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Land-Use Land-Cover Change Detector



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Introduction

- **GIS softwares are widely used in the fields of Urban Planning, engineering, geography, managing land assets, habitat management, disaster management and many of its relating fields.**
- **Users are able to use GIS software because of the developers who bring user friendly tools that can help in executing an application oriented work on GIS platform.**
- **One such GIS platform, ESRI's ArcGIS has a built in function to build our own customized tools.**
 - **Model Builder**
 - **Python Scripting**
- **Model Builder and Python Scripting are the two means of customization through which a user can built his/her own required tool.**

What Is GIS Customization ?

- Customisation is the process of transforming a system to an individual need.
- The task of developing specific-purpose, end-user customisations is generally seen as the main focus area of application developers.
- ESRI's ArcGIS allows its users to customize tools as per users requirement using either Model Builder or Python Scripting.
- Model Builder allows user to built their customized tools/application without a single line of code. Just drag and drop required tools from search window to model builder window, compile your application and done.
- Python Scripting can be very useful when there are multiple inputs or complicated loops. Cursors is one of the major USP of Python Scripting.

What is LULC Change Detector ?

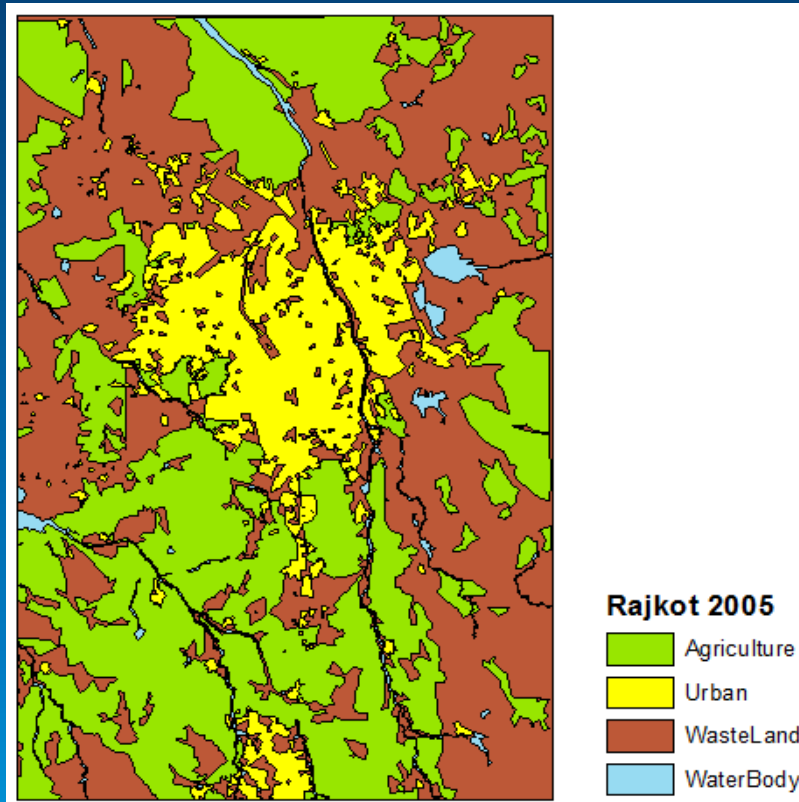
- “Land-Use Land-Cover Change Detector” is a small tool scripted in python windows of ESRI’s ArcGIS 10.2.2 which can be useful for those who are in the fields of engineering, urban planning, urban sprawl, disaster management and all the applications which requires to find temporal land use / land cover changes of the same location.
- The tool presented here works on the logic of comparing two vector classified images, by comparing its attributes, finding the area and then the percentage change.
- The need of such tool became important because of lack of freely available customized tools in ArcGIS, which can help to detect changes in land forms in terms of area and percentage.
- There was urgent use of a tool that can detect such changes and gives analytical statistical results.

