The Forest is the most ancient and biological diverse of the world's ecosystem. As per Forest Survey of India recent investigation highlight that the country's forest meet about 40% energy needs and 70% of the fuel wood is used by households and rest by commercial and industrial units. Approximately 80% of the rural people and 48% of urban people use fuel wood for households purpose (FSI 1997). It is now well established that the present day satellite data combined with GIS has lot of potential in the field of preparation and revision of forest working plan. Remote Sensing (RS) and Geographic Information System are now providing new tools for advanced ecosystem management. Remote Sensing has unique potential of forest cover assessment. Temporal data allows change detection of land cover changes over a period of time (Kushwaha et al., 2002). Remote Sensing provides potential to improve upon the conventional in site monitoring (George, 2005).

The result of different anthropogenic activities the dense forest cover is now depleted drastically. The problem has been further compounded through improper land use practices in these depleted forests. The Pathri R.F. is affected in this process. (Panikkar, 2006). Detection of the changes, therefore, has to be an important activity in forest monitoring. The types of changes can vary from short-term phenomena such as disease attack to the long term phenomena like successional changes in structure and the density etc. The frequency of change detection depends to a large extent on the nature of the forest under observation. Dynamic forest areas (undergoing rapid changes) are monitored with frequency (IIRS, FED, 2007). Forests are one of the most valuable ecological resources of global interest. Forests also provide habitat for numerous animal species. People generally consider that product of forest rather than forests themselves as useful.

An analysis of the nature and rates of environmental changes over recent decades is essential for proper understanding of why present environmental problems have arisen. It is also necessary to allow formulation of accurate predictive models of environmental changes. In this respect information on the existing land use/land cover pattern, its spatial destruction and changes in the land use pattern is a pre-requisite for planning, utilization and formulation of policies and programs for making development plans at micro and macro levels (Sahadevan, 2005). Change detection is important process in monitoring and managing natural resources and urban development because it provides quantitative analysis of spatial distribution of the population of interest. Change detection as land use change analysis (Jegannathan et al., 2010 and Tiwari and Saxena, 2011), vegetation dynamics (Reddy and Roy, 2008), biodiversity conservation (Roy and Srivastava, 2012), monitoring shifting cultivation, assessment of deforestation (Nanday et al., 2011) and sustainable development (Kushwaha et al., 2010) Various techniques have been described for change detection.

The exercise demonstrated the high potential of RS and GIS for forest ecosystem dynamics assessment to predict the forest of Zoology, Kumaun University, Nainital-Uttarakhand. The
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authors are thankful to Department of Zoology, Kumaun University, Nainital for providing necessary facilities to carry out the research work.

MATERIALS AND METHODS

Materials Used:
1. Material required Satellite data (LAND SAT) resolution 30m Resolution, Path 146, Row 39, Path 146 Row 39.
2. Topographic map on 1:50,000 scale, Survey of India Toposheet No. 53 K/1 surveyed on 1966-67.

Software Used:
(i) ERDAS Imagine 9.3, To register and process the digital data interpretation
(ii) Arc GIS 10, To digitize data, To add attribute data to the shape, File of digital data, Area calculation of the attributes.
(iii) MS Office Excel, Calculation of area under different classes, Change matrix calculations
(iv) MS Office Word, To analyze results, Project compilation, Hardware used, PC with Core Quad processor, HP Scanner, HP Laser Printer

Acquisition of Satellite Imagery (1990 and 2013) Landsat-TM 30 m resolution Path 146 Row 39. Image Enhancement using histogram equalization, standard deviation stretch, contrast and brightness enhancement etc. Geometric correction of satellite image and match the projections of satellite image and digitized map. Subset image has prepared by using area boundary prepared by using toposheet. Digital image classification technique was used for the interpretation of the satellite images. The unsupervised classification of the T1 and T2 images was prepared by using same technique. The T1 and T2 classified images were intersect with each other for the preparation of change detection matrix. The change matrix table was prepared by using MS-Excel Pivot table. The results were interpreted by using land cover land use map of T1 and T2 images.

