



# **Rare and Endemic Species: Why are they prone to extinction?**

**Prof. Dr. Kani IŞIK**

**Akdeniz University  
Faculty of Arts and Sciences  
Dept of Biology  
and  
Biodiversity Research and  
Development Center  
ANTALYA**

# TOPICS

## 1- DEFINITIONS

(RARE SPECIES, ENDEMIC SPECIES)

## 2- THE PATH TO EXTINCTION (4 Ds)

## 3- IUCN CONSERVATION CATEGORIES

## 4- COMMON CHARACTERISTICS OF EXTINCTION- PRONE SPECIES

## 4- SUMMARY

## **RARE SPECIES X Common species**

**HAS any one or more of the following characteristics:**

- **Grows naturally in a narrow geographical area,**
- **Occupies only one or few specialize habitats,**
- **Forms only small population(s) in its range.**

**ENDEMIC SPECIES    X    cosmopolitan species**

**GROWS naturally in a single geographic area,  
the size of which could be either narrow or  
relatively large.**

Depending on the **scale of “geographic range”**,  
**ENDEMICS** are called under different names:

**Local endemic,**  
**Provincial endemic,**  
**National endemic,**  
**Regional endemic,**  
**Continental endemic.**



# Examples on LOCAL endemics:

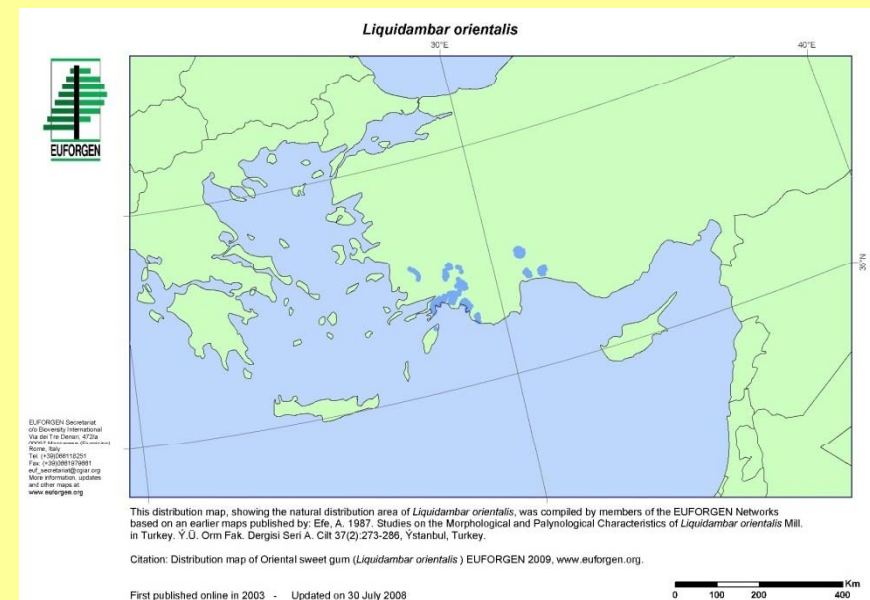
**Sternbergia candida (Liliaceae Fam.)**  
**[Fethiye (Muğla) and its neighbourhood]**

**Liquidambar orientalis**

**Köyceğiz, Fethiye, Aksu vadisi (Bucak)**



**Photo: Prof.Dr. Mecit Vural, Gazi Univ.**



**Examples on PROVINCIAL endemics:**

***Anthemis ammophila* (Asteraceae Fam.) (Antalya Daisy)**



(Sümbül et al. 1998)



## Examples on NATIONAL endemics:

### ***Crocus ancyrensis* (Iridaceae Fam.) (Central Anatolia and its neighbourhood)**



([www.agacler.net](http://www.agacler.net))