Working of LULC Change Detector

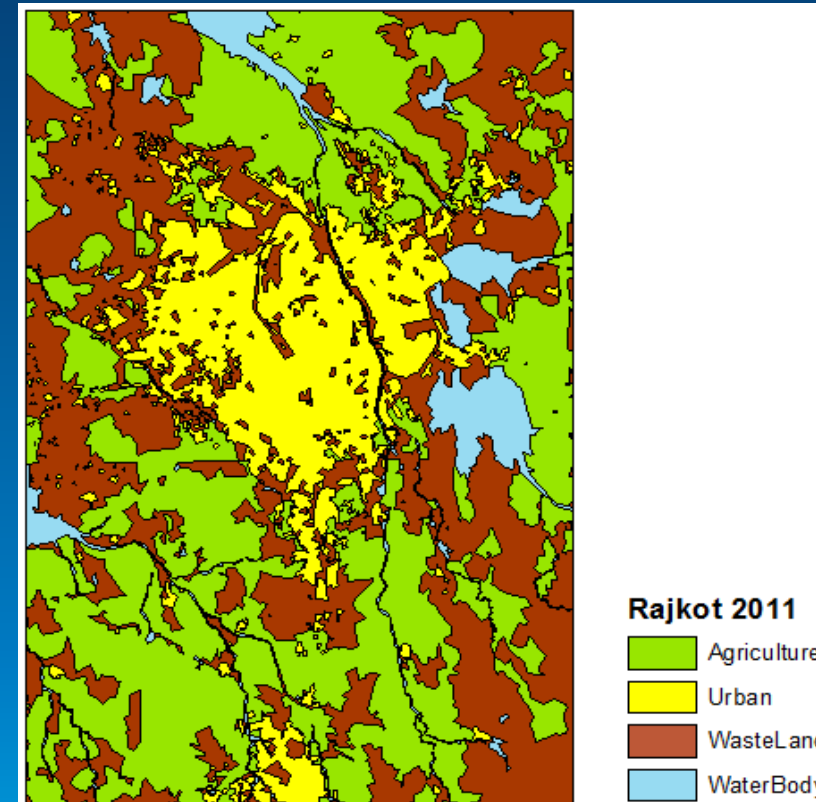
In order to let LULC Change Detector work some minimum criterias should be checked first:-

- 1) Both the shapefiles should be in UTM Projection.
- 2) Both the shapefiles should have same extent, and same numbers of land feature classes.
- 3) Both the shapefiles must have following field:-
 - 1) FID
 - 2) Land Feature
 - 3) Year
 - 4) Area Unit (Sq.Km, Sq. M., Sq. Ft
- 4) There should be no spelling mistakes in any of the two shapefiles for better and correct output.

Working of LULC Change Detector



FID	Shape	Land	Year	Area_Unit
0	Polygon	Urban	2005	Sq.Km.
1	Polygon	Agriculture	2005	Sq.Km.
2	Polygon	WasteLand	2005	Sq.Km.
3	Polygon	WaterBody	2005	Sq.Km.



FID	Shape	Land_New	Year_New	Area_UnitN
0	Polygon	Urban	2011	Sq.Km.
1	Polygon	Agriculture	2011	Sq.Km.
2	Polygon	WasteLand	2011	Sq.Km.
3	Polygon	WaterBody	2011	Sq.Km.

Working of LULC Change Detector

- **Once both the shapefiles are verified as per the minimum criterias of LULC Change Detector, this tool will then union both the shapefiles.**
- **Required fields of area will be added.**
- **On union of both the shapefiles, areas of each polygon will be compared to corresponding polygon areas of second image.**
- **Increase / Decrease in terms of area and percentage will be displayed in union shapefile.**
- **Attribute table of union shapefile will be then converted to text reports and result table.**
- **From result table, bar graphs can be prepared for visualizing change in Land-Use Land-Cover features within the two temporal vector images.**

