10. SUMMARY

a). The listing of threatened species serves to trigger a range of mechanisms aimed at protecting that species, including preparation of recovery plans, requirements for species impact statements and preparation of threat abatement plans. The development of threatened species lists in itself is also useful, as they can function as a resource document for conservation, as important tools for legislative purposes, as sources of information in increasing public awareness for the conservation issues and as a focus for research planning. Therefore, to identify all the threatened taxa of the region, the present regional assessment of the vascular flora of Southern Assam was carried out by following “IUCN Red List Categories and Criteria Version 3.1” (IUCN, 2001) and “Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0.”(IUCN, 2003).

b). Extensive field exploration covering all the seasons was carried out during 2010-2012 to locate the presence points. Global Positioning System (Garmin GPS 72H) equipment was used to note georeference presence points. In addition to the above some associated data such as habitat, number of mature individuals in case of small population, elevation and forest types etc. were also noted.

c). Screening of herbarium sheets preserved at ASSAM were done to find out all the collections previously made from Southern Assam. The botanical names were recorded with the place of collection, collector’s names, collection numbers with particular date or the month of the year in which they have been collected, because detailed scrutiny of collections in the herbaria can provide valuable information as to the status of a species. The data on present distribution and on their past distribution along with the trends of shrinkage of population are very important in categorization of the status of a species.

d). Extensive literature surveys were also conducted to find out all the literature published for the area and finally these were scrutinized to find out the location of all the previously reported vascular plants from Southern Assam.

e). Herbarium specimens were prepared by following the routine herbarium methods (Jain & Rao 1977). The taxonomic identity of the collected plants was determined by consulting regional and national floras, contemporary monographs and taxonomic revisions. Finally the
identity was confirmed after the verification with the authentic plant materials deposited at ASSAM and their regional and global distributions were noted from the herbarium material and published literatures.

f). Regional taxa for the assessment process were selected by using following filters: Widely distributed species and weeds were not considered. Assessment was done only for the wild populations inside their natural range. A taxon that is currently expanding its distributional range outside the region and appears to be in a colonization phase within Southern Assam was not considered. Visiting, vagrant and introduced taxa were not assessed.

g). Presence points were plotted manually by observing the collection site using Google Earth, especially those locality data without having any co-ordinates and only those locality data having co-ordinates were plotted using DIVA-GIS. These Presence points were organized in an MS Excel file and then converted into appropriate formats for spatial analysis using DIVA-GIS and then incorporated as raster data.

h). The resulting distribution map obtained from DIVA-GIS is then imported in Google Earth. The EOO was calculated by drawing minimum convex polygon in Google Earth and the areas were worked out by using the software GE Path. The AOO was calculated by the sum of the occupied grid squares in Google Earth.

i). Now in step one, criteria B & D of IUCN (2001) was applied to the selected regional population, resulting in a preliminary categorization. In step two, the existence and status of any conspecific populations outside the region that may affect the risk of extinction within the region was investigated either through field visit or based on the information from herbarium data and published regional floras. If the taxon is endemic to the region, the Red List Category defined by the criteria was adopted unaltered. If, on the other hand, conspecific populations outside the region are judged to experience a “rescue effect”. In this cases, downgrading of the category obtained in step one was done.

j). Endemic elements are mainly divided into “Political area endemism” type (Chowdhery & Murti, 2000), depending on the range of occurrence from localized area (small administrative units) to larger geographical regions (political boundary of a country, province or state).

k). Taxa qualifying the IUCN Red List Criteria are emphasized with their currently accepted names, synonyms, citations, information about type specimens, vernacular names, taxonomic description, phenology, global and regional distribution, habitat, specimen examined, notes,
uses (if any), global red list category, regional red list category and criteria, photographic illustrations, line drawings and map showing distribution of the population studied.

1). Out of the approximately 2000 taxa found occurring in the region, 201 taxa (ca. 10%) belonging to 146 genera and 74 families, have been qualified to the different red list categories, of which 2 are Extinct (EX), 2 are Extinct in the Wild (EW), 8 are Regionally Extinct (RE), 18 Critically Endangered (CR), 43 Endangered (EN) and 86 Vulnerable (VU), 16 are Near Threatened (NT), 4 are Least Concern (LC) and 22 are Data Deficient (DD). Out of the total taxa categorized, 25 species are Pteridophytes belonging to 14 families and 18 genera and 3 taxa belonging to 3 genera are distributed in 3 families of gymnosperms. Whereas 173 taxa belongs to Angiosperms distributed in 58 families and 125 genera, of which 133 taxa belongs to dicots. and 40 are monocots. Among them 167 are terrestrial, 24 are epiphytes, 5 are lithophytes, 2 are parasitic, 1 is aquatic and 2 are either epiphytic or lithophytic.

m). The family Orchidaceae comprises highest no of threatened taxa (16), followed by Rubiaceae with 15 taxa, Acanthaceae with 10 taxa, Fabaceae, Lauraceae and Myrsinaceae represented with 8 taxa each, and the family Arecaceae is represented with 6 taxa and so on. Out of the total 201 taxa, 69 are herbs, 55 shrubs, 47 are trees, 16 lianas and 14 are herbaceous climbers. Therefore, it has been assumed that herbs are more vulnerable to extinction compared to either trees or shrubs.