**Examples on REGIONAL endemics:**

***Pancratium maritimum* (Amaryllidaceae Fam.) = Sea Daffodil**

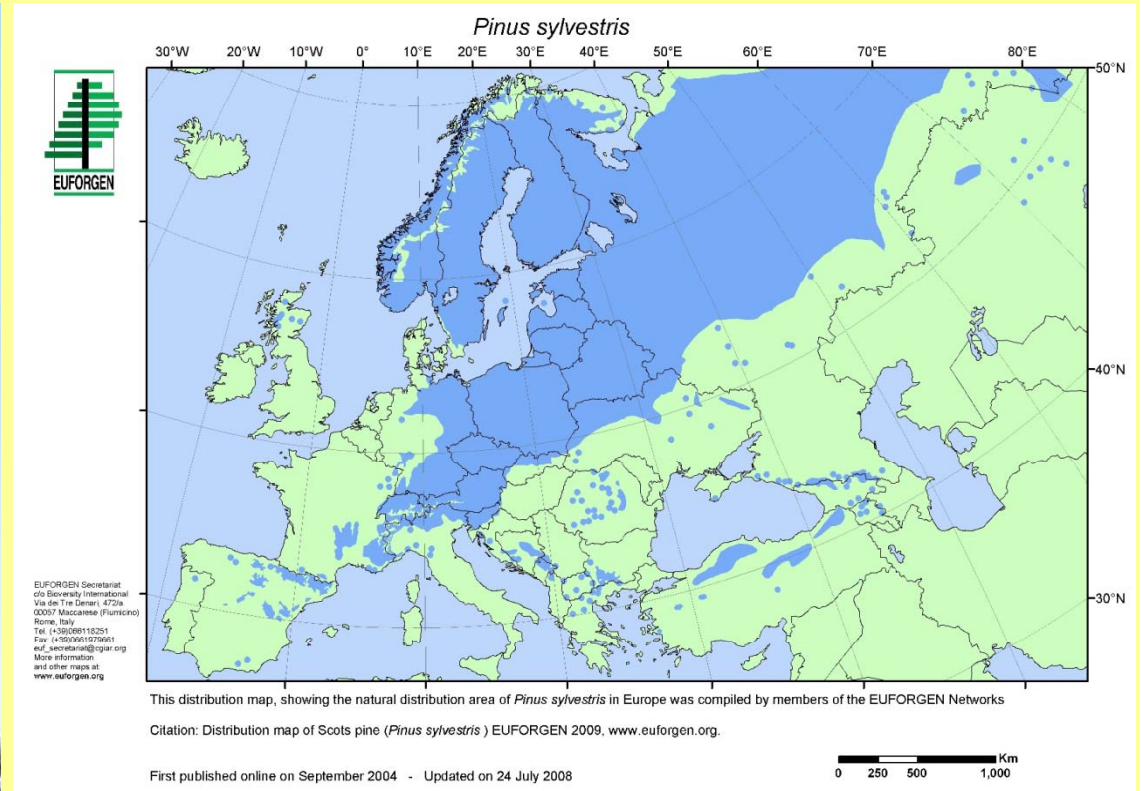
**(Mediterranean coastal sands)**



**([www.agacler.net](http://www.agacler.net))**

## Examples on CONTINENTAL endemic:

### *Pinus sylvestris* (Pinaceae Fam.)(Eurasia)



([www.euforgen.org](http://www.euforgen.org))

# **THREE CRITERIA that mark the distribution of rare and endemic species**

**A- Geographic range,**

**B- Population size,**

**C- Habitat demands.**

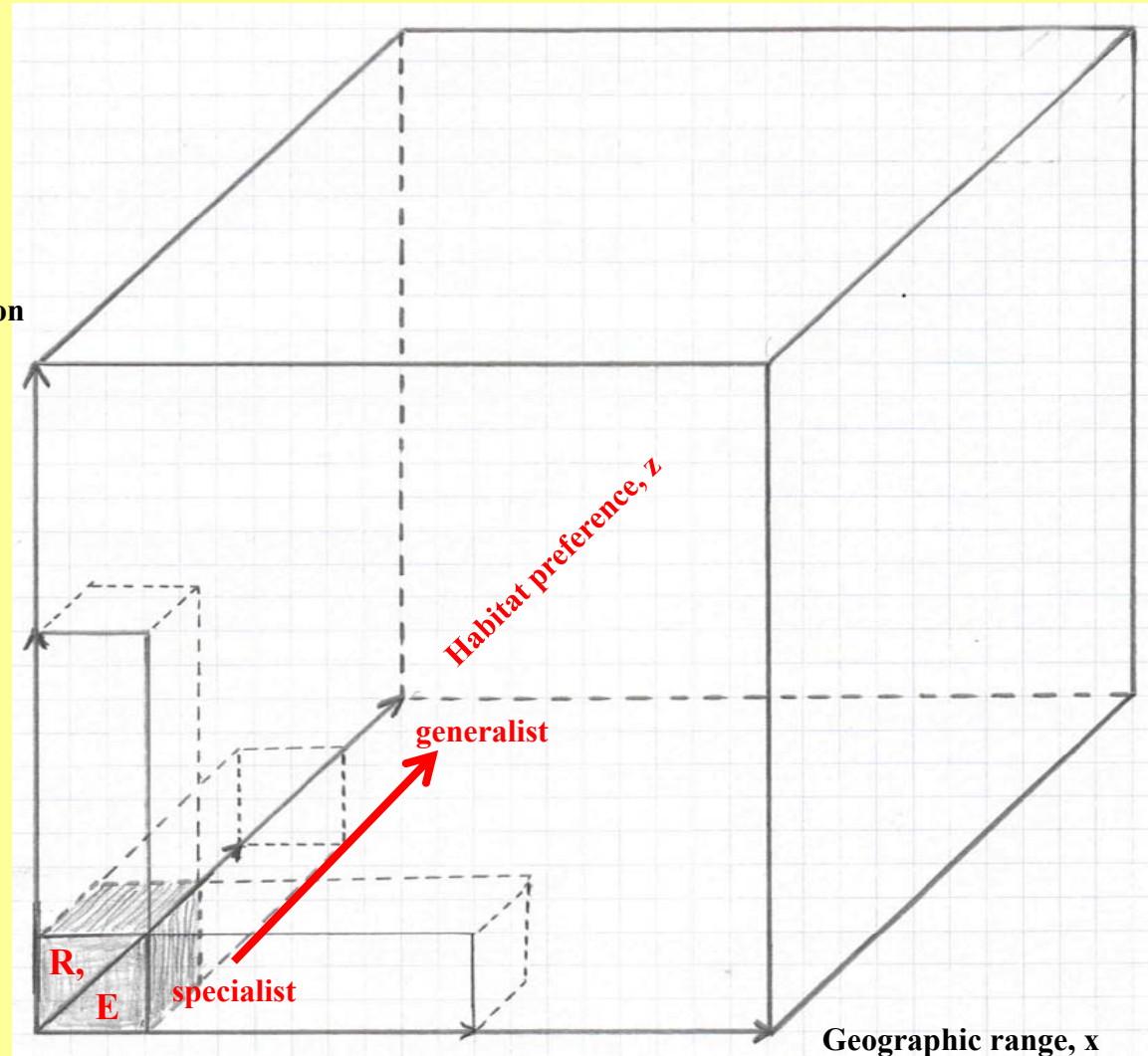


Population  
size,  $y$

large



small



narrow



wide

Geographic range,  $x$



## **BOTH RARE AND ENDEMIC ?**

**A species may be both RARE and ENDEMIC if it lives in a narrow (and single) geographical area.**

## 2- THE PATH TO EXTINCTION

**Extinct species:** A species is considered as “extinct” when **no member of the species remains alive anywhere in the world.** Species close to extinction usually lose their ability to adapt to changing environments.

**Extinct in the wild:** If individuals of a species **remain alive ONLY in captivity or under human-care**, the species is considered as “extinct in the wild”.

**Locally extinct or extirpated species:** A species is locally extinct or extirpated when it is no longer found in an area where it used to live, but it still lives elsewhere in the wild.