Working of LULC Change Detector

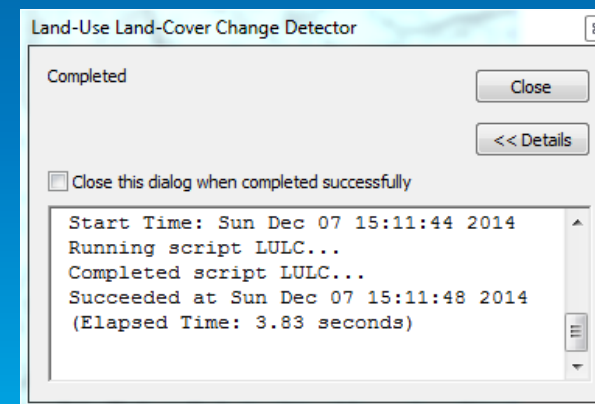
The screenshot displays the 'Land-Use Land-Cover Change Detector' dialog box. It contains the following fields and settings:

- Workspace (Input):** C:\Users\Rushi_MUFC\Desktop\Sample Data\New folder\LULC
- Previous Year Image (Input):** C:\Users\Rushi_MUFC\Desktop\Sample Data\Rajkot_2005.shp
- Next Year Image (Input):** C:\Users\Rushi_MUFC\Desktop\Sample Data\Rajkot_2011.shp
- Union (Output):** C:\Users\Rushi_MUFC\Desktop\Sample Data\New folder\LULC\Union.shp
- FID Field (Previous Year Image):** FID
- Year Field (Previous Year Image):** Year
- Land Cover Field (Previous Year Image):** Land
- Area Unit Field (Previous Year Image):** Area_Unit
- FID Field (Next Year Image):** FID
- Year Field (Next Year Image):** Year_New
- Land Cover Field (Next Year Image):** Land_New
- Area Unit Field (Next Year Image):** Area_UnitN
- Detail Report (Output):** C:\Users\Rushi_MUFC\Desktop\Sample Data\New folder\LULC\Detail Report.txt
- Result (Output):** C:\Users\Rushi_MUFC\Desktop\Sample Data\New folder\LULC\Result Table.xls

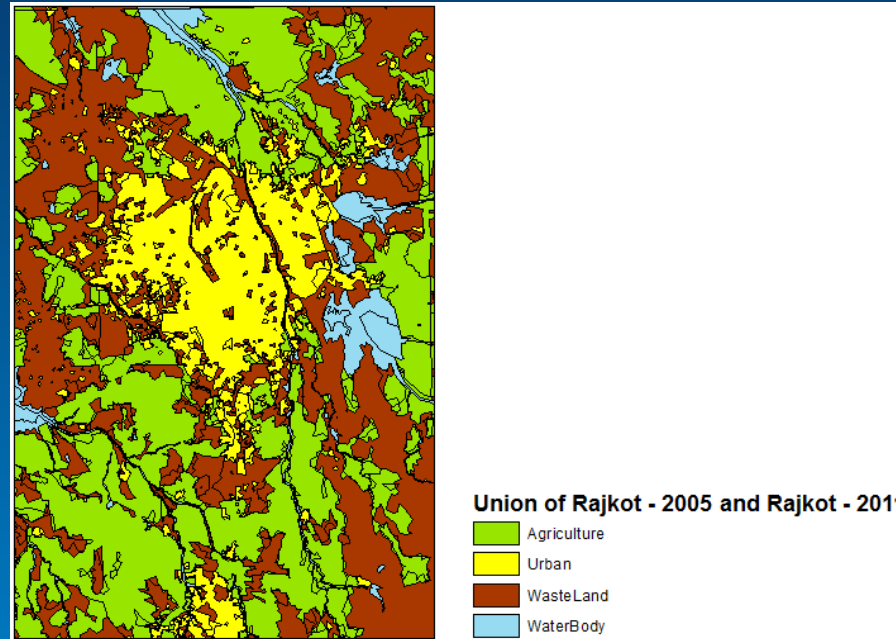
Buttons at the bottom: OK, Cancel, Environments..., Show Help >>

Results of LULC Change Detector

- 1) Automatically generated Microsoft Excel file showing the overall comparison of land use / land cover changes between two vector images of two different years.
- 2) Automatically generated report text file shows the change in area (in Sq.Km.) and percentage by which a certain LULC feature has increased or decreased within the two different years.
- 3) Automatically generated detailed report shows which part, to what area and to what percentage has one feature of year has been changed to what feature of the second year.
- 4) LULC Change Detector just took **3.83 Seconds** to complete its processing for input data.
Time depends of no. of LULC class defined and
Computer processing speed.

