CHAPTER V

QUANTIFICATION OF POPULATION OF IMPORTANT SPECIES OF EACH FOREST TYPE

5.1. Introduction

Girth class distribution is very commonly used in ecology to illustrate the population structure as well as regeneration status of the forests. The successful establishment of a community depends on its regeneration efficacy under varied environmental conditions. Many authors have quantified regeneration status of tree species based on age and diameter structure of their population (Saxena and Singh 1984, Khan et al. 1987, Bhuyan et al. 2003). The height structure of the forests generally simplifies the stratum of canopy layer such as top canopy, subcanopy and understorey. The girth class as well as height class distribution of individuals provide complete scenarios of the forests. The population structure in several ecological studies had been characterised by number or percentage of individuals in different girth/diameter classes as well as height classes (Murali et al. 1996, Uma Shankar 2001, Pandey and Shukla 2003, Ghosh 2007, Reddy et al. 2008, Nongrum 2012, Swer 2013, Kumar 2013).

A large number of authors had studied the population structure of forests as well as populations of important plants in Meghalaya (Rao et al. 1990, Barik 1992, Jamir 2000, Upadhaya et al. 2003, 2004, Mishra et al. 2004, 2005, Prabhu 2004, Tripathi et al. 2010, Tripathi and Reynald 2010). Most of these studies are limited to subtropical forest only.

The present chapter presents results of the girth-class (population) structure and height-class structure of six major forest types described in Chapter IV. In addition, the girth-
class (population) structure and height-class structure of the major species in each of these forest types are analyzed.

5.2. Methodology

The girth class distributions of individuals of six major forest types of Meghalaya were plotted in nine 20 cm wide girth classes (10-<30, 30-<50, 50-<70, 70-<90, 90-<110, 110-<130, 130-<150, 150-<170, ≥170). The height class distribution of major forest types was plotted in five 5 m wide height classes (<5, 5-<10, 10-<15, 15-<20, ≥20).

The regeneration behaviour of forest as well as important species of each forest types was assessed based on girth measurement. All stems in the forests which had girth ≥10 cm to <30 cm over the bark at breast height (1.37 m) were considered as saplings and ≥30 cm were considered as adults (Uma Shankar 2001). The state of regeneration was deduced in each forest type as follows:

a) Good regeneration, if seedlings > saplings > adults
b) Fair regeneration, if seedlings > saplings ≤ adults
c) Poor regeneration, if a species survive only at sapling stage, but no seedlings (saplings may be >, < or = adults)
d) No regeneration, if a species is present only in adult form
e) New regeneration, if the species has no adults but only seedlings or saplings

The larger number of stems in ≥10 cm to <30 class indicates high regeneration, whereas the small number of stems in this class suggests low regeneration. The individuals less than 10 cm girth (seedlings) were not measured and hence the state of regeneration was based only on saplings and adult categories.
Selection of economically and ecologically important species

Among each forest types, top three tree species which have highest IVI values were selected for population structure. A girth class distribution (density-diameter distribution) as well as height class distribution was prepared for these species. The state of regeneration were assessed based on data on the individuals ≥10 cm to <30 cm gbh. The girth class distribution of stems of dominant species were plotted in 20 cm wide interval for nine girth classes (10-<30, 30-<50, 50-<70, 70-<90, 90-<110, 110-<130, 130-<150, 150-<170 and ≥170 cm) and height class distribution were plotted in 5 m wide interval for five height classes (<5, 5-<10, 10-<15, 15-<20 and ≥20 m).

5.3. Results

5.3.1. Girth class distribution

The number of individuals recorded in different girth classes of six forest types, namely, tropical evergreen, tropical moist mixed-deciduous, Khasi hill sal-pine, Khasi-Jaintia subtropical pine, Khasi subtropical mixed-broadleaved and Khasi subtropical oak-dominated forest are given in Table 5.1. A plot of this data showed a reverse J-shaped curve, i.e., with increasing girth size, the numbers of individuals decreased in all forest types (Fig. 5.1 a, b, c, d, e, f). The lower gbh class A (10-<30 cm) was most prominent in most of the cases which shows that these forests have good regeneration potential.
Table 5.1. Number of individuals in different girth classes (cm) for six forest types.