## 4 Ds that lead to extinction

**D**estruction,

**D**egradation,

**D**ecline,

**D**isappearance (Extinction)

## HOW 4Ds OPERATE TOWARD EXTINCTION

**Increasing human population, increasing consumption**



**Human activities**

**Agriculture   Logging   Fisheries   Industry   Urbanization and   International  
and fossil fuel use   road construction   trade**

**Habitat loss and degradation  
Pollution (especially nitrogen)  
Land cover change  
Habitat fragmentation**

**Overexploitation**

**Introduction of  
invasive species  
and disease**

**Climate change**

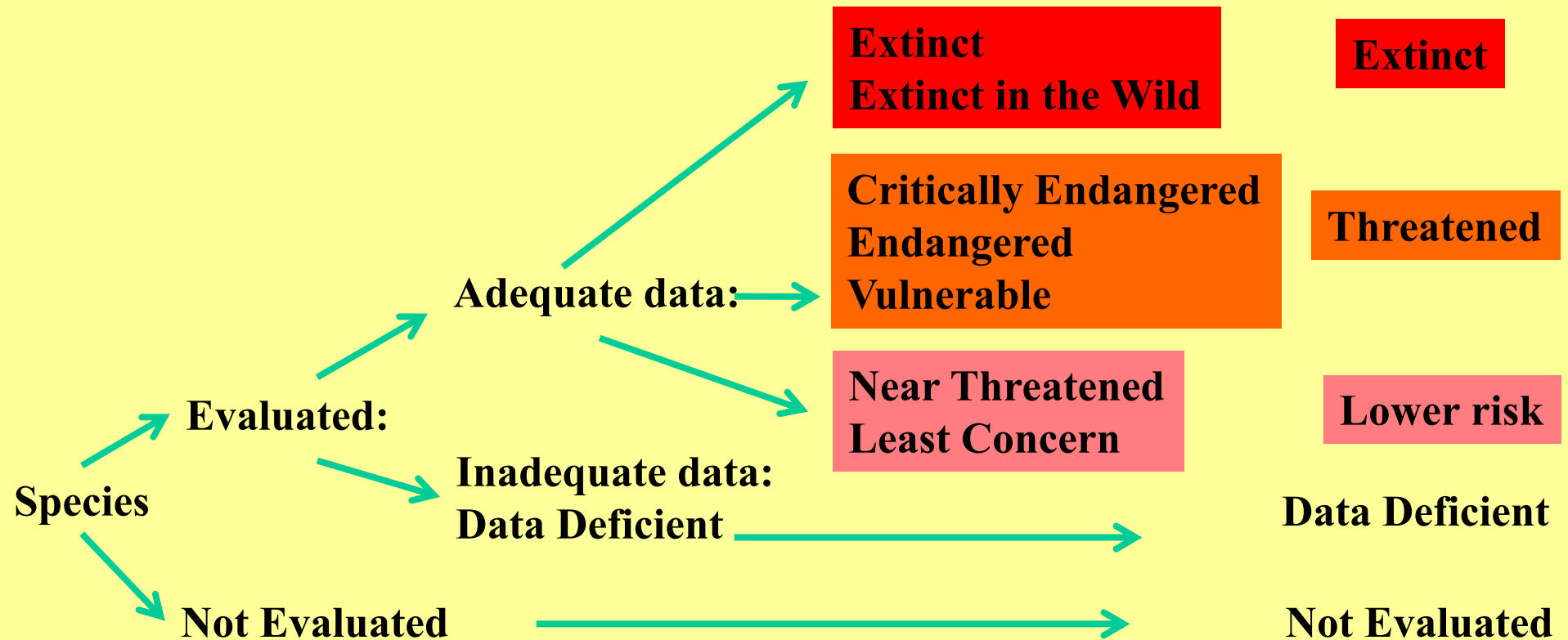
**Degradation of ecosystems  
Erosion of genetic diversity and evolutionary potential  
Loss of ecosystem services  
Erosion of support systems for human societies  
Loss of biological diversity**

**Extinction of species and populations (Groom et al. 2006)**



### 3- IUCN CONSERVATION CATEGORIES

- The IUCN (International Union for Conservation of Nature) has established nine categories of species (IUCN 2001).



These categories helps to define the status of rare and endangered species for conservation purposes.

Such information on a species is essential to establish strategies and guidelines for its conservation.

## **4- COMMON CHARACTERISTICS OF EXTINCTION-PRONE SPECIES**

**RARE species and ENDEMIC species that exhibit one or more of the following characteristics are vulnerable to extinction:**

