Rare Species

In general, a connotation where rare species are synonymous with legal protections exists in popular culture. However, rarity is the normal conditions under which a vast multitude of species exist. One of the only observations, which warrants consideration as a law of ecology is that few species constitute the majority of biomass in an area, and many species make up the remainder of the biomass. This rule commonly called, , is evident across most kingdoms of life and nearly all environments. Those taxa which make up the 'remainder', encompass a plurality of the species in many areas, and globally are enormous in terms of their numbers.

..In many areas there appear to be relatively few uncommon taxa, but the relatively high spatial overturn in them makes them numerous at a global scale..

Rare species tend to make of enormous amounts of diversity (WHY THEY BEST). Rare species may be the first to go. Rare species encode enormous functional diversity and ability to respond to disturbance (Isbell et al. (2011), Leitao et al. (2016), Mouillot et al. (2013), Oliver et al. (2015)). Rare species reduce the possibility and severity of biological invasions (Lyons & Schwartz (2001), Oakley & Knox (2013)).

A conceptual framework to discuss these species may be considered which contains three dimensions, their restriction to particular habitats, their geographic extents, and the number of individuals per population (Rabinowitz (1981)). Collectively the interaction between these traits results in seven forms of rare species (Rabinowitz (1981)). The rare species which receive most of the attention, are those which are restricted to particular habitats across narrow geographical extents, *'narrow (local) endemics'* (Kruckeberg & Rabinowitz (1985)). In general narrow endemics tend to be the species which require special legal protection to ensure their habitats undergo minimal alterations. However, the remaining types of rarity still call for consideration by land management agencies.

Seven Forms of Rarity
From Rabinowitz 1981

Geo. Range:	Large		Small	
Habitat:	Wide	Narrow	Wide	Narrow
Population Size				
Large, dominant somewhere	Locally abundant over large range in several habitats	Locally abundant over large range in a specific habitat	Locally abundant in several habitats but restricted geographically	Locally abundant in a specific habitat but restricted geographically
Small, non-dominant	Constantly sparse over large range in several habitats	Consistently sparse in a specific habitat but over a large range	Constantly sparse and geographically restricted in several habitats	Constantly sparse and geographically restricted in a specific habitat

A typology of rare species based on three characteristics: geographic range, habitat specificity, and local population size. Note upper left box are common species

Recently approaches to develop a consensus index of Rabinowitzs sense of rarity exist (Maciel & Arlé (2020), Maciel (2021))...

now go through rare species increasing towards those requiring legal protection

Seven Forms of Rarity
From Rabinowitz 1981

Geo. Range: Habitat: Population Size	Large		Small	
	Wide	Narrow	Wide	Narrow
Large, dominant somewhere	Common	Camissonia eastwoodiae	Sclerocactus glaucus	Penstemon retorsus
Small, non-dominant	Draba oligosperma	Cypripedium calceolus ssp. parviflorum		Eriogonum pelinophilum

A typology of rare species based on three characteristics: geographic range, habitat specificity, and local population size. Note upper left box are common species

> "Many species are abundant in portions of their range, but uncommon in others Brown et al. (1995), Ter Steege et al. (2016)" — Enquist et al. 2021

Using the conceptual model, we see that a number of species in the UFO field office may fall into this category if they are in the the left two columns. In particular, they may be species which are at the *edges* of their ranges. These species may be interesting as ones which are at the *trailing* edge ... and ones which are at the *leading* edge ... Conserving leading edge taxa at the local level is important as they may contain many forms of genes which are pre-disposed to adapting to climate change associated variables.

Under the conceptual model species with Small geographic ranges, but wide habitat specificity, and quite often to be encountered at AIM plots. These taxa are generally noted as rare by the State, and oftentimes BLM... They

These three columns of species are seldom tracked at large ranges, as they fundamentally are more recalcitrant to extinction, and should ... However, it is possible that land management has allowed for them to decline in our study area. We can identify these taxa using ... We can consider that their range of habitat specificity (Rabinowitz (1981)) may include a subordinate element, tolerance fo disturbance, which includes many human enacted actions.

Finally the column at right represents the species at the fundamental core of our notions of 'rarity'. These taxa are generally warranted legal protections as human modification of their habitats...

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