<table>
<thead>
<tr>
<th>Forest types</th>
<th>10-&lt;30</th>
<th>30-&lt;50</th>
<th>50-&lt;70</th>
<th>70-&lt;90</th>
<th>90-&lt;110</th>
<th>110-&lt;130</th>
<th>130-&lt;150</th>
<th>150-&lt;170</th>
<th>≥170</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I) TEG</td>
<td>1240</td>
<td>463</td>
<td>242</td>
<td>178</td>
<td>99</td>
<td>50</td>
<td>54</td>
<td>21</td>
<td>38</td>
<td>2385</td>
</tr>
<tr>
<td>% of total</td>
<td>52.0</td>
<td>19.4</td>
<td>10.1</td>
<td>7.5</td>
<td>4.2</td>
<td>2.1</td>
<td>2.3</td>
<td>0.9</td>
<td>1.6</td>
<td>100</td>
</tr>
<tr>
<td>II) TMMD</td>
<td>563</td>
<td>477</td>
<td>203</td>
<td>119</td>
<td>49</td>
<td>19</td>
<td>31</td>
<td>3</td>
<td>32</td>
<td>1496</td>
</tr>
<tr>
<td>% of total</td>
<td>37.6</td>
<td>31.9</td>
<td>13.6</td>
<td>8.0</td>
<td>3.3</td>
<td>1.3</td>
<td>2.1</td>
<td>0.2</td>
<td>2.1</td>
<td>100</td>
</tr>
<tr>
<td>III) KHSP</td>
<td>2077</td>
<td>1251</td>
<td>703</td>
<td>331</td>
<td>136</td>
<td>55</td>
<td>22</td>
<td>5</td>
<td>9</td>
<td>4589</td>
</tr>
<tr>
<td>% of total</td>
<td>45.3</td>
<td>27.3</td>
<td>15.3</td>
<td>7.2</td>
<td>3.0</td>
<td>1.2</td>
<td>0.5</td>
<td>0.1</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>IV) KJSP</td>
<td>2946</td>
<td>3119</td>
<td>2946</td>
<td>2511</td>
<td>1005</td>
<td>291</td>
<td>118</td>
<td>40</td>
<td>42</td>
<td>13018</td>
</tr>
<tr>
<td>% of total</td>
<td>22.6</td>
<td>24.0</td>
<td>22.6</td>
<td>19.3</td>
<td>7.7</td>
<td>2.2</td>
<td>0.9</td>
<td>0.3</td>
<td>0.3</td>
<td>100</td>
</tr>
<tr>
<td>V) KSMB</td>
<td>3547</td>
<td>1233</td>
<td>434</td>
<td>320</td>
<td>169</td>
<td>74</td>
<td>50</td>
<td>22</td>
<td>56</td>
<td>5905</td>
</tr>
<tr>
<td>% of total</td>
<td>60.07</td>
<td>20.88</td>
<td>7.35</td>
<td>5.42</td>
<td>2.86</td>
<td>1.25</td>
<td>0.85</td>
<td>0.37</td>
<td>0.95</td>
<td>100</td>
</tr>
<tr>
<td>VI) KSOD</td>
<td>4260</td>
<td>1827</td>
<td>896</td>
<td>476</td>
<td>174</td>
<td>62</td>
<td>43</td>
<td>13</td>
<td>24</td>
<td>7775</td>
</tr>
<tr>
<td>% of total</td>
<td>54.8</td>
<td>23.5</td>
<td>11.5</td>
<td>6.1</td>
<td>2.2</td>
<td>0.8</td>
<td>0.6</td>
<td>0.2</td>
<td>0.3</td>
<td>100</td>
</tr>
</tbody>
</table>

The number of individuals for lowest size class (10-<30 cm) contributed approximately 52% in tropical evergreen forest, 37.6% in tropical moist mixed-deciduous forest, 45.3% in Khasi hill sal-pine forest, 22.6% in Khasi-Jaintia subtropical pine forest, 60.1% in Khasi subtropical mixed-broadleaved forest and 54.8% in Khasi subtropical oak-dominated forest. The Khasi-Jaintia subtropical pine forest showed almost equal dominance of number of individuals for girth class A to D (10-<30 to 70-<90). This was due to single species dominance of this forest i.e. *Pinus kesiya*. The higher girth class (110-<130, 130-<150, 150-<170 and ≥170 cm) were characterised by a very less number of individuals in each forest type (Fig. 5.1 a, b, c, d, e, f).
Fig. 5.1. Population structure of six forest types in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170).