**A- Species with a narrow (or single) geographic range,**

**B- Species with only one or few populations,**

**C- Species with small population size,**

**D- Species with declining population size,**

**E- Species hunted or harvested by people,**

**F- Species with low reproductive ability and/or germplasm-dispersal-ability,**

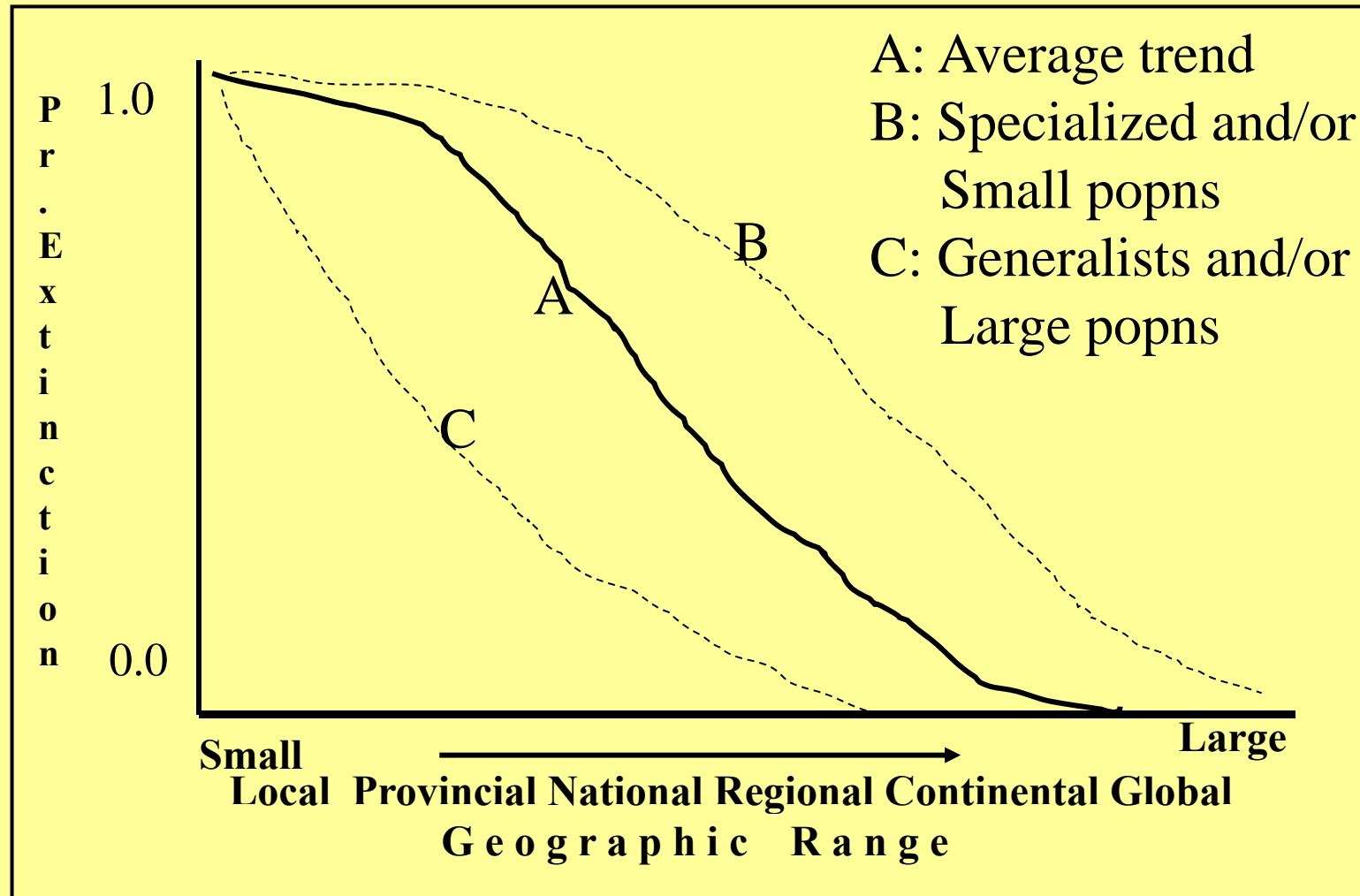
**G- Species that require specialized niche, or stable environments.**

The above listed characteristics of extinction-prone species are **not independent of each other**. For example, species with specialized nich requirements also tend to have small population size.

Species that have full range of these characteristics are the most vulnerable to extinction.



## A- Species with a narrow (or single) geographic range



- Thomas et al (2004) estimated that more than one million species, mainly those with narrow ranges, could become extinct by 2050 merely as a result of global climate change

## **B- Species with only one or few populations,**

**This category is related to the previous one, because species with only one or few populations will also tend to have a narrow geographical range.**

**Species with only one population have greater risk of extinction than those with more than one population. Any chance factor or human activity may result in habitat destruction, population decline and eventual extinction.**

