**<A>Introduction**

* **Biodiversity is declining because of global change causing asymmetry in the loss of biodiversity.**

We live in a world amidst accelerating erosion of resource diversity in ecosystems (Grime 1998, Worm et al. 2006, Srivastava et al. 2012). Anthropogenic disruption to functional interactions within ecosystems alters assemblage, threatens biodiversity, and diminishes resource richness (Camargo et al., 2020; Donoso et al., 2020; Jordano et al., 2007; Lorts et al., 2008; Monteiro et al., 2021; Pigot et al., 2016). Animals play a key role in shaping their ecosystems through fundamental ecological processes such as seed dispersal, changing plant biomass, nutrient recycling, pollination, and physical structure alteration (González-Castro et al., 2019; Hempson et al., 2017; McAfee et al., 2018; Parr et al., 2018). However, due to persistent progression of human activities causing abrupt environmental disruptions, we have created an asymmetric skew in the loss of biodiversity, with animals at higher trophic levels and lower populations sizes going extinct first via habitat loss or fragmentation (Davies et al., 2000; Duffy, 2003) (Cramer et al. 2007). This decline of animal populations and species richness is well documented worldwide and has raised concerns on how this will impact the assembly and sustainability of ecosystems (Powers & Jetz, 2019; Spooner et al., 2018; Wang & Loreau, 2016).

* **Plants importance to ecosystems connected to animals?**

Animal resource availability is considerably affected by plants, making plant communities an influential ecosystem characteristic (Bascompte & Jordano, 2007; Sebastián-González et al., 2020). Plant community assembly and succession is influenced by abiotic (e.g., soil nutrients [Aerts, 1999; Coomes & Grubb, 2000]) and biotic (e.g., seed dispersal [Carlo & Morales, 2016; González-Varo et al., 2013; Levine & Murrell, 2003; Nathan & Muller-Landau, 2000; Olden et al., 2004; Tylianakis et al., 2010) factors. Manipulating these factors creates drastically different plant communities from the same starting points (Bakker, 1998; González-Castro et al., 2019). Due to this variability, recent dramatic anthropogenic shifts to ecosystems have increased the need to study functional interactions within ecological communities for conservation efforts, specifically interactions between seed vectors and plant assemblage (Camargo et al., 2020; Emer et al., 2019; García et al., 2018; Monteiro et al., 2021; Morán-López et al., 2019; Ribeiro da Silva et al., 2015).

* **There is increasing concern with seed vectors (e.g., frugivores) because they play a vital role in dispersing seeds in the environment; however...**

The decline of seed vector populations (e.g., frugivores) globally has garnered much attention due to their somewhat contradictory (e.g., see Camargo et al., 2021; Farwig et al., 2017) influence on seed dispersal ~~across landscapes~~ (Jordano et al., 2007; Naniwadekar et al., 2019; Carpenter et al., 2018; Case & Tarwater, 2020; Caves et al., 2013; Mokany et al., 2014; Rumeu et al., 2017). However, many of these studies examine specialized diffuse mutualisms in specific tropical ecosystems (Escribano-Avila et al., 2018; Estrada & Fleming, 1986; Herrera, 1985). Diffuse mutualisms occur when a species is dependent on multiple other species, all of which positively interact; for example, pollination, seed dispersal, and plant protection (Rico-Gray 1993, Zamora 2000, Stanton 2003, Gove et al. 2007). In Nearctic diffuse mutualisms, it is less clear how diminishment of seed vector diversity might influence seed dispersal (Davies et al., 2000, 2004; Herrera, 1985). This is due to tropical and temperate hardwood plant community differences (e.g., plant height, seed structure), which have been documented to influence seed dispersal ranges (XXXX; XXXX). Therefore, perhaps tropical seed dispersal research should not be used to make inferences about diffuse mutualisms worldwide. This underscores the need to study seed dispersal relationships outside the tropics for stronger understanding of available resource effects on diffuse mutualisms. (Escribano-Avila et al., 2018).

* **In diffuse mutualisms with functionally redundant seed disperser assemblages, resource diversity may modulate seed dispersal more than the loss of individual species.**

Resources are defined as a substance or object in the environment required by an animal for growth, maintenance, and reproduction (Borah & Beckman, 2021; Gleditsch et al., 2017; Howe & Smallwood, 1982). Resource abundance and diversity influence animal behavior (García et al., 2011; Schupp et al., 2019). Resource diversity in ecosystems is declining (XXXX) and there is a need to better understand how declining resource diversity impacts diffuse mutualisms.

Cramer et al. 2007 – Forest fragmentation differentially affects seed dispersal of large and small-seeded tropical trees

Grime 1998 – Benefits of plant diversity to ecosystems: immediate, filter, and founder effects

Grove et al. 2007 – A keystone ant species promotes seed dispersal in a “diffuse” mutualism

Rico-Gray 1993 – Use of plant-derived food resources by ants in the dry tropical lowlands of coastal Veracruz, Mexico.

Srivastave et al. 2012 – Phylogenetic diversity and the functioning of ecosystems

Worm et al. 2006 – Impacts of biodiversity loss on ocean ecosystem services