5.3.2. Height class distribution

The number of individuals recorded in different height classes of six forest types, namely, tropical evergreen, tropical moist mixed-deciduous, Khasi hill sal-pine, Khasi-Jaintia subtropical pine, Khasi subtropical mixed-broadleaved and Khasi subtropical oak-
dominated forest are given in Table 5.2. A plot of this data showed varied patterns for different forest types (Fig. 5.2 a, b, c, d, e, f).

### Table 5.2. Number of individuals in different height classes (m) for six forest types.

<table>
<thead>
<tr>
<th>Forest types</th>
<th>&lt;5</th>
<th>5-&lt;10</th>
<th>10-&lt;15</th>
<th>15-&lt;20</th>
<th>≥20</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I) TEG</td>
<td>1004</td>
<td>629</td>
<td>472</td>
<td>184</td>
<td>96</td>
<td>2385</td>
</tr>
<tr>
<td>% of total</td>
<td>42.1</td>
<td>26.4</td>
<td>19.8</td>
<td>7.7</td>
<td>4.0</td>
<td>100</td>
</tr>
<tr>
<td>II) TMMD</td>
<td>324</td>
<td>650</td>
<td>378</td>
<td>79</td>
<td>65</td>
<td>1496</td>
</tr>
<tr>
<td>% of total</td>
<td>21.7</td>
<td>43.4</td>
<td>25.3</td>
<td>5.3</td>
<td>4.3</td>
<td>100</td>
</tr>
<tr>
<td>III) KHSP</td>
<td>1423</td>
<td>1625</td>
<td>1054</td>
<td>459</td>
<td>28</td>
<td>4589</td>
</tr>
<tr>
<td>% of total</td>
<td>31.0</td>
<td>35.4</td>
<td>23.0</td>
<td>10.0</td>
<td>0.6</td>
<td>100</td>
</tr>
<tr>
<td>IV) KJSP</td>
<td>2335</td>
<td>3432</td>
<td>3632</td>
<td>3024</td>
<td>595</td>
<td>13018</td>
</tr>
<tr>
<td>% of total</td>
<td>17.9</td>
<td>26.4</td>
<td>27.9</td>
<td>23.2</td>
<td>4.6</td>
<td>100</td>
</tr>
<tr>
<td>V) KSMB</td>
<td>2606</td>
<td>1969</td>
<td>781</td>
<td>389</td>
<td>160</td>
<td>5905</td>
</tr>
<tr>
<td>% of total</td>
<td>44.1</td>
<td>33.3</td>
<td>13.2</td>
<td>6.6</td>
<td>2.7</td>
<td>100</td>
</tr>
<tr>
<td>VI) KSOD</td>
<td>3037</td>
<td>3003</td>
<td>1406</td>
<td>289</td>
<td>40</td>
<td>7775</td>
</tr>
<tr>
<td>% of total</td>
<td>39.06</td>
<td>38.62</td>
<td>18.08</td>
<td>3.72</td>
<td>0.51</td>
<td>100</td>
</tr>
</tbody>
</table>

The tropical evergreen, Khasi subtropical mixed-broadleaved and Khasi subtropical oak-dominated forest showed a successive decline of number of individuals from lower to next higher class (Fig. 5.2 a, e and f). The tropical moist mixed deciduous forest and Khasi hill sal-pine forest showed highest number of individuals for 5-<10 m (Fig. 5.2 b, c). In case of Khasi-Jaintia subtropical pine forest, the height class distribution of individuals showed a peak in 10-<15 m (Fig. 5.2d). Only few individuals in each forest types were characterized by ≥20 m height, viz., 4% in tropical evergreen forest, 4.3% in tropical moist mixed-deciduous forest, 0.6% in Khasi hill sal-pine forest, 4.6% in Khasi-Jaintia subtropical pine forest, 2.7% in Khasi subtropical mixed-broadleaved forest and 0.5% in Khasi subtropical oak-dominated forest.
Fig. 5.2. Height structure of six forest types in different height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).