## **C- Species with small population size,**

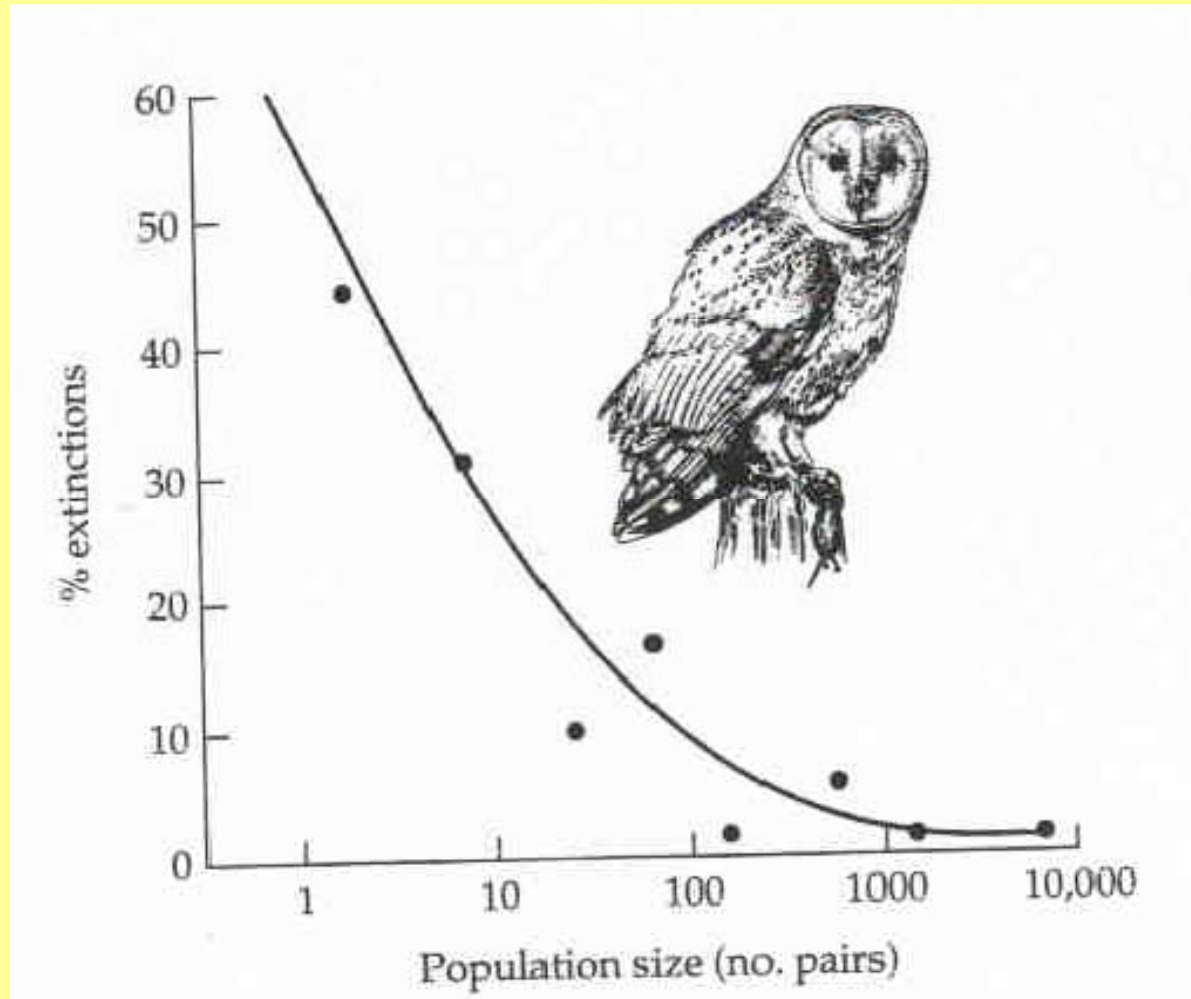
### **Small populations:**

- **are likely to have low genetic variability,**
- **are likely to go through inbreeding depression,**
- **more susceptible to environmental changes,**
- **more susceptible to demographic variation.**