RESULTS AND DISCUSSION

The selected area of interest (AOI), the Pathri Reserve Forest with the total area of 38.56 (sq.km.) based on the classification the dense forest, open forest, marshy land/river bed, grassland, settlement, agriculture area and water bodies etc., classed was prepared. Form the change matrix of Pathri Reserve Forest it has been observed that in 1990 out of the total area 24.35% (9.38 sq.km) area is under dense forest, 25.39% (9.7 sq.km) areas is under open forest, 30.87% (11.9 sq.km) area covered with marshy land and dry river beds. While 9.78% (3.77 sq.km), 0.35% (0.13 sq.km) and 7.79% (3.07 sq.km) area covered by grasslands, settlement and agricultural land respectively. Water body contributes up to 1.28% (0.49 sq.km) area in 1990.

Change matrix of Pathri Reserve Forest for 2013 shows that 18.68% (7.20 sq.km) area is under dense forest, 19.65% (7.58 sq.km) areas is under open forest, 1.34% (0.51 sq.km) area covered with marshy land and dry river beds. While 10.94% (4.21 sq.km), 1.34% (0.51 sq.km) and 47.83% (18.44 sq.km) area covered by grasslands, settlement and agricultural land respectively. Water body contributes up to 0.21% (0.079 sq.km) area in 2013.

Probable reasons for changes:
Due to anthropogenic activities like agriculture development, roads, settlements etc. areas of agriculture, settlements and grassland has considerably increased manifolds. From 1990 up to 2013 the agricultural areas was increased 39.86 %, grassland area was increased by 1.16% and settlement was increased by 0.99% with due course of time.
Table 1: Showing land use land cover change in Pathri Reserve Forest during time period 1990 to 2013.

<table>
<thead>
<tr>
<th>LU90</th>
<th>Dense Forest</th>
<th>Open Forest</th>
<th>Marshy Land</th>
<th>Grassland</th>
<th>Settlement</th>
<th>Agriculture</th>
<th>Water Body</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dense Forest</td>
<td>4.46</td>
<td>3.21</td>
<td>0.20</td>
<td>0.84</td>
<td>0.04</td>
<td>0.61</td>
<td>0.01</td>
<td>9.38</td>
</tr>
<tr>
<td>Open Forest</td>
<td>1.76</td>
<td>2.26</td>
<td>0.27</td>
<td>2.00</td>
<td>0.06</td>
<td>3.38</td>
<td>0.03</td>
<td>9.79</td>
</tr>
<tr>
<td>Marshy Land</td>
<td>0.71</td>
<td>1.43</td>
<td>0.03</td>
<td>0.87</td>
<td>0.19</td>
<td>8.62</td>
<td>0.02</td>
<td>11.90</td>
</tr>
<tr>
<td>Grassland</td>
<td>0.07</td>
<td>0.14</td>
<td>0.01</td>
<td>0.17</td>
<td>0.03</td>
<td>3.39</td>
<td>0.003</td>
<td>3.77</td>
</tr>
<tr>
<td>Settlement</td>
<td>0</td>
<td>0.01</td>
<td>0</td>
<td>0</td>
<td>0.03</td>
<td>0.09</td>
<td>0</td>
<td>0.13</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.03</td>
<td>0.31</td>
<td>0.01</td>
<td>0.34</td>
<td>0.12</td>
<td>2.26</td>
<td>0</td>
<td>3.07</td>
</tr>
<tr>
<td>Water Body</td>
<td>0.15</td>
<td>0.21</td>
<td>0</td>
<td>0.04</td>
<td>0.01</td>
<td>0.07</td>
<td>0</td>
<td>0.49</td>
</tr>
<tr>
<td>Grand Total</td>
<td>7.2036</td>
<td>7.578</td>
<td>0.5184</td>
<td>4.2192</td>
<td>0.5184</td>
<td>18.4464</td>
<td>0.0792</td>
<td>38.56</td>
</tr>
</tbody>
</table>

The rehabilitation practices make a burden on the forest areas. The dense forest area reduced by 5.67%, open forest 5.74%, marshy land 29.53% and water body by 1.07% that means the dense forest were reduced approximately from 24% to 19%, open forest were reduced from approximately 26% to 20%, marshy land were reduced approximately from 31% to 1% and water body from 1.08% to 0.21% considerably.

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REFERENCES