5.4. Population structure of economically and ecologically important plant species

The economically and ecologically important species were identified from among the dominant tree species recoded in different forest types. The size of populations of these tree species was determined based on the phytosociological data from the transect.
inventory. Recently, the importance of population structure of many economically and ecologically plants had been seen through various study in Meghalaya such as *Cinnamomum tamala* (Ghosh 2007), *Ilex khasiana* (Upadhaya et al. 2009), *Parkia roxburghii* (Nongrum 2012), *Taxus wallichiana* (Swer 2013) and 16 species in lower Assam region of India (Kumar 2013).

5.5. Population structure of important species of tropical evergreen forest

The tropical evergreen forest showed a mixed dominance of a number of species in top canopy, subcanopy and under canopy. Out of 184 species, the top three important plant species selected on the basis of IVI in this forest were *Schima wallichii*, *Macropanax undulatus* and *Cinnamomum tamala* with an importance value of 18.7, 16.0 and 11.0, respectively (Table 4.1 in Chapter IV). These species together cover 15.2% of total IVI.

The population structure of *S. wallichii* (35.7%) and *C. tamala* (29.5%) was characterised by the highest number of individuals in gbh class 10-<30 cm, whereas *M. undulatus* showed highest number of individuals in gbh class 50-<70 cm (28.5%). *S. wallichii* showed lowest number of individuals in size class 30-<50 cm. *M. undulatus* showed an increasing trend of number of individuals from lower gbh class 10-<30 to 50-<70 cm and successive decline afterwards. In case of *C. tamala* showed reverse J-shaped curve. The higher gbh class (150-<170 and ≥170 cm) were absent in *M. undulatus* and *C. tamala*. *S. wallichii* had highest number of individuals in <5 m height class whereas *M. undulatus* and *C. tamala* showed a peak in 10-<15 m (Fig. 5.2d, e, f). Approximately, 68.8% individuals of *M. undulatus* were in 10-<15 m height. The number of individuals for ≥20 m were absent in *M. undulatus* and *C. tamala* but were 16.3% for *S. Wallichii*.
Fig. 5.3. Population structure of three important plant species in tropical evergreen forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).
5.6. Population structure of important species of tropical moist mixed-deciduous forest

The tropical moist mixed deciduous forest showed a mix dominance of a number of species in top canopy, subcanopy and under canopy. Out of 65 species, the top three important plant species selected on the basis of IVI in this forest were *Microcos paniculata*, *Schima wallichii*, and *Dillenia indica* with an importance value of 28.2, 24.2 and 20.6, respectively (Table 4.7 in Chapter IV). These species together cover 24.3% of total IVI.

The three species exhibited different density-diameter patterns. *M. paniculata* was characterised by highest number of individuals in gbh class 30-<50 cm (42.6%), *S. wallichii* in 90-<110 cm (25.8%) and *D. indica* in highest gbh class i.e. ≥170 cm (31.4%) (Fig. 5.4 a, b, c). In case of *M. paniculata*, gbh class 90-<110 cm to ≥170 cm and in *S. wallichii* 150-<170 cm were absent. Three classes were absent in *D. indica*, i.e., 30-<50, 90-<110 and 110-<130 cm. The state of regeneration (10-<30 cm) was maximum in *M. paniculata* (30.1%) followed by *D. indica* (17.1%). Very few individuals (1.5%) were showing regeneration in *S. wallichii*.