**Therefore, they are more likely to go locally extinct.  
(some graphics follow)**

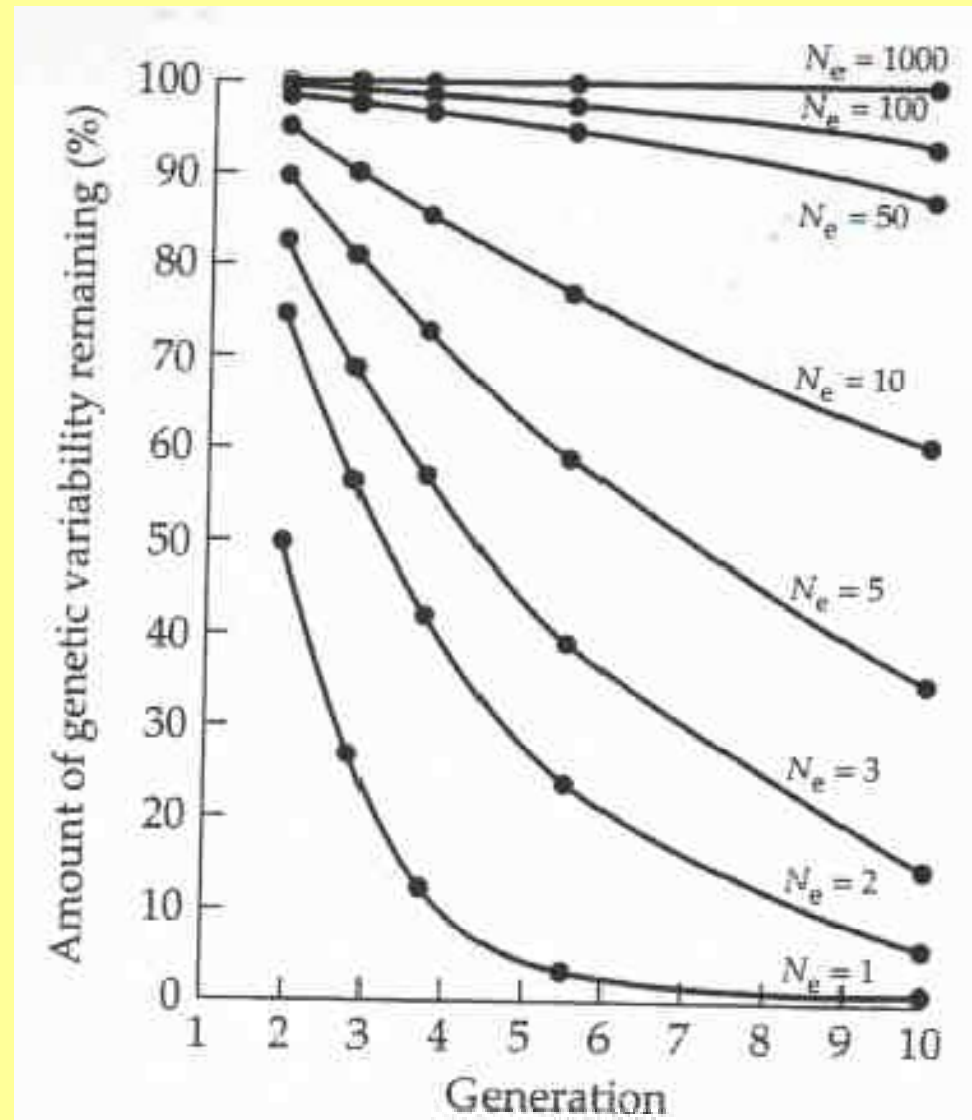


## Popn size vs Extinction rate (in an island, non-migrating bird sp)



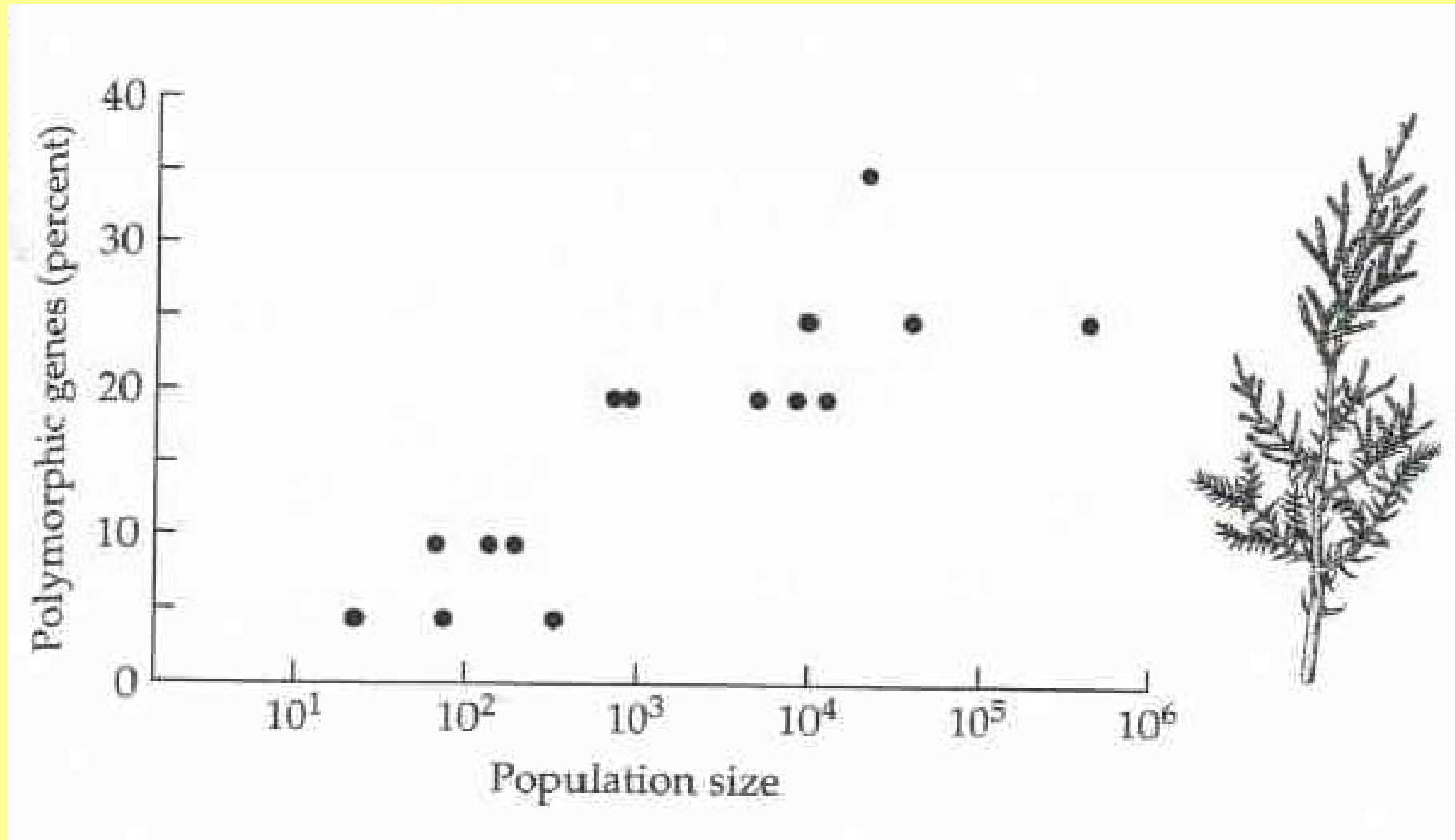
(From Jones and Diamond 1976)

## Popn size vs genetic variability



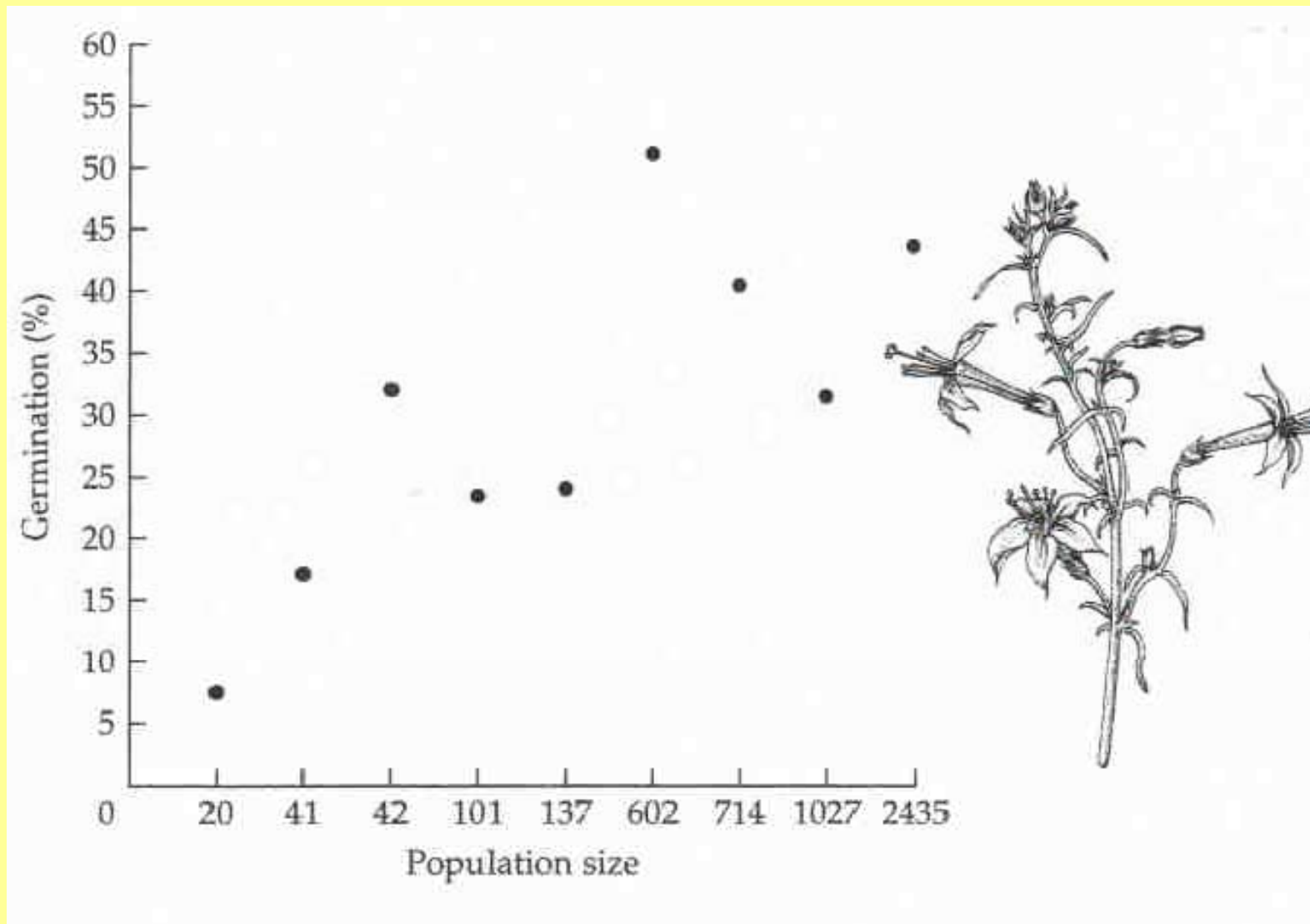
(From Meffe and Carroll 1997)

