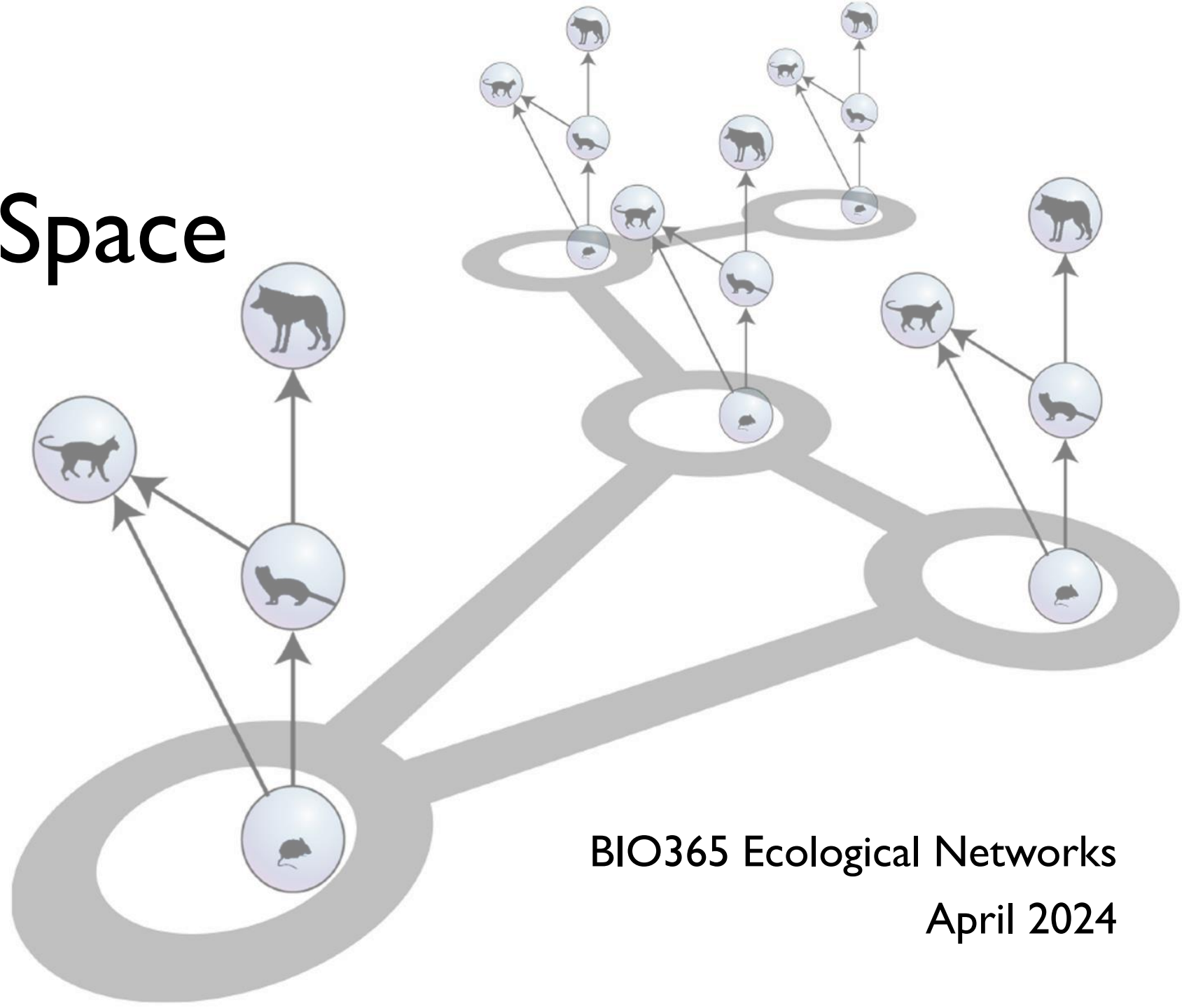


# Comparing Networks in Space