*M. paniculata* had highest number of individuals in 5-<10 m height class (53.6%) whereas *S. wallichii* (33.3%) and *D. indica* (37.1%) showed a peak in ≥20 m (Fig. 5.4 d, e, f). With increasing tree height, the numbers of individuals also increased in case of *S. wallichii* and *D. indica*. 
Fig. 5.4. Population structure of three important plant species in tropical moist mixed-deciduous forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).
5.7. Population structure of important species of Khasi hill sal-pine forest

The Khasi hill sal-pine forest showed a mix dominance of a number of species in top canopy. Out of 123 species, the top three important plant species selected on the basis of IVI in this forest were *Shorea robusta*, *Schima wallichii*, and *Pinus kesiya* with an importance value of 55.7, 47.2 and 22.5, respectively (Table 4.13 in Chapter IV). These species together cover 41.8% of total IVI of this forest.

The population structure of *S. robusta* and *S. wallichii* showed a reverse J-shaped curve. *P. kesiya* represented increasing number of individuals with increasing girth classes up to 70-<90 cm and reverse trend seen after that (Fig. 5.5 a, b, c). *S. robusta* were characterised by highest number of individuals in gbh class 10-<30 cm (37.0%), *S. wallichii* in 30-<50 cm (29.4%) and *P. kesiya* in 70-<90 cm gbh class (36.5%). In case of *S. robusta*, gbh class ≥ 170 cm were absent. Two classes were absent in *P. kesiya* i.e. 150-<170 and ≥ 170 cm. The state of regeneration (10-<30 cm) were maximum in *S. robusta* (55.7%) followed by *S. wallichii* (28.7%). Very few numbers of individuals (1.5%) were showing regenerating stage in *P. kesiya*.

The height class distribution of *S. robusta*, *S. wallichii* and *P. kesiya* were showing different trends. *S. robusta* had highest number of individuals in 5-<10 m height class (31.7%), whereas *S. wallichii* (38.1%) and *P. kesiya* (45.9%) showed a peak in 10-<15 m (Fig. 5.5 d, e, f). The numbers of individuals for ≥20 m height were very less in all three species.
Fig. 5.5. Population structure of three important plant species in Khasi hill sal-pine forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).
5.8. Population structure of important species of Khasi-Jaintia subtropical pine forest

The Khasi-Jaintia subtropical pine forest showed a single species dominance in top canopy. Out of 156 species, *Pinus kesiya* topped with more than 50% of total IVI (176.9), followed by *Schima wallichii* (20.1) and *Myrica nagi* (6.6) (Table 4.19 in Chapter IV). These selected species together cover 67.9% of total IVI.

The density-diameter distribution of *P. kesiya* and *S. wallichii* showed a similar trend, i.e., increasing number of individuals with increasing girth classes upto 50-<70 cm and decreasing afterwards. *M. nagi* showed decreasing number of individuals with increasing girth classes (Fig. 5.6 a, b, c). *P. kesiya* (26.1%) and *S. wallichii* (26.7%) contributed highest number of individuals in gbh class 50-<70 cm. In case of *M. nagi*, gbh class ≥ 170 cm were absent. The state of regeneration (10-<30 cm) was maximum in *M. nagi* (48.5%) followed by *S. wallichii* (21%) and *P. kesiya* (12.9%).

The height class distributions for *P. kesiya*, *S. wallichii* and *M. nagi* were showing different trends. *S. robusta* had highest number of individuals in 10-<15 m height class (32.4%), whereas *S. wallichii* (28.4%) and *M. nagi* (51.5%) showed a peak in 5-<10 m (Fig. 5.6 d, e, f). In case of *M. nagi*, height class 15-<20 and ≥20 m were absent.
Fig. 5.6. Population structure of three important plant species in Khasi-Jaintia subtropical pine forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).* indicates value divided by 20.
5.9. Population structure of important species of Khasi subtropical mixed-broadleaved forest

The Khasi subtropical mixed-broadleaved forest showed a mix dominance of a number of species in top canopy, sub canopy and under canopy. Out of 233 species, the top three important plant species selected on the basis of IVI in this forest were *Schima wallichii*, *Pinus kesiya* and *Syzygium tetragonum* with an importance value of 27.9, 16.9 and 13.3 respectively (Table 4.25 in Chapter IV). These species together cover 19.4% of total IVI.

