### Island Biogeography and Habitat Loss

- 1. Habitat loss and fragmentation
- 2. Lessons from islands
- Effects of patch area and shape on species richness
- Macarthur-Wilson equilibrium theory of island biogeography







#### Aboveground Woody Biomass



#### **AREA effects: Species – Area Curves**



#### Data from habitat patches is similar to data from islands



10|2 Rule for z = 0.25





As Area  $\checkmark$  Population sizes  $\checkmark$ 



As Area  $\checkmark$  Wide ranging species  $\checkmark$ 



### Patch area AND shape affect species richness through edge effects



**Edge species** 



Detection or occurrence

Island size and connectivity determine species richness MacArthur and Wilson 1963

Theory

Rate

Number of species on island (S)

S is a balance between *immigration* of new species and *extinction* of resident species







# of species present is a balance between *immigration* of new spp. and *extinction* of resident spp.; species composition continually changing, but total number of species constant







## The Distance Effect: Data



Dispersal

Odum 1959; Wolfenbarger 1976

## The Area Effect: Theory



## The Area Effect: Data



Figure 23.7 The effect on the number of arthropod species of artificially reducing the size of mangrove islands. Islands 1 and 2 were reduced in size after both the 1969 and 1970 censuses. Island 3 was reduced only after the 1969 census. The control island was not reduced, and the change in its species richness was attributable to random fluctuations. (After Simberloff, 1976.)



# Modifying Effects for MW model

Target effect = immigration is higher on large islands

Rescue effect = extinction is lower on near islands



### Simberloff's mangrove island experiments "Defaunation"



Fig. 5-2

The colonization curves of four small mangrove islands in the lower Florida Keys whose entire faunas, consisting mostly of arthropods, were removed by methyl bromide fumigation. The species numbers just before defaunation and at intervals following it are shown. The number of species is an inverse function of the distance from the nearest source. This effect was evident in the predefaunation census and was preserved when the faunas regained equilibrium after defaunation. Thus, the near island E2 has the most species, the distant island E1 the fewest, and the intermediate islands E3 and ST2 intermediate numbers of species. (From Simberloff and Wilson, 1970.)

				- Days after defaunation
776.0	alazista of isla	- ·	Ţ,	64 5 5 5 2 3 3 2 1 2 1 2 1 2 2 5 5 5 5 5 5 5 5 5 5 5 5
ORTHOPTER A	Cevilidae	Cuclantifum so.	Ē.	
	01/0.000	Cyrtoxipha confusa Orocharis m		
DERMAPTERA	Labiduridae	Labidure riparia	20.0000-	
COLEOPTERA	Anoosose	Tricorynus sp.	5.85G	
	Anthicidae	Sapintus juivipes Vacūsus vicinus	<u>  </u>	
	Buprestidae	Actenodes auronotata Chrysobothris tranquebarica	8383.S	
	Cantharidae	Chauliognathus marginatus Srylojennys hiustus	6.47.58	
	Curculionidae	Cryptorhynchus minutissimus		
	Lathridiidae	Holoparamecus sp.		
	Oedemeridae Fam. Unk.	Oxacis sp. Gen. sp.	Н	
THYSANOPTERA	Phiseothripidae	Haplothrips flavipes Neurothrips magnatemoralis	F	
CORRODENTIA	Thripidae	Pseudothrips inequalis Caecilius sti. pp	1001D	
CORRODENTIA	Lachesillidae	Lachesilla n. sp.		
	Lepidopsocidae Liposcelidae	Echmepteryx hageri b Belaphotroctes okalensis		
	-	Embidopsocus laticeps Liposcelis sp. not bostrychophilus	Н	
	Peripsocidae	Ectopsocus sp. bµ Peripsocus sterniyoeus	1008	
	Psocidae	Procidus texanus		
·	Trogiomorpha	Gen. sp.		
HEMIPTERA	Anthocoridae Cixiidae	Oliarus sp.	539135	
	Miridae Pentatomidae	Psallus conspurcatus Ocbaius pugnax		
NEUROPTERA	Fam. Unk. Corresonidae	Gen. sp. Chrystone collects	8 1980 8	
	chijoophao	Chrysopa externa		
LEPIDOPTERA	Eucleidae	Alarodia slossoniae +		
	Olethreutidae Phycitidae	Ecdytotopha sp. T Bema ydda		
	Psychidae Princidae	Oiketicus abbottil Nematoron sp.		
	Pyralidae Saturniidae	Thoieria reversalis Automerit io	F	
	Fam. Unk.	Gen sp.	$\square$	
DIFIERA	Fam. Uok.	Gen. sp.		
RYMENOPTERA	Braconidae	Apanteles hemileucae Apanteles marginiventris		
		Callihormius bifasciatus Ecphylus n. sp. nt. chramesi	81.00	
	Chalcidae	Iphiaulax epicus Gen. sp. 1	Η	
		Gen. sp. 2		
		Gen. sp. 4		
	Eumenidae	Биаегиз sp. Pachodynerus nasidens		
	Eupelmidae Formicidae	Gen. sp. Brachymyrmex sp:		
		Camponotus floridanus Camponotus sp.		
		Crematogaster ashmeadi Monomorium floricola	19136	
		Paracryptocerus varians Penulomyrmex elongatus		
		Pseudomyrmex "flavidula" Taninoma littorala		
		Xenomyrmex floridanus		
	Ichneumonidae	Gen. sp. Colliephialtes ferrugineus	H	
	Pteromalidae	<ul> <li>Casinaria texana Uralepis rullpes</li> </ul>	H	
	Sphecidae Vesnidae	Trypoxylon collinum Polistes sp.	Η	
ARANEAE	Araneidae	Argiope argentata Esiophora en	Ē	
		Eustala sp.	- 100	
		Metepeira labyrinthea		
	Clubionidas	Aysho sp.		
	Dictynidae Gnaphosidae	Dietyna sp. Serziolus sp.	3592	╞╶┽╌┼╌┼╌┼╌╫╌╢╌╢╧┙
	Linyphildae	Meioneta sp. Bizata ap		
•	Salticidae	Hentzia palmarum	<u>asa</u>	
	PCAtOOIGSE	acytodes sp.		
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Pre: 29 species Post: 24 species

#### Overlap: 8 species