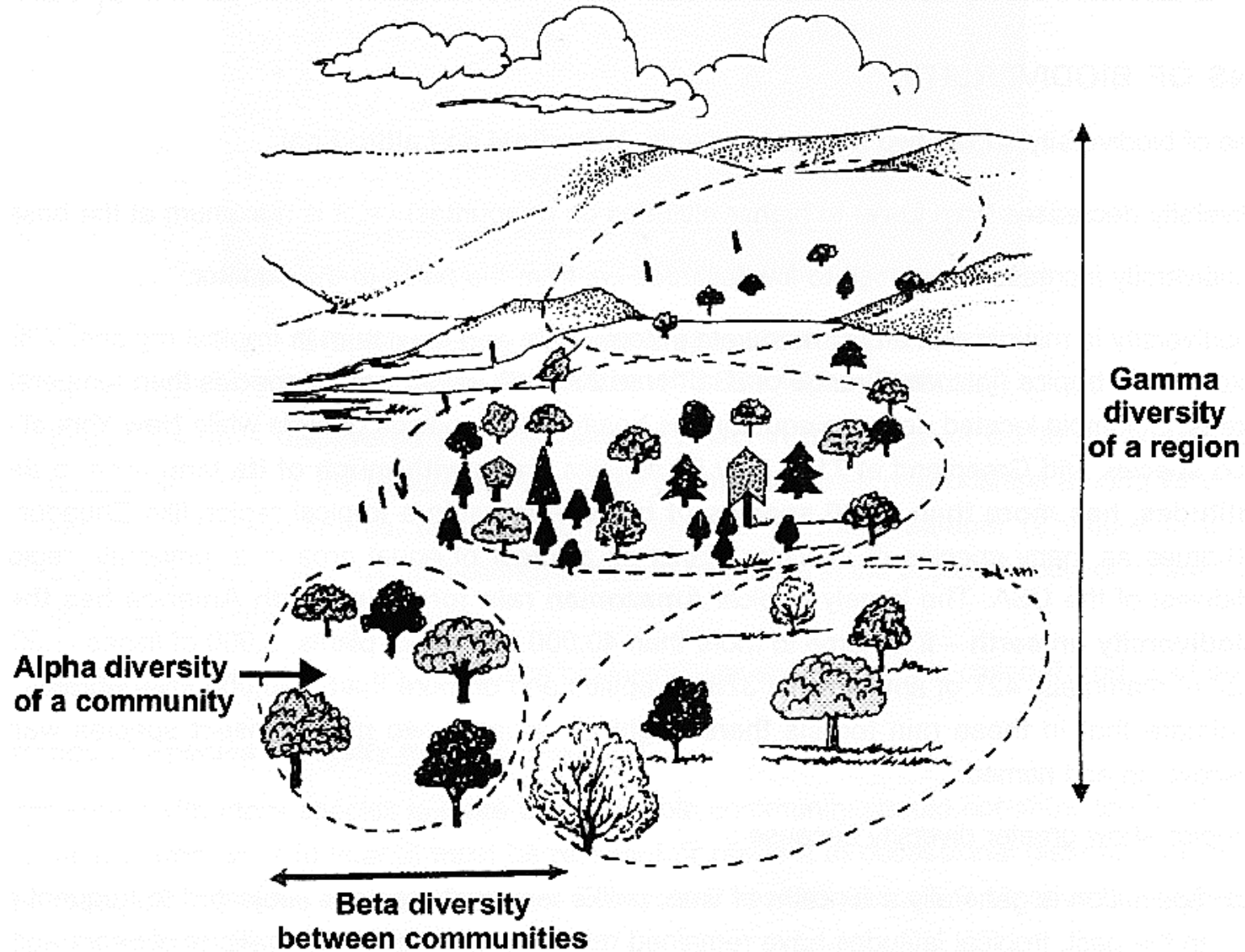
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