The population structure of *S. wallichii* and *S. tetragonum* showed more or less a reverse J-shaped curve. *P. kesiya* showed increasing number of individuals with increasing girth classes up to 70-<90 cm and reverse trend seen after that (Fig. 5.7 a, b, c). The lowest size class 10-<30 cm (regenerating class) contributed maximum in *S. wallichii* (38.9%) and *S. tetragonum* (53.1%). *P. kesiya* had highest number of individuals in 70-<90 cm gbh class (31.2%) and very less number of individuals (5.4%) in lowest size class (10-<30cm). In case of *S. tetragonum*, gbh class 150-<170 cm were absent.

The height class distributions for all three species were showing different trends. *S. wallichii* had highest number of individuals in 5-<10 m height class (37.1%) whereas *P. kesiya* showed a peak in 15-<20 m (56.1%) (Fig. 5.7 d, e). With increasing tree height classes, numbers of individual for *S. tetragonum* were decreased (Fig. 5.7 f). The lowest height class (<5 m) contributed maximum (40.4%) in *S. tetragonum*. The numbers of individuals for ≥20 m height were very less in all three species.
Fig. 5.7. Population structure of three important plant species in Khasi subtropical mixed broadleaved forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).
5.10. Population structure of important species of Khasi subtropical oak-dominated forest

The Khasi subtropical oak-dominated forest showed a mix dominance of a number of species in top canopy, sub canopy and under canopy. Out of 225 species, *Pinus kesiya* topped with IVI (15.4), but overall oak family (Fagaceae) contributed maximum IVI (56.9) with occurrence of 13 species, viz; *Castanopsis purpurella*, *Lithocarpus fenestratus*, *Castanopsis tribuloides*, *Lithocarpus dealbatus*, *Castanopsis armata*, *Quercus lineata*, *Lithocarpus elegans*, *Quercus semiserrata*, *Castanopsis lanceaefolia*, *Quercus griffithii*, *Quercus glauca*, *Quercus serrata* and *Castanopsis indica*. On the basis of IVI, the top three species selected in this forest were: *Pinus kesiya*, *Castanopsis purpurella* and *Lithocarpus fenestratus* with an importance value of 15.4, 13.5 and 13.1 respectively (Table 4.31 in Chapter IV). These species together cover 14% of total IVI.

All three species exhibited different density-diameter pattern. *P. kesiya* showed increasing number of individuals with increasing girth classes up to 70-<90 cm and decreasing after that. *C. purpurella* represented decreasing number of individuals from gbh class 30-<50 cm to 110-<130 cm. *L. fenestratus* showed more or less reverse J-shaped curve. (Fig. 5.8 a, b, c). The lowest size class 10-<30 cm (regenerating class) contributed maximum in *L. fenestratus* (56.7%) followed by *C. purpurella* (14.7%) and *P. kesiya* (10.7%). *P. kesiya* had highest number of individuals in 70-<90 cm gbh class (33.9%) and *C. purpurella* in 30-<50 cm gbh class. *L. fenestratus* showed highest number of individuals (56.7%) in lowest size class (10-<30cm). In case of *P. kesiya*, gbh class 150-<170 and ≥170 cm were absent. Three highest gbh classes (130-<150, 150-<170 and ≥170 cm) were absent in *C. Purpurella* and *L. fenestratus*. 

162
Fig. 5.8. Population structure of three important plant species in Khasi subtropical oak-dominated forest in different girth classes (A; 10-<30, B; 30-<50, C; 50-<70, D; 70-<90, E; 90-<110, F; 110-<130, G; 130-<150, H; 150-<170, I; ≥170) and height classes (A; <5, B; 5-<10, C; 10-<15, D; 15-<20, E; ≥20).
The height class distribution for *P. kesiya* (45%) and *C. purpurella* (52.4%) were showing more or less similar trends, with highest number of individuals in 10-<15 m height class whereas *Lithocarpus fenestratus* showed peak in 5-<10 m height (53.2%) (Fig. 5.8 d, e, f). The numbers of individuals for ≥20 m height were very less in *P. kesiya* and *L. fenestratus*, whereas it was absent in *C. purpurella*.

