Vegetation Change Detection

Remote Sensing For Ranger Districts Using Image Analysis For ArcGIS

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Assumptions of this technique

- *Your Landsat TM imagery:*
  - *Covers the same area of interest*
  - *Has been acquired at different dates (or times)*
  - *Must be the same resolution (30-meter)*
  - *Share the same projection information*
- *You have derived vegetation indices from Landsat TM imagery. Note: For this tutorial, we will assume that you have derived NDVI images from the Landsat TM imagery (to learn about how to derive NDVI imagery, visit http://fsweb.geotraining.fs.fed.us/tutorials/ia_10things/pdfs/10_band_ratios.pdf).*

*Ensure that the Image Analysis extension and toolbar are enabled. To enable the Image Analysis extension in ArcMap click **Tools | Extension** and place a check next to **Image Analysis**. To enable the Image Analysis toolbar, click: **View | Toolbars | Image Analysis**.*

*You, the user, have control as to what the significant change thresholds will be. You can determine significant change by specifying a percentage of pixels (**As Percent**) or simply by the pixel values (**As Value**). Determining the exact thresholds is typically an iterative process and dependent on the data as well as your project.*

Objectives

- To perform a vegetation change detection using Landsat TM imagery
- Interpret change detection results

Required Data

- Two single-layer vegetation indices (e.g., NDVI (Normalized Difference Vegetation Index), NBR (Normalize Burn Ratio), etc…)—see technique assumptions to the left

Introduction and Overview of Procedure Steps

Vegetation change detection identifies vegetative land cover changes over time. Change detection has numerous applications in the Forest Service. The focus of this tutorial is to describe how to perform a vegetation change detection using Landsat TM imagery and interpret the results. The topics include:

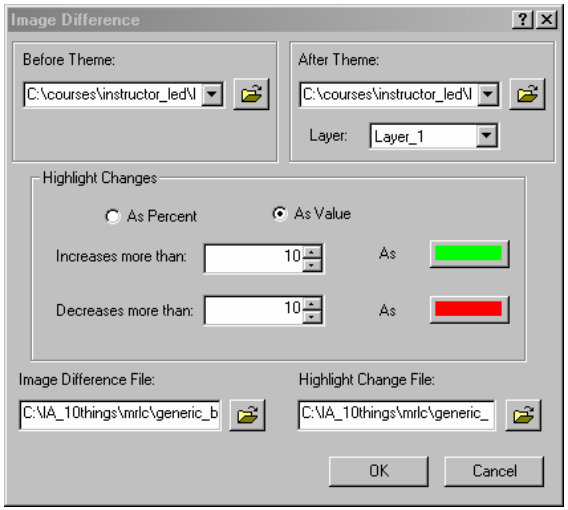
1. Initial Set-up of the Image Difference dialog
2. Determine Significant Change
3. Inspect and Interpret the Results

I. Initial Set-up of the Image Difference dialog (please see assumption to the left before proceeding with the tutorial).

1. Launch **ArcMap** from the **Start** menu (**Start | Programs | ArcGIS | ArcMap**).
2. Ensure that **A New Empty Map** is enabled.
3. Click **OK**.
4. Close the **Add Data** dialog.
5. Select **Image Analysis | Utilities | Image Difference** from the **Image Analysis** toolbar. This will open the **Image Difference** dialog.
6. Click the **Yellow Folder** button associated with the **Before Theme** field.
7. Navigate to and single-click your **Time 1 NDVI Image** in the **Choose Source Dataset** dialog.
8. Click the **Add** button.
9. Click the **Yellow Folder** button associated with the **After Theme** field.
10. Navigate to and single-click your **Time 2 NDVI Image** in the **Choose Source Dataset** dialog.
11. Click the **Add** button.

II. Determine Significant Change

1. Enable **As Percent** or **As Value** to highlight significant changes.
2. Enter appropriate values in the **Increases More Than** and **Decreases More Than** fields.
3. Set the **Colored Boxes** to colors of your choice (or simply accept the defaults).



The Image Difference dialog

*The **Image Difference** algorithm simply uses Image Algebra to perform the change detection. Pixel values of the Time 1 image are subtracted from corresponding pixel values of the Time 2 image (Time 2-Time 1).*

4. Click on the **Yellow Folder** button associated with the **Image Difference File** field.
    5. Navigate to an appropriate output file location.
    6. Type an output file name for your **Difference Image** in the **Name** field.
    7. Ensure the Save As Type is set to ERDAS IMAGINE.
8. Click on the **Yellow Folder** button associated with the **Highlight Change File** field.
    9. Navigate to an appropriate output file location.
    10. Type an output file name for your **Highlight Change Image** in the **Name** field.
    11. Ensure the **Save As Type** is set to **ERDAS IMAGINE**.
12. Click **OK**. The **Difference** and **Highlight Change Images** will both automatically display in the **Data View**.

III. Inspect and Interpret the Results.

1. Toggle off your **Highlight Change Image** in the **Table of Contents** so that only your **Difference Image** is visible in the **Data View**.
2. Inspect your **Difference Image**.
    3. Very light (white) and dark (black) tones suggest vegetation change over time. Lighter tones are indicative of increases in vegetation, while darker tones are indicative of decreases in vegetation.
4. Toggle off your **Difference Image** and toggle on your **Highlight Change Image**.
5. Inspect your thematic **Highlight Change Image** that contains five classes based on the threshold you specified (Section 2, step 2) as your highlight change values.
    6. Your **Hightlight Change Image** contains five classes:
        7. The **Decreased** class highlights pixels that suggest significant vegetative decreases over time, and will appear as the color you set for the **Decreases more than** option.
        8. The **Increased** class highlights pixels that suggest significant vegetative increases over time, and will appear as the color you set for the **Increases more than** option.
        9. The **Some Decreased** and **Some Increased** classes represent non-significant decreases and increases in vegetation over time.
        10. The **Unchanged** class represents no change over time.
11. Use both the **Image Difference** and **Highlight Change** images together to refine your change detection. Run the process again and experiment with the threshold settings until you get a suitable result for your project.