## Popn size vs genetic variability (*Halocarpus bidwillii*)



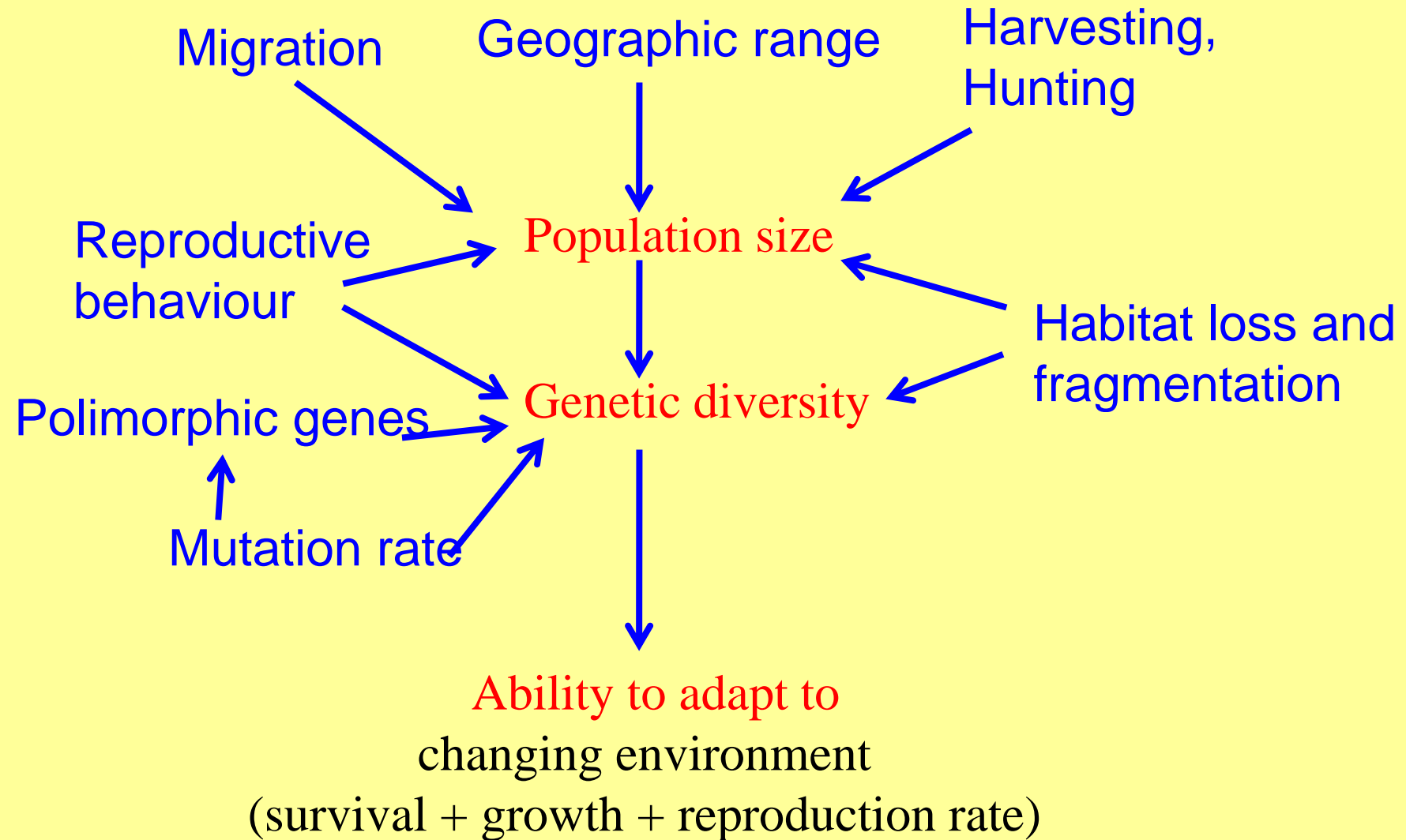
(Billington 1991)

## Popn size vs seed germination (*Ipamopsis aggregata*)



(Heschel and Paige 1995)

