



Lecture for 4th Semester Special Paper
BOT 4.02A: ANGIOSPERM TAXONOMY

Endemics: Types, Characters, Theories, Endemic Plants, IUCN



Course Coordinator

Prof. A.K.Mondal, FLS, FIAAT

Professor of Botany & Coordinator

UGC-DRS-SAP-II and DBT-BOOST-WB

Plant Taxonomy, Biosystematics and Molecular Systematics Laboratory

UGC-DRS-SAP-II and DBT-BOOST Supported Department

Department of Botany & Forestry

Vidyasagar University



Endemics:

Types, Characters, Theories, Endemic Plants, IUCN



Contents:

- ✓ *Meaning of Endemism*
- ✓ *Endemic Species*
- ✓ *Types of Endemism*
 - *(a) Neo-endemism:*
 - *(b) Palaeo-endemism:*
 - *(c) Epibiotics or Relic, endemics:*
- ✓ *Characters of Endemism*
- ✓ *Theories of Endemism*
- ✓ *Factors of Endemism*
- ✓ *Causes of Endemism*
- ✓ *Endemic Species in India*
- ✓ *IUCN Categories*
 - *Factors of extinction*
 - *Preserving extinction species*
 - *Strategic goals for conservation and suitable use of biodiversity*

What is Endemism?

- ❑ Endemism means the confinement of a particular species, genus, or groups of plants and animals to a particular area.
- ❑ Taxa occurring only a single restricted geographical area is known as endemics.
- ❑ Endemism normally applied only where there is a considerable restriction in the area of distribution.

Endemism is the ecological state of being unique to a defined geographical location, such as Island, Nation, Country or other defined zone, or habitat type.

Organisms that are indigenous to a place are not endemic to it if they are also found elsewhere.

The extreme opposite of endemism is called cosmopolitan distribution.

Endemic Species

Concept:

The concept of Endemism was first given by Candolle.

When a species is found only a particular geographical region because of its isolation, soil and climate conditions, it is said to be endemic.

Types of Endemism:

Endemism is basically of following types:

(a) Neo-endemism:

(b) Palaeo-endemism:

(c) Epibiotics or Relic, endemics:

(a) Neo-endemism:

A taxon is evolutionarily young and not yet spread over the new area e.g., *Senecia combrensis*.

(b) Palaeo-endemism:

The taxon is restricted now but once it was widely distributed.

The restriction of species in a pocket is due to physical barrier like deserts mountain, sea, etc. or change in climate or soil type etc.

(c) Epibiotics or Relic, endemics:

The plants belong to fossil groups and are restricted to few pockets due to favourable climate, lack of competition e.g., *Ginkgo biloba* which is restricted to China but widely spread in the north temperate zone as a fossil, *Sequoiadendron giganteum* is now restricted to Californian Sierra Nevada.



□ According to Richardson (1978) endemics is intermediate between the two extremes i.e., plants which are not of recent origin but have retained a narrow distribution and he called them Holoendemics.

□ If the local conditions induce reactivation of Palaeoendemics evolving new endemic species after a long gap they are called active epibiotics.

□ The degree of isolation of the area involved is usually proportional to the percentage of endemic species in flora.

□ The degree of isolation is measured either as the distance from other similar areas or the length of time that the area has been isolated.

□ Endemism represents a unique step in the process of evolution which could be perpetuated and sustained only in the locality concerned depending on the environmental quality.

□ The importance of habitat is very much as in most of the cases such localities possess a number of endemic species distributed in several taxonomic categories.

Endemics are sometimes restricted to a very small area.

They are termed as Local endemics. Endemics arising due to mutation are called Pseudo endemics e.g., *Franklinia alatamaha*; only one plant of this family was present in 18th century in Alotamaha river in Georgia.

It is now vanished but its progeny is found in gardens.

***Amliestic nobilis* (Burma),**

***Picrella trifoliata* (West Indies) are already vanished while only a few plants of *Sophora wightii* are found in islet of Louisiade Archipelago.**

Larger areas usually have a greater proportion of endemics than smaller areas.

If the whole world is considered as one unit with 100% then the number of species endemic to the eastern alps or to western alps added together amount to 78% of the total number of Alpic endemics.