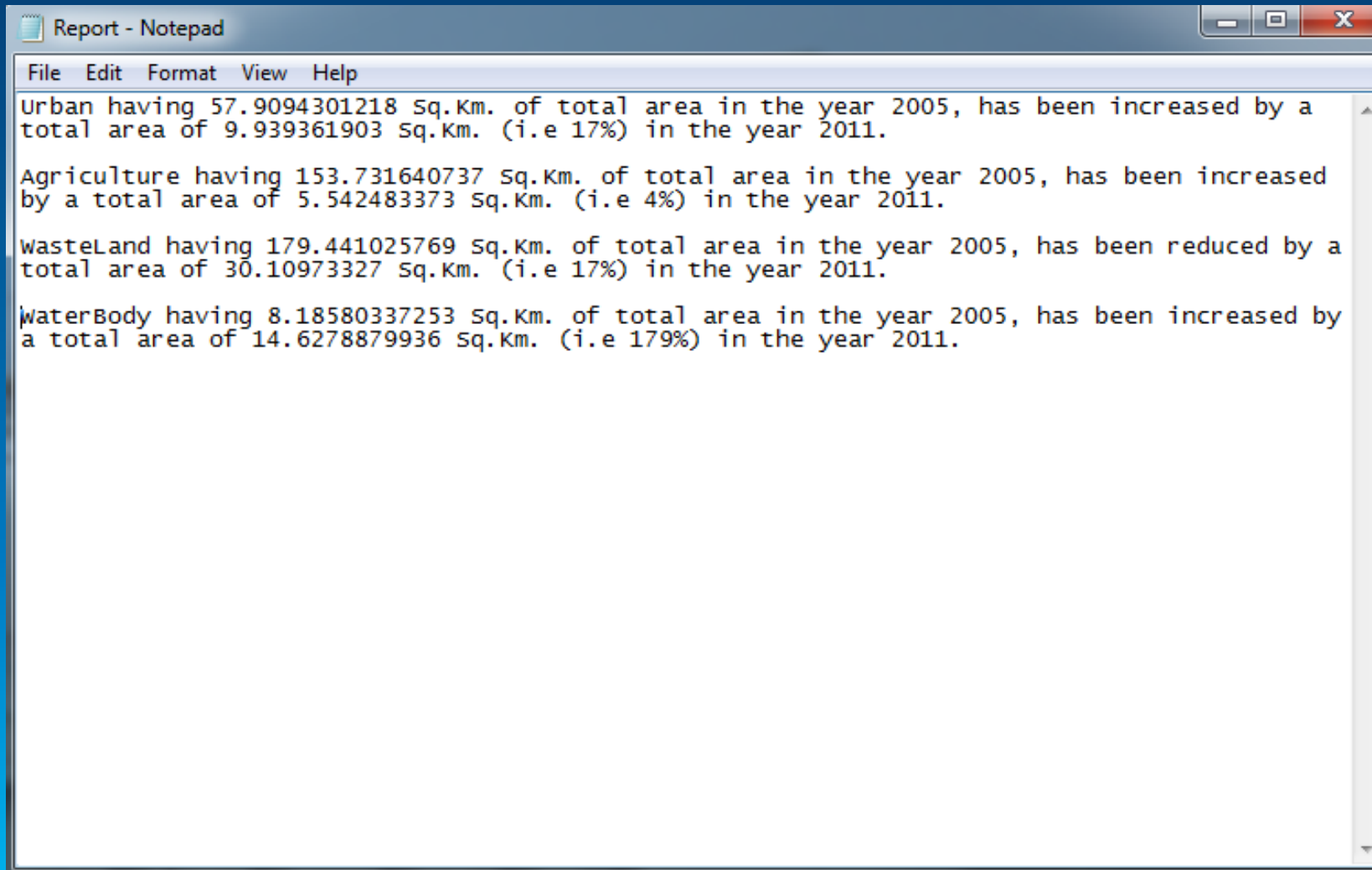


Results of LULC Change Detector



	FID	Shape *	FID_Rajkot	Land	Year	Area	FID_Rajk_1	Land_New	Year_New	Conv_Area	Area_Unit	Conv_Prnt
▶	0	Polygon	0	Urban	2005	57.90943	0	Urban	2011	57.089758	Sq.Km.	99
	1	Polygon	0	Urban	2005	57.90943	1	Agriculture	2011	0.087424	Sq.Km.	0
	2	Polygon	0	Urban	2005	57.90943	2	WasteLand	2011	0.666251	Sq.Km.	1
	3	Polygon	0	Urban	2005	57.90943	3	WaterBody	2011	0.065997	Sq.Km.	0
	4	Polygon	1	Agriculture	2005	153.731641	0	Urban	2011	4.00205	Sq.Km.	3
	5	Polygon	1	Agriculture	2005	153.731641	1	Agriculture	2011	120.683238	Sq.Km.	79
	6	Polygon	1	Agriculture	2005	153.731641	2	WasteLand	2011	23.636781	Sq.Km.	15
	7	Polygon	1	Agriculture	2005	153.731641	3	WaterBody	2011	5.409572	Sq.Km.	4
	8	Polygon	2	WasteLand	2005	179.441026	0	Urban	2011	6.710911	Sq.Km.	4
	9	Polygon	2	WasteLand	2005	179.441026	1	Agriculture	2011	38.354212	Sq.Km.	21
	10	Polygon	2	WasteLand	2005	179.441026	2	WasteLand	2011	124.964973	Sq.Km.	70
	11	Polygon	2	WasteLand	2005	179.441026	3	WaterBody	2011	9.41093	Sq.Km.	5
	12	Polygon	3	WaterBody	2005	8.185803	0	Urban	2011	0.046073	Sq.Km.	1
	13	Polygon	3	WaterBody	2005	8.185803	1	Agriculture	2011	0.14925	Sq.Km.	2
	14	Polygon	3	WaterBody	2005	8.185803	2	WasteLand	2011	0.063288	Sq.Km.	1
	15	Polygon	3	WaterBody	2005	8.185803	3	WaterBody	2011	7.927192	Sq.Km.	97