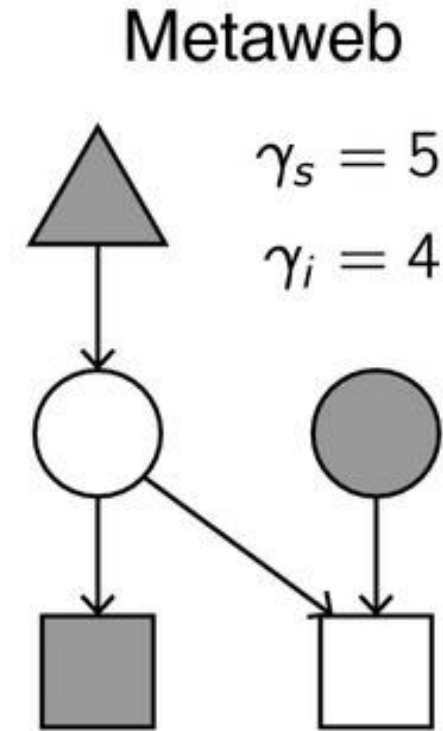
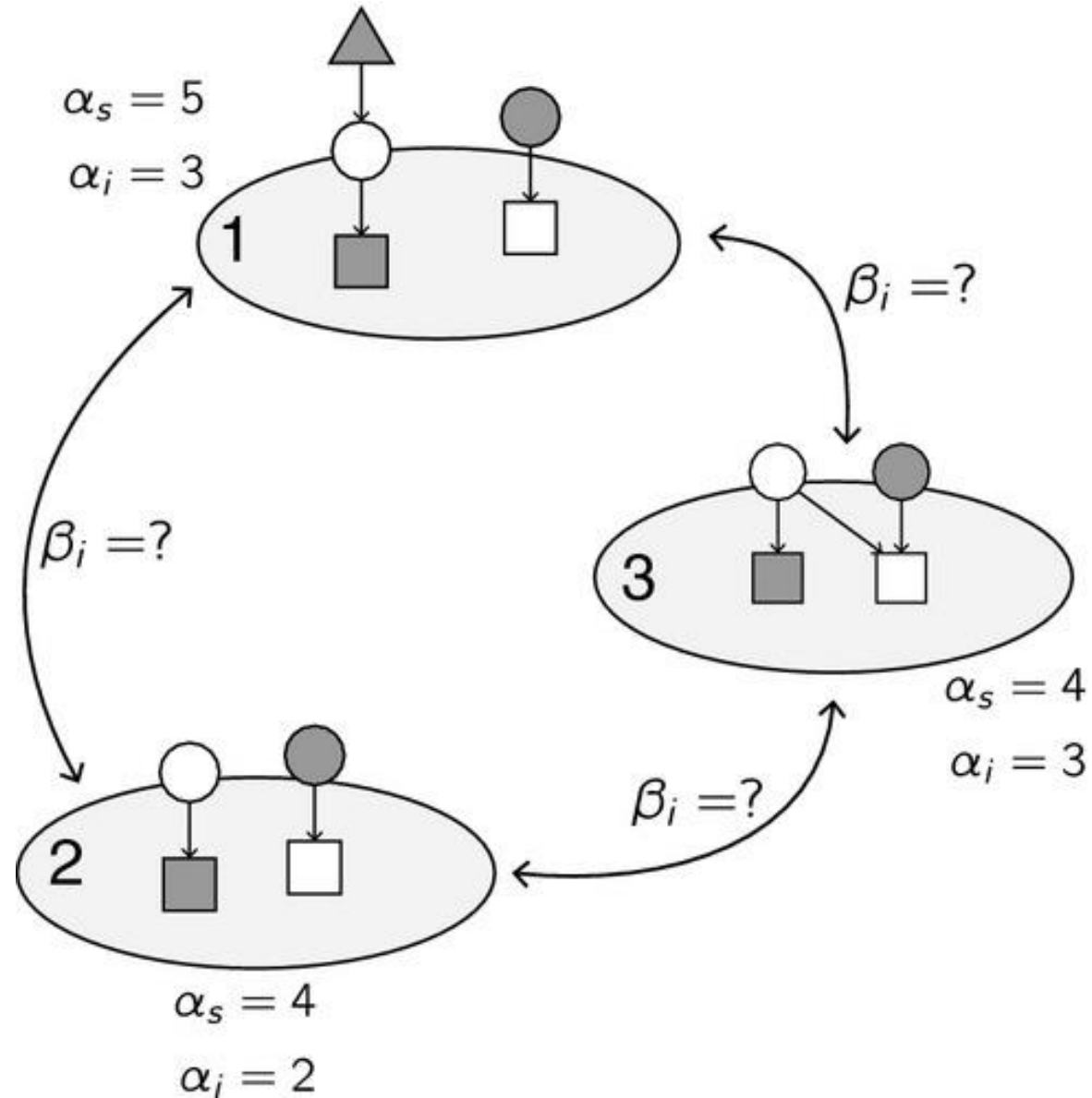
BIO365 Ecological Networks