In the process of natural selection, changes are there which may be disadvantageous to the organism to survive in the present environment and are eliminated but on the other hand advantageous ones are retained.

Paleoendemism refers to a species that was formerly widespread but is now restricted to a smaller area.

But on the other hand

Neoendemism refers to a species that has recently arisen such as a species that has diverged and become reproductively isolated, or one that has formed following hybridization and is now classified as separate species.

Protecting just 1.4% of the World's land surface containing all the endemism hotspots, 44% of the World's vascular plants and 35% of its terrestrial vertebrates could be preserved. But, these hotspots also contain 20% of the World's population, most of them rapidly increasing and are therefore areas of intense commercial exploitation and habitat destruction. Therefore, successful conservation cannot focus on wilderness areas alone!

**A lot of work is going on Neoendemics.
On the basis of cytotaxonomic studies
Favager and Contandriopoulos (1961)
differentiated 3 types of neoendemics.**

(a) Schizoendemics:

(b) Patroendemics:

(c) Apoendemics:

(a) Schizoendemics:

Derived from or having given rise to a more widespread taxon of same chromosome number.

(b) Patroendemics:

Restricted diploids which have given rise to widespread polyploids.

(c) Apoendemics:

Restricted polyploids which have arisen from widespread diploids.

❑ There is a great confusion in the terms endemic, rare, relicts etc.

❑ All endemics are not relicts as there are a larger number of Neoendemics.

❑ All endemics are not rare as some are abundantly present in the particular locality.

❑ All rare plants are not endemics. Some may occur at several places, with few representatives.

Causes for Endemism



CHARACTERS OF ENDEMICIS:

- 1. They are localized in distribution because of their Narrow Ecological Amplitude and are unable to invade in fresh areas.**
- 2. They lack potentially to migrate because of saturate genomes.**
- 3. Real endemics never migrate while Neoendemics have the potential to migrate.**
- 4. The dispersal propagules are not able to sustain during migration to other area. It may be due to physical barriers.**

Theories of Endemism:

- ❑ There are 2 main theories of Endemism.
- ❑ The first theory believes that the last survivors of once flourishing flora which is now declining are the relics or epibiotics which are endemics.
- ❑ However, second theory believes that these are recent and youthful forms in course of gradual extinction.
- ❑ The theory is also known as Age and Area hypothesis.

➤ The first theory is supported by Geographers e.g., *Sequoia semipenirens* of the central Valley of California and Oregon and *S. gigantea* of Sierra Nevada which are endemic to their respective native homes, were extensively distributed in Cretaceous and Tertiary periods.

➤ The supporters of second theory have the examples of *Primula*, *Impatiens* *Rhododendron* etc. According to this theory, Area is directly proportional to its age in the scale of evolution.

✓ So, a small area of distribution shows relatively young in age e.g., *Coleus* is distributed on the summit of the dry Ritigala mountains in Sri Lanka, with two species *C. elongatus* and *C. barbatus*. *C. elongatus* is endemic and *C. barbatus* is widely distributed in tropical Asia and Africa.

✓ Willis believed *C. elongatus* to be derived from *C. barbatus*.

Factors Responsible for Endemism:

❑ Factors responsible for the production of endemics are Natural crossing among the closely related plants growing under favourable conditions and Mutations.

❑ If the condition of isolation is developed the effect becomes more pronounced.

- ❑ Endemism is found in isolated e.g., islands, isolated areas etc.
- ❑ According to Wulff 85% of Flora of St. Helena, 80% of Hawaii islands and 72% of New Zealand is endemic.
- ❑ Mountains also have more endemic species as they are isolated e.g., 70% sp. of Himalayas is endemic.
- ❑ Climate also is one of the factors e.g., North of Himalaya is dry plateau of Tibet and South Himalayan range has alluvial fertile soil.

□ According to Professor D. Chatterjee the percentage of endemic species of Dicot plants in India is more than 50.

□ Maximum endemic plants are found in the Himalayas and South India.

□ Indo-Gangetic plains have a very small number of endemic species.