n). During the study three new species viz. Ornithochilus cacharemis, Justicia cacharensis and Toxicodendron bimannii has been discovered from the low-land tropical evergreen forest of Borail Wildlife Sanctuary and also a new combination Glinus lotoides var. keenanii is proposed.

o). The present study also leads to the addition of 494 taxa belonging to 350 genera of vascular plants to the flora of Southern Assam. Out of which Eurya stenophylla, Asplenium apogamum and Ixora rangonensis are reported for the first time from India. Dendrobium darjeelingensis is reported for the first time from N.E. India, 53 species have been reported for the first time from Assam. Whereas, 437 species are reported for the first time from Southern Assam.

p). Out of the total no of threatened taxa 45.8 % are widely distributed and the remaining 54.2% showed restricted distribution, of which ca. 17.4 % (35 taxa) are exclusively endemic.
to political boundary of India. They are viz. *Agapetes odontocera var. pulcherrima*, *Ardisia griffithii*, *A. keenanii*, *A. odontophylla*, *A. paniculata var. hookeri*, *Beilschmiedia brandisii*, *Brachycome assamica*, *Chassalia curviflora var. ellipsoidis*, *Cleisocentron pallens*, *Derris cuneifolia var. cuneifolia f. assamica*, *D. pseudorobusta*, *Erycibe al biflora*, *Ficus laevis var. assamica*, *Garcinia keenania*, *G. lanceaefolia var. oxyphylla*, *Glinus lotoides var. keenanii*, *Gymnema acuminatum*, *Impatiens laeavigata var. grandifolia*, *Justicia cacharensis*, *Larsenianthus assamensis*, *Leptomischus modesta*, *L. wallichii*, *Melocalamus indicus*, *Mussaenda keenanii*, *Ornithochilus cacharensis*, *Platostoma verbenifolium*, *Plectocomia khasyana*, *Rhaphidophora schottii*, *Schizostachyum mannii*, *Selaginella pentagona*, *Strobilanthes elongatus*, *Strychnos aenea var. acuminata*, *Syzygium anisopetalum*, *Thelasis bifolia* and *Toxicodendron bimannii* and the remaining ca. 36.8% (74 taxa) showed comparatively restricted distribution with the adjoining countries.

As the present work is restricted to the Southern Assam, out of the total taxa listed, red list determined for the following 7 taxa viz. *Derris cuneifolia var. cuneifolia f. assamica*, *Garcinia keenania*, *Glinus lotoides var. keenanii*, *Justicia cacharensis*, *Leptomischus modesta*, *Ornithochilus cacharensis* and *Toxicodendron bimannii* can be considered as global level, because they are exclusively endemic to Southern Assam. The global and national status of the rest of the taxa can be ascertained only after studying them throughout in their geographical range of distribution. It is interesting to note here that out of the total no of taxa categorized, following 12 taxa viz. *Acacia caesia*, *Aglaia chittagonga*, *Alocasia fornicata*, *Derris cuneifolia var. cuneifolia f. assamica*, *Euryale ferox*, *Gnetum gnemon var. brunonianum*, *Ixora malabarica*, *Leptomischus wallichii*, *Mycetia mukerjiana*, *Nageia wallichiana*, *Ophiorrhiza hispida* and *Podocarpus neriifolius*, have already been added to IUCN Red-List at global level.

To promote ex-situ conservation following 30 taxa of red-listed plants have been introduced at the Experimental Botanic Garden of Botanical Survey of India, located at Barapani, Shillong: *Acanthephippium sylhetense*, *Amorphophallus bulbifer*, *A. napalensis*, *Ardisia khasiana*, *Begonia annulata*, *B. hatacoa var. hatacoa*, *B. siletensis*, *B. thomsonii*, *Citrus indica*, *Dipteris wallichii*, *Eria excavata*, *E. stricta*, *Garcinia lanceaefolia var. oxyphylla*, *Gastrochilus inconspicuous*, *Geodorum appendiculatum*, *Hemiorchis pantlingii*, *Hoya griffithii*, *Huperzia phlegmaria*, *H. squarrosa*, *Larsenianthus careyanus*, *Mesua floribunda*, *Panisea uniflora*, *Pelatantheria insectifera*, *Phalaenopsis parishii*, *Piper
khasianum, Podocarpus neriifolius, Selaginella decipiens, Taenitis blechnoides, Tinospora crispa and Trivalvaria argentea and at present a few are found to have well established.

s). A number of factors contribute to the extinction of plant species; however recent attention has focused largely on the anthropogenic threats to plant species. The following factors are generally considered as important human-based threats to the conservation of plant species in Southern Assam, e.g. encroachment of forest land, clearance of forest for agriculture, grazing, forestry, road works, urbanisation, intentionally induced fire, spread of exotic species, plant based industries, land degradation, pollution, illegal trade, establishment and expansion of the tea gardens, floods etc.

t). To restrict further extinction of the species and to reverse the processes which have caused threat, following eight conservation measures have been suggested: locality mapping and in-situ conservation, ex-situ conservation, in-vitro propagation and reintroduction, check of illegal tree felling and extensive timbering, active participation from tribal people, mass awareness about environment, control of overgrazing and afforestation.