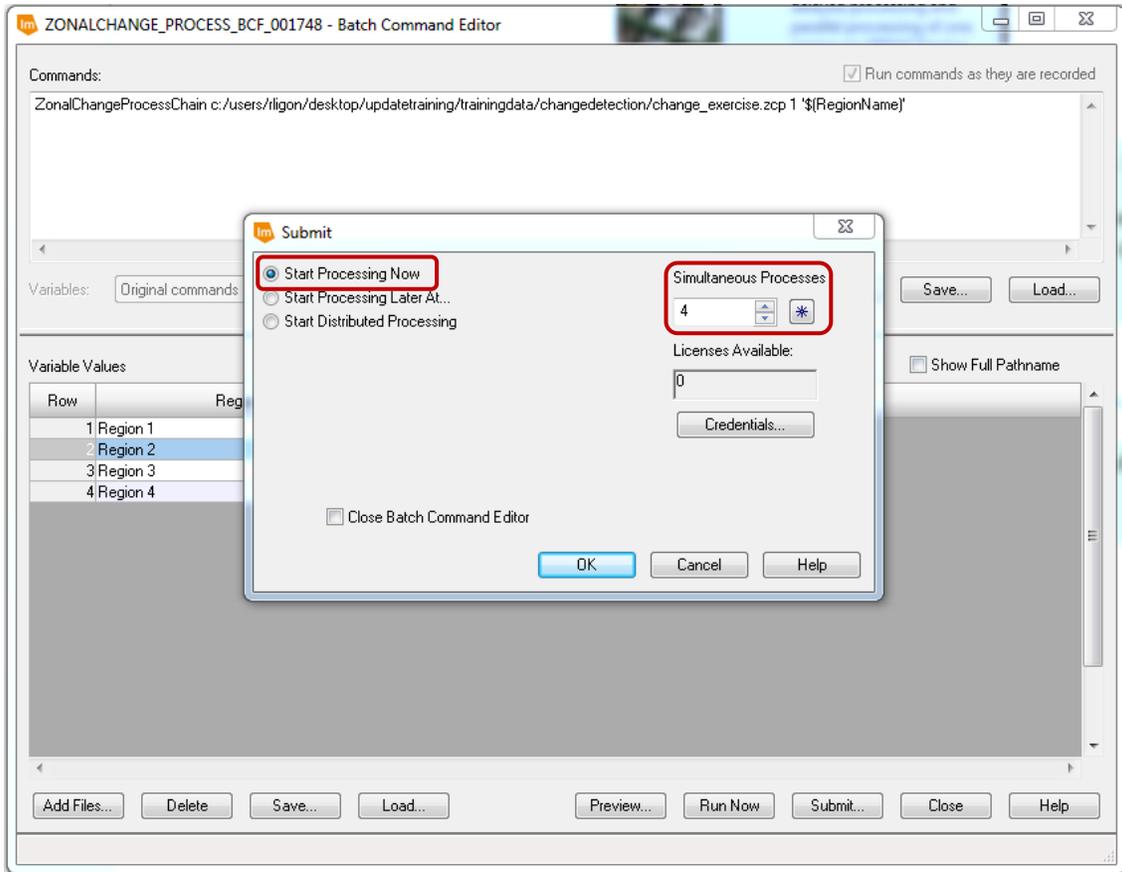
- Batch multiple regions as a serial process (one after another)
- Batch multiple regions as a parallel process (simultaneous processing)
- Immediate processing
- Time delayed processing

2. In the **Variable Values** list, highlight **All Zones** by click on the **1**. Right-click and **Delete Selection**.



Leaving the **All Zones** along with all of the regions would effectively run all of the regions twice.

3. Click **Submit**.
4. Change the **Simultaneous Processes** to **4**.
5. Keep the **Start Processing Now** radio button selected.



6. Click **OK**.

## Exercise 2: Review Change Likelihood and Define Change

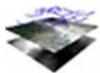
### Objective:

Students will gain an understanding of the zonal change review process.

### Task 2.1: Review Change Likelihood

Students will review the results of the Change Detection process.

1. When all processes have been completed, begin review process.
2. Click **Load Results** for Region 1.



This loads the change likelihood results for each region. The zones are automatically ranked from high likelihood to low likelihood. Sort the priority by clicking the Change Likelihood Panel column headers.

- Use the **Caret** > column to review the Change Detection results.



The Change Likelihood ranking is scaled for every zone in the region, from high to low. A high likelihood rating means that among the zones in the region, these have the highest likelihood of change.

The screenshot shows a GIS application window. On the left, a 'Change Likelihood Rank' table lists various zones with their DataID, Label, Status, and Change indicators. The main area displays two aerial views of a site with a green boundary. The bottom of the window shows a data table with columns for OBJECTID, P/N, Total\_Acres, Land\_Value, Land\_Units, Sq\_Ft, Actual\_Yrs, Last\_Inspe, Living\_Are, Number\_Bus, Legal\_1, Street\_Add, Shape\_S\_TAv, and Shape\_S\_TLe.

OBJECTID	P/N	Total_Acres	Land_Value	Land_Units	Sq_Ft	Actual_Yrs	Last_Inspe	Living_Are	Number_Bus	Legal_1	Street_Add	Shape_S_TAv	Shape_S_TLe
2824	02942	227180.00000000	17680.00000000	8776.00000000	9370.00000000	2007	0308	2590		1 LOT 240 THE VIL 623 LITTLE RIVER PAH1	6862 70117980000	343 645265763000	
2825	02942	262050.00000000	47860.00000000	7714.00000000	7981.00000000	2007	0308	2582		1 LOT 228 THE VIL 580 LITTLE RIVER PAH1	7757 7712952000	261 55986327200	
2826	02942	324180.00000000	27950.00000000	13953.00000000	1464.00000000	2007	0308	2479		1 LOT 219 THE VIL 525 LITTLE RIVER PAH1	10671 76991700000	448 76392229000	

- Review the first zone and click the following options to mark the zone in the project. While reviewing, notice areas of change you are interested in and change you are not. These will help you determine the setting.



**Mark Changed:** Zones that contain the change you are interested in mapping.

**Mark Unchanged:** Zones that do not contain change, or do not contain the change you are interested in mapping.

**Need Review:** Zones where the change status is unclear. The reviewer may need assistance, or the zone may need a field visit.

**Unknown:** Zones where the status is unknown. This is the default after processing.



Note: While defining the change, the viewer automatically moves to the next zone on the list.

5. Repeat for the remaining regions.



To see the complete process, check out Hexagon Geospatial's Training videos:

Smarter Change – Zonal Change Detection Part 1: Creating Your Project

<http://community.hexagongeospatial.com/t5/ERDAS-IMAGINE/Smarter-Change-Zonal-Change-Part-1-Creating-Your-Project/ta-p/500>

Smart Change – Zonal Change Part 2: Analyzing Your Results

<http://community.hexagongeospatial.com/t5/ERDAS-IMAGINE/Smarter-Change-Zonal-Change-Part-2-Analyzing-Your-Results/ta-p/579>