ENDEMIC SPECIES OF PLANTS

NEXT SLIDE 

Endemic Species of India:

- ✓ *Rhododendron* (Ericaceae),
- ✓ *Beaumontia grandiflora* (Apocynaceae),
- ✓ *Eleusine coracana* (Poaceae),
- ✓ *Caryota urena* (Arecaceae),
- ✓ *Aegle marmelos* (Rutaceae),
- ✓ *Crotolaria juncea* (Fabaceae),
- ✓ *Ficus religiosa* (Moraceae), and
- ✓ *Seasamum indicum* (Pedaliaceae).



Alpine



Acacia

Pinophyta



Some
More
Endemic
Plants

Rhododendron



The other species belong to families like:

- ✓ **Rubiaceae (6 genera),**
- ✓ **Rosaceae,**
- ✓ **Asteraceae,**
- ✓ **Primulaceae,**
- ✓ **Acanthaceae etc.**

DO YOU KNOW ?

The Sagebrush, a very common resident of Great Basin National Park, is well adapted to the area. The Big Sagebrush root system can extend as much as 90 feet in circumference. This adaptation allows the plant to collect as much water as possible during infrequent rains. It is an endemic plant.



RHODODENDRON

Rhododendron is a genus of 1,024 species of woody plants in the heath family either evergreen or deciduous, and found mainly in Asia. Most species have showy flowers. Azaleas make up two subgenera of *Rhododendron*. They are distinguished from "true" rhododendrons by having only five anthers per flower. It is the national flower of Nepal.



PINOPHYTA

Pinophyta is one of 12 extant division-level taxa within the Kingdom Plantae and 10 within the extant land plants.

Pinophytes are gymnosperms, cone-bearing seed plants with vascular tissue. All extant conifers are woody plants with secondary growth, the great majority being trees with just a few being shrubs.



ACACIA

Acacia is a genus of shrubs and trees belonging to the subfamily Mimosoideae of the family Fabaceae, described by the Swedish botanist Carl Linnaeus in 1773 based on the African species *Acacia nilotica*. Many non-Australian species tend to be thorny, whereas the majority of Australian acacias are not. It is found in Australia.



ALPINE

Alpine plants are plants that grow in the alpine climate, which occurs at high elevation and above the tree line. Alpine plants grow together as a plant community in alpine tundra. Alpine plants must adapt to the harsh conditions of the alpine environment, which include low temperatures, dryness, ultraviolet radiation, and a short growing season. It is found in Alps Mountain Range.