Results of LULC Change Detector



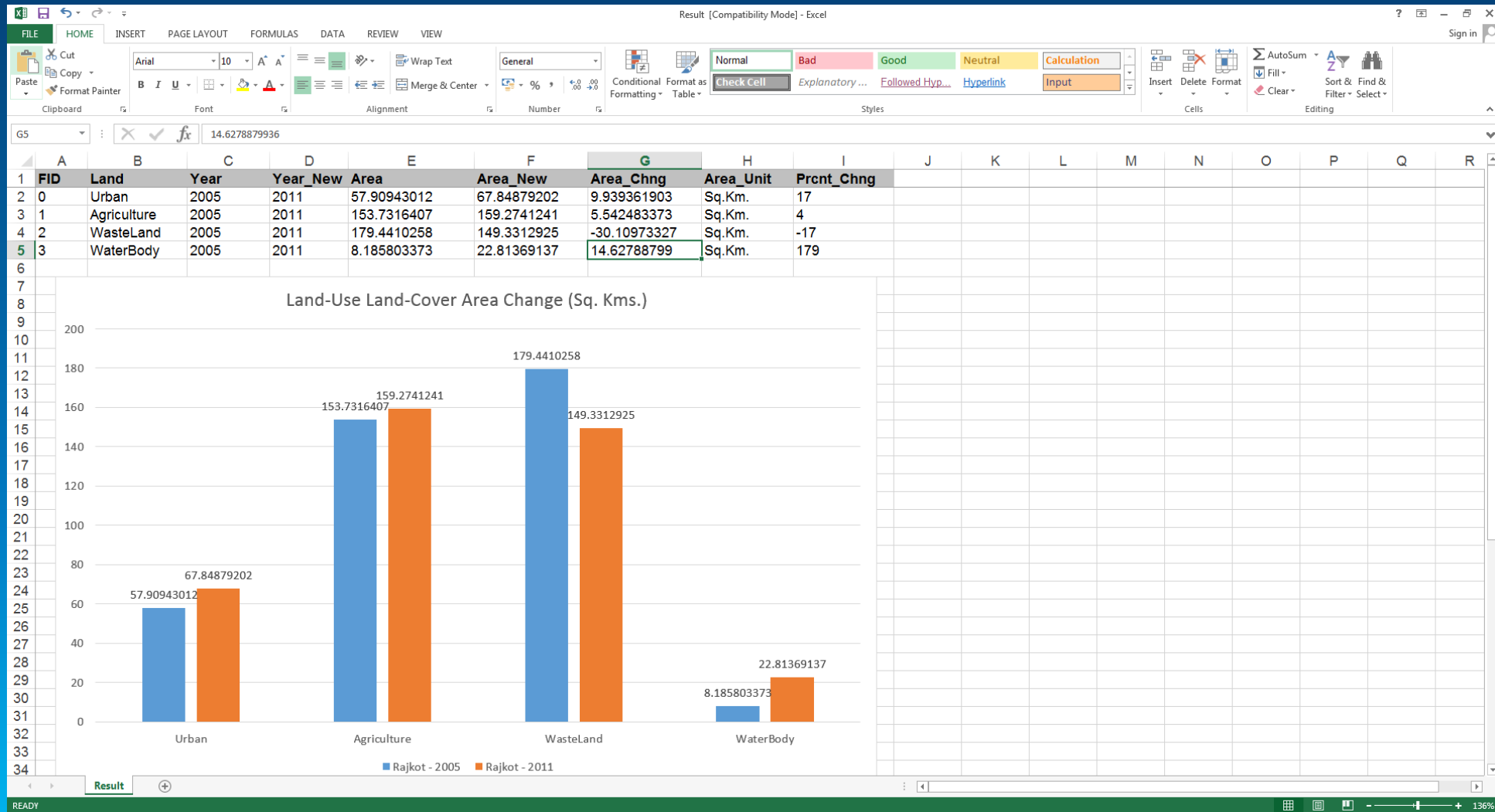
The screenshot shows a Notepad window titled "Report - Notepad" with a menu bar (File, Edit, Format, View, Help) and a text area containing the following text:

```
Urban having 57.9094301218 Sq.Km. of total area in the year 2005, has been increased by a total area of 9.939361903 Sq.Km. (i.e 17%) in the year 2011.  
  
Agriculture having 153.731640737 Sq.Km. of total area in the year 2005, has been increased by a total area of 5.542483373 Sq.Km. (i.e 4%) in the year 2011.  
  
wasteLand having 179.441025769 Sq.Km. of total area in the year 2005, has been reduced by a total area of 30.10973327 Sq.Km. (i.e 17%) in the year 2011.  
  
waterBody having 8.18580337253 Sq.Km. of total area in the year 2005, has been increased by a total area of 14.6278879936 Sq.Km. (i.e 179%) in the year 2011.
```