April 2024

# Species diversity



# Species and interactions diversity



$s$  = species  
 $i$  = interactions

# Interaction $\beta$ -diversity

**dissimilarity of interactions**  
differences in interactions  
between networks

$$\longrightarrow \beta_{WN} = \beta_{ST} + \beta_{OS}$$

**dissimilarity of interactions  
due to species turnover**  
differences in interaction structure  
introduced by differences in  
species composition

**dissimilarity of interactions  
due to rewiring**  
differences in interactions between  
co-occurring species

# Interaction $\beta$ -diversity

$\beta_{WN}$  and  $\beta_{OS}$  can be calculated using Whittaker's dissimilarity measure  $\beta_W$ :

$$\beta_W = \frac{a + b + c}{(2a + b + c)/2} - 1$$

$a$  – number of interactions shared between two communities

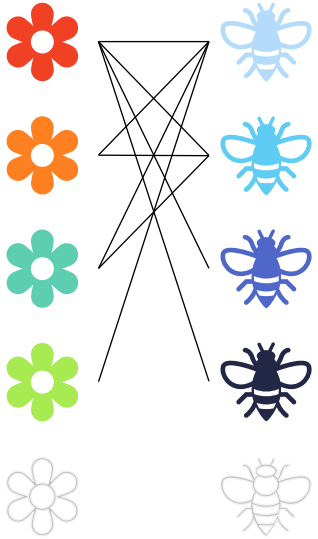
$b$  – number of interactions unique to community 1