### 5.11. Discussion

All six forest types in the present study followed reverse J-shaped distribution, i.e., with increasing girth class, the number of individuals decreased. Such trends have been reported by Poore (1968) in Malaysia, Kadavul and Parthasarathy (1999) in tropical semi-evergreen forests in Eastern Ghats, India, Upadhaya *et al.* (2004) in subtropical forest of Meghalaya, Padalia *et al.* (2004) and Tripathi *et al.* (2004) in the forests of Andaman Islands, Reddy *et al.* (2008) in tropical dry-deciduous forest of Andhra Pradesh, and Majumdar *et al.* (2012) in moist-deciduous forest in Tripura. The preponderance of individuals in lower girth class shows that these forests have a good potential of regeneration. The number of individuals for regenerating class (10-<30 cm) contributed approximately 52% in tropical evergreen forest, 37.6% in tropical moist mixed-deciduous forest, 45.3% in Khasi hill sal-pine forest, 22.6% in Khasi-Jaintia subtropical pine forest, 60.1% in Khasi subtropical mixed-broadleaved forest and 54.8% in Khasi subtropical oak-dominated forest.

The distribution of girth classes for six forest types was showing similar pattern, with exception of the dominance of lowest to medium size class (10-<30 to 70-<90 cm) in Khasi-Jaintia subtropical pine forest, which contributed approximately 90% of total individuals. This forest shows a relatively mature stand than other forests due to dominance of a large tree, i.e., *Pinus kesiya*. The number of individuals for higher girth
class in all forest types is very less, this is because of good proportion of small tree, shrub and woody climber species in the forests, as these species do not attain much girth.

The height class distribution of forest types showed that the tropical evergreen, Khasi subtropical mixed-broadleaved and Khasi subtropical oak-dominated forest have highest number of individuals in <5 m class. The dominance of <5 m height class has also been reported by Reddy et al. (2008) in tropical dry-deciduous forest of Andhra Pradesh. The tropical moist mixed-deciduous forest and Khasi hill sal-pine forest show highest number of individuals for 5-<10 m, whereas Khasi-Jaintia subtropical pine forest showed a peak in 10-<15 m. Only a few individuals were characterised by ≥20 m height; 4% in tropical evergreen forest, 4.3% in tropical moist mixed-deciduous forest, 0.6% in Khasi hill sal-pine forest, 4.6% in Khasi-Jaintia subtropical pine forest, 2.7% in Khasi subtropical mixed-broadleaved forest and 0.5% in Khasi subtropical oak-dominated forest.

The population structure of dominant species in each forest type revealed that *Schima wallichii* was one among the top three species in most of the forests except Khasi subtropical oak dominated forest. The girth class distribution of *Schima wallichii* showed decreasing number of individuals with increasing girth classes in all forest types except tropical moist mixed-deciduous forest, which shows regeneration ability of the species.

The size class distribution for *Cinnamomum tamala*, *Myrica nagi*, *Syzygium tetragonum*, *Shorea robusta* and *Lithocarpus fenestratus* followed more or less similar pattern, where the number of individuals decreased with increasing girth classes. All these species showed higher level of regeneration as maximum number of individuals in these species were present in regenerating class (10-<30 cm).
*Pinus kesiya* was one of the most dominant tree species found throughout Shillong plateau. Out of six forest types, it was dominating in four forest types, i.e. Khasi hill sal-pine, Khasi-Jaintia subtropical pine, Khasi subtropical mixed-broadleaved and Khasi subtropical oak-dominated forest. The size class distribution showed almost bell-shaped curve with maximum number of individuals in medium size class (70-<90 cm) and successive decline after and before this class. The *Microcos paniculata* rarely attains a very large girth and this may be a possible reason for absence of higher size class in this species. Being a large to medium tree, the absence of higher gbh class in *Schima wallichii, Castanopsis purpurella* and *Lithocarpus fenestratus* were observed. This may be due to the reason that the larger girth of these species is preferred for charcoal making as well as household timber by the local people.

In conclusion, the number of individuals in all six forest types showed preponderance of lower girth classes which represents good regeneration, but at the same time absence or very less number of individuals in higher gbh class also suggest the occurrence of past disturbances in these forests.