Results of LULC Change Detector

```
Detail Report - Notepad
File Edit Format View Help
For FID 0 in the year 2005, Urban having total area of 57.9094301218 Sq.Km., has been reduced to 57.08975797 Sq.Km. (i.e 99%), having FID 0 in the year 2011.
For FID 0 in the year 2005, from Urban having total area of 57.9094301218 Sq.Km., 0.08742429564 Sq.Km. (i.e 0%) of the total area has been converted to Agriculture having FID 1 in the year 2011.
For FID 0 in the year 2005, from Urban having total area of 57.9094301218 Sq.Km., 0.666250847536 Sq.Km. (i.e 1%) of the total area has been converted to wasteland having FID 2 in the year 2011.
For FID 0 in the year 2005, from Urban having total area of 57.9094301218 Sq.Km., 0.0659970607296 Sq.Km. (i.e 0%) of the total area has been converted to waterBody having FID 3 in the year 2011.
For FID 1 in the year 2005, from Agriculture having total area of 153.731640737 Sq.Km., 4.00204972466 Sq.Km. (i.e 3%) of the total area has been converted to Urban having FID 0 in the year 2011.
For FID 1 in the year 2005, Agriculture having total area of 153.731640737 Sq.Km., has been reduced to 120.683238256 Sq.Km. (i.e 79%), having FID 1 in the year 2011.
For FID 1 in the year 2005, from Agriculture having total area of 153.731640737 Sq.Km., 23.636780919 Sq.Km. (i.e 15%) of the total area has been converted to wasteland having FID 2 in the year 2011.
For FID 1 in the year 2005, from Agriculture having total area of 153.731640737 Sq.Km., 5.40957170053 Sq.Km. (i.e 4%) of the total area has been converted to waterBody having FID 3 in the year 2011.
For FID 2 in the year 2005, from wasteland having total area of 179.441025769 Sq.Km., 6.71091119732 Sq.Km. (i.e 4%) of the total area has been converted to Urban having FID 0 in the year 2011.
For FID 2 in the year 2005, from wasteland having total area of 179.441025769 Sq.Km., 38.3542116473 Sq.Km. (i.e 21%) of the total area has been converted to Agriculture having FID 1 in the year 2011.
For FID 2 in the year 2005, wasteland having total area of 179.441025769 Sq.Km., has been reduced to 124.964972504 Sq.Km. (i.e 70%), having FID 2 in the year 2011.
For FID 2 in the year 2005, from wasteland having total area of 179.441025769 Sq.Km., 9.41093043728 Sq.Km. (i.e 5%) of the total area has been converted to waterBody having FID 3 in the year 2011.
For FID 3 in the year 2005, from waterBody having total area of 8.18580337253 Sq.Km., 0.0460732866272 Sq.Km. (i.e 1%) of the total area has been converted to Urban having FID 0 in the year 2011.
For FID 3 in the year 2005, from waterBody having total area of 8.18580337253 Sq.Km., 0.149249873541 Sq.Km. (i.e 2%) of the total area has been converted to Agriculture having FID 1 in the year 2011.
For FID 3 in the year 2005, from waterBody having total area of 8.18580337253 Sq.Km., 0.0632882563587 Sq.Km. (i.e 1%) of the total area has been converted to wasteland having FID 2 in the year 2011.
For FID 3 in the year 2005, waterBody having total area of 8.18580337253 Sq.Km., has been reduced to 7.92719202321 Sq.Km. (i.e 97%), having FID 3 in the year 2011.
```

Results of LULC Change Detector



Results of LULC Change Detector

- **GIS Customization using Python Scripting in ArcGIS 10.2.2 is quiet simple and straight forward, provided you have a working knowledge of Python.**
- **LULC Change detector saved a lot of time against time consuming manual calculations.**
- **Easily able to produce output in notepad (Report text file) and in Microsoft Excel (Result table file).**
- **GIS Customization on ESRI's ArcGIS platform can save a lot of time when dealing with developing and solving user defined application on a single click.**
- **Main advantage of using python over model builder for this tool is availability of programming advance iterative tools and nested loops. To accomplish a similar result in Model Builder, you would have to construct intricate, and complicated, nested models.**

THANK YOU