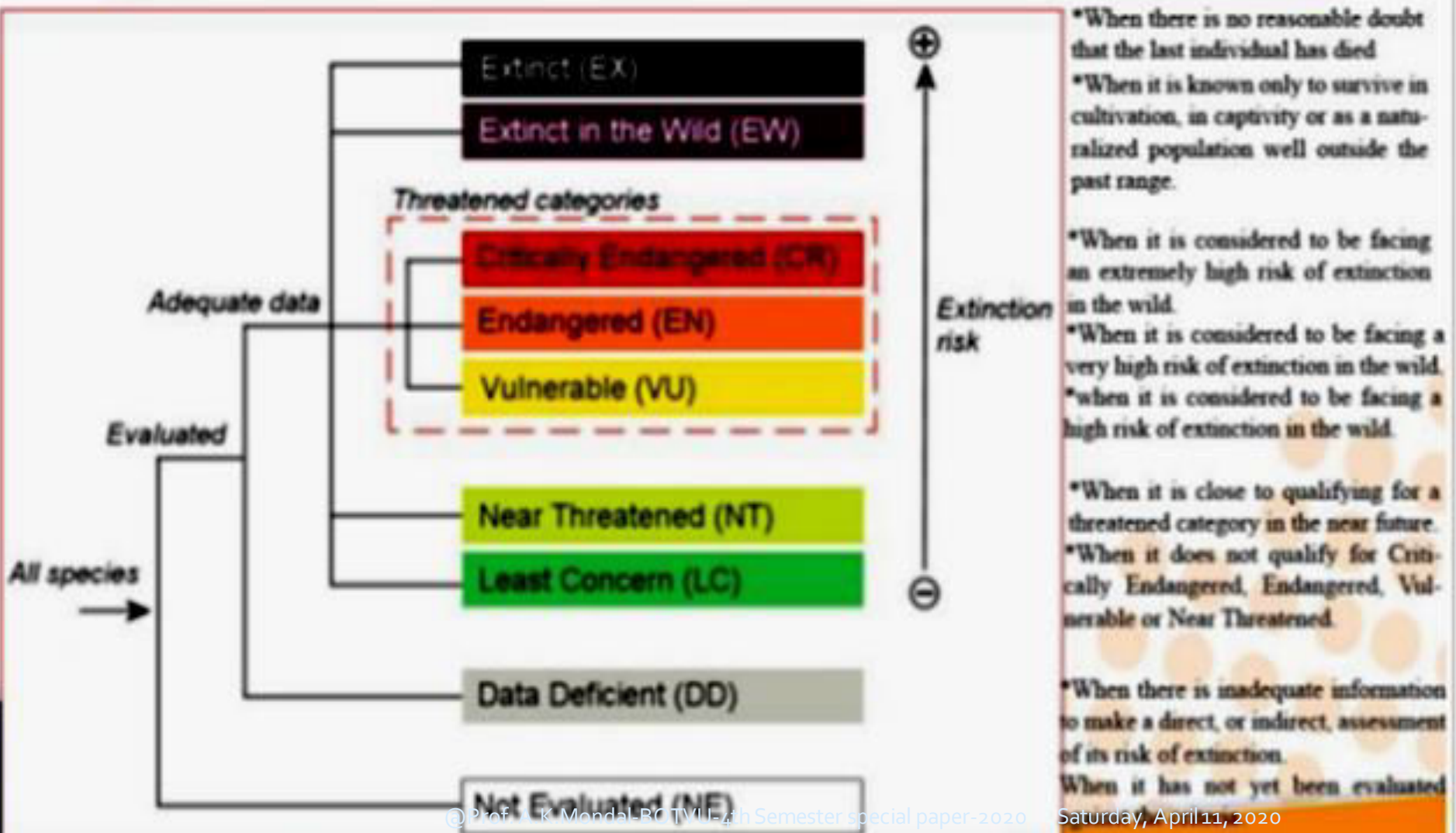




IUCN Red List

The IUCN Red List of Threatened Species is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of species.

Risk of Extinction categories



EXTINCT (EX)

- When there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD (EW)

- When it is known only to survive in cultivation, in captivity or as a naturalized population well outside the past range.

CRITICALLY ENDANGERED (CR)

- When it is considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

- When it is considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)

- When it is considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

- When it is close to qualifying for a threatened category in the near future.

**LEAST
CONCERN
(LC)**

- When it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.

**DATA
DEFICIENT
(DD)**

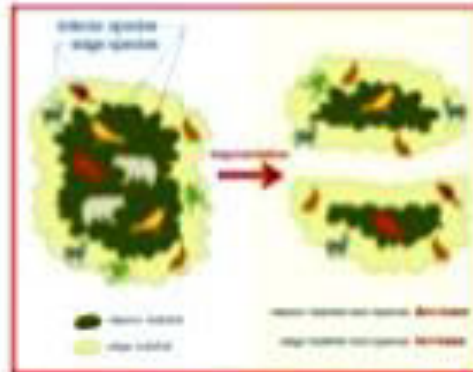
- When there is inadequate information to make a direct, or indirect, assessment of its risk of extinction

**NOT
EVALUATED
(NE)**

- When it has not yet been evaluated against the criteria.

Factors of extinction

- Habitat fragmentation
- Overexploitation
(hunting, fishing ..)
- Introduced species
- Disruption of ecological interactions
- Pollution
- Loss of genetic variability
- Plant diseases
- Overgrazing



Preserving endangered species

- Preservation approaches-1
- Habitat restoration-2
- Removal of introduced species-3
- Cleanup and rehabilitation-4



Strategic goals for conservation and sustainable use of biodiversity

Steps taken for conservation the remaining species

Establishment of national parks –protected area-1

Establishment of gene banks-2

Collection and preservation of germplasm-3

Legislation for conservation-4

Control an overexploitation-5





THANK YOU!