# Factors effecting population size, genetic diversity and adaptation

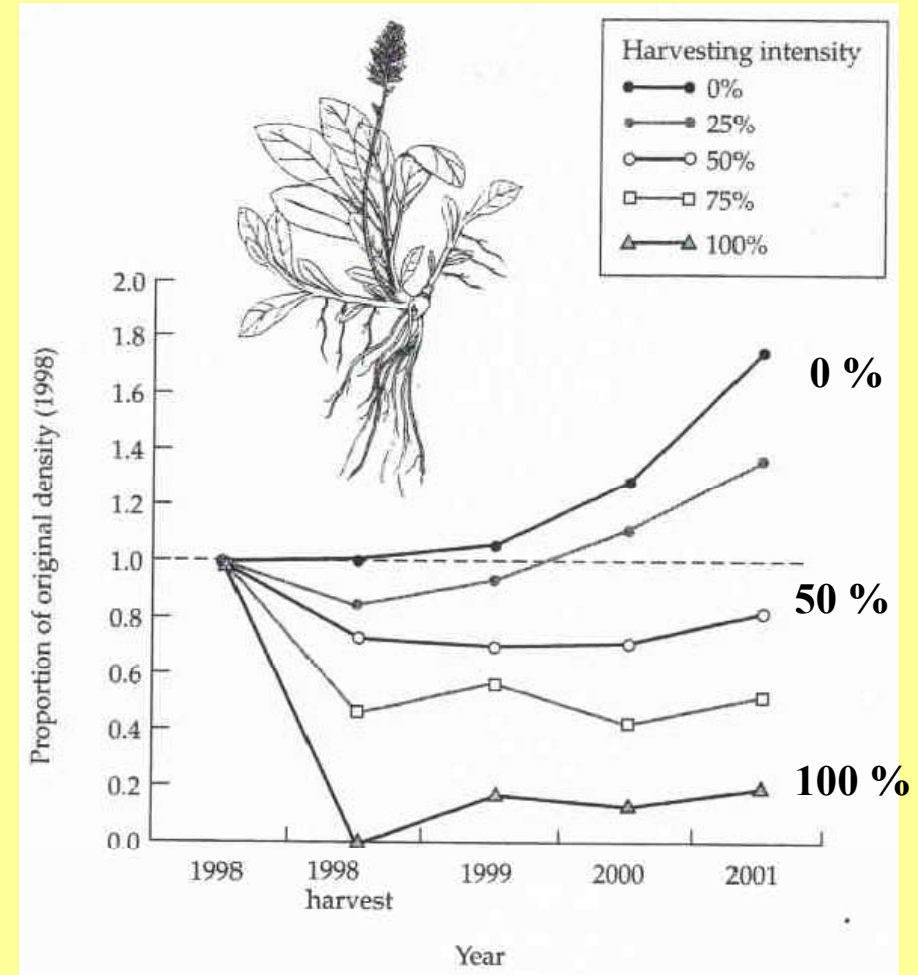


## **D- Species with declining population size**

- **A population may be large, but population size could show signs of declining trend over time.**
- **Unless the cause of decline is identified and corrected, the final outcome first is small population size, and then related consequences seen in small populations.**

## E- Species hunted or harvested by people.

Overharvesting or overhunting can rapidly reduce the population size of a species. If the harvesting is not regulated by national laws, local ethics and international regulations (such as CITES), the species can be driven to extinction.



*Neopicrorhiza*, a Himalayan medicinal plant (Ghimire et al. 2005)



## **F- Species with low reproductive ability and/or germplasm-dispersal-ability (1)**

- Under changing environments (either human-induced or natural), a species either has to migrate to suitable habitats or has to adapt, either behaviorally or physiologically, to the new habitat conditions. Otherwise, they have to face extinction.**
- The rate of adaptation (i.e., genetic changes) is often cannot catch with the rate of rapid human-induced environmental changes. Therefore, species that are unable to disperse and colonize new areas have higher risk of extinction.**

## **F- Species with low reproductive ability and/or germplasm-dispersal-ability (2)**

- **Species with low biotic potential and low dispersal ability (especially the species with larger size) are more prone to extinction.**
- **In plants, species with large and/or short-lived seeds are more vulnerable than those with smaller, long-lived seeds (Kolb and diekmann, 2005).**
- **Species that are able to produce both by seeds and clonal means have higher chance of survival.**

**G- Species that require specialized niche, or stable environments.**

- Species with low tolerance range (those with specialized niche requirements) have a greater tendency to become extinct when some changes occur in the environment (For example wetland plants, plants with specific pollinators, plants with specific dispersal agents...)**
- Many species are found in environments where human disturbance is minimal such as species in old stands, in core areas of forests, in wild-pastures (pastures with no cultivation).**
- Under changes in physical and chemical environments in such areas, certain species are unable to adapt, and fail to rebuild their populations fast enough to avoid extinction.**

## 5- SUMMARY (1)

A species is considered to be “rare” if it exhibits any one of the following attributes: (1) grows naturally *in a narrow* geographical area, (2) occupies only one or a few specialized habitats, or (3) forms only small population(s) in its range.

An “endemic” species, however, grows naturally *in a single* geographical area, the size of which could be either narrow or relatively large.

Not all endemic species could be rare, just as not all rare species could be endemic. The only common criterion that makes a species *both rare and endemic* is the attribute of living in a *narrow (and single) geographical range*.

## 5- SUMMARY (2)

When habitats of a rare and/or endemic species are damaged and/or fragmented by various human activities, the **distribution ranges** and **population sizes** of them will be reduced and the species would be vulnerable to extinction with a rate more than any other species.

## 5- SUMMARY <sup>(3)</sup>

Many rare and/or endemic species exhibit one or more of the following attributes which make them especially prone to extinction, however, with differential rates:

- (1) species with a narrow (and single) geographical range,
- (2) species with only one or a few populations present,
- (3) species with small population size and little genetic variability,
- (4) species that are hunted and harvested by people,
- (5) species with declining population sizes,
- (6) species that do not have effective reproductive and/or germplasm (seed, vegetative material...) dispersal ability,
- (7) species with specialized niche demands,
- (8) species that grow in stable and nearly constant environments.

Species with any one or more of the above attributes must be carefully monitored and managed in genetic conservation efforts.

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# Teşekkürler

Thanks to all of you for listening, and to Yusuf Kurt (my RA) for fixing the figures on the data show



**Sternbergia candida (Liliaceae Fam.)- A Local endemic  
[Fethiye (Muğla) and its neighbourhood] Photo: Mecit Vural, Gazi Univ.**