$c$  – number of interactions unique to community 2

$\beta_{ST}$  is calculated as  $\beta_{WN} - \beta_{OS}$

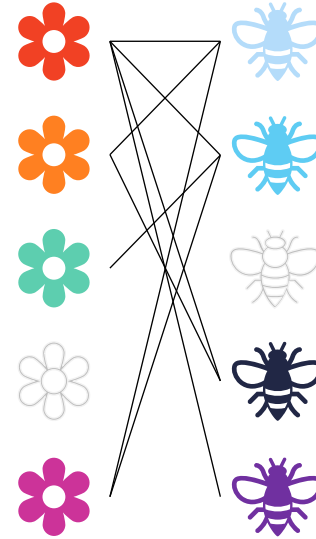
# Example – $\beta_{WN}$

## Network 1



		POLLINATORS			
		A	B	C	D
PLANTS	A	1	1	1	1
	B	1	1	0	0
	C	1	1	0	0
	D	1	0	0	0

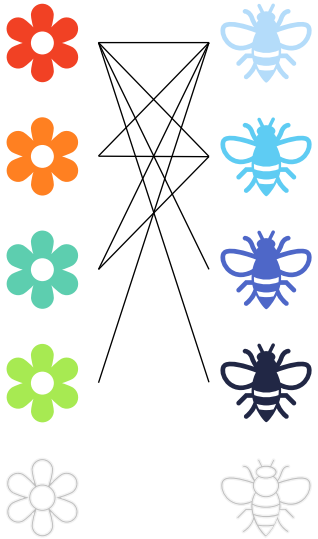
## Network 2



		POLLINATORS			
		A	B	D	E
PLANTS	A	1	1	1	1
	B	1	0	1	0
	C	0	1	0	0
	E	1	1	0	0

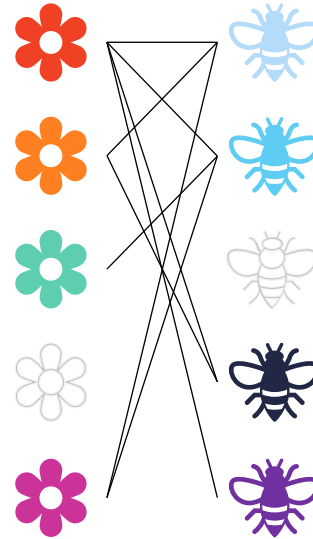
# Example – $\beta_{WN}$

## Network 1



		POLLINATORS			
		A	B	C	D
PLANTS	A	I	I	I	I
	B	I	I	0	0
	C	I	I	0	0
	D	I	0	0	0

## Network 2



		POLLINATORS			
		A	B	D	E
PLANTS	A	I	I	I	I
	B	I	0	I	0
	C	0	I	0	0
	E	I	I	0	0

$a = 5$  – number of interactions shared between two communities

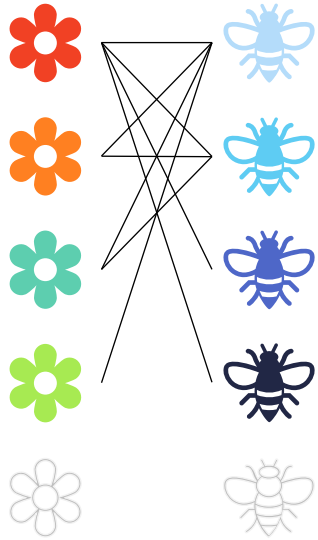
$b = 4$  – number of interactions unique to community 1

$c = 4$  – number of interactions unique to community 2

$$\beta_{WN} = \frac{5 + 4 + 4}{(2 \times 5 + 4 + 4)/2} - 1 = 0.44$$

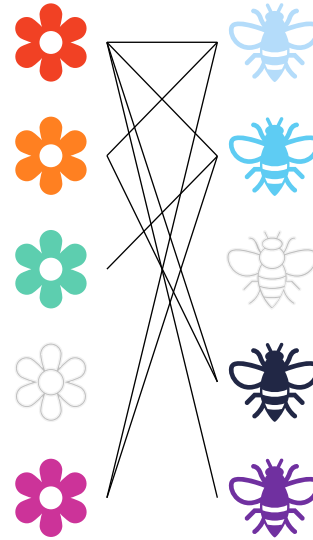
# Example – $\beta_{Os}$

## Network 1



		POLLINATORS			
		A	B	C	D
PLANTS	A	1	1	1	1
	B	1	1	0	0
	C	1	1	0	0
	D	1	0	0	0

## Network 2

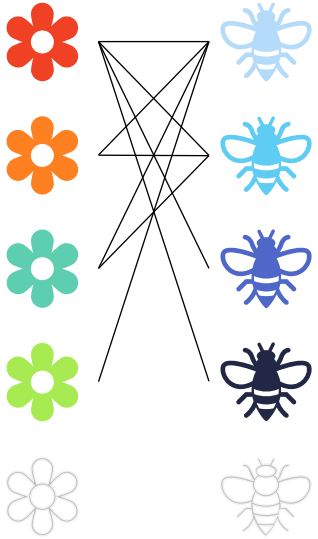


		POLLINATORS			
		A	B	D	E
PLANTS	A	1	1	1	1
	B	1	0	1	0
	C	0	1	0	0
	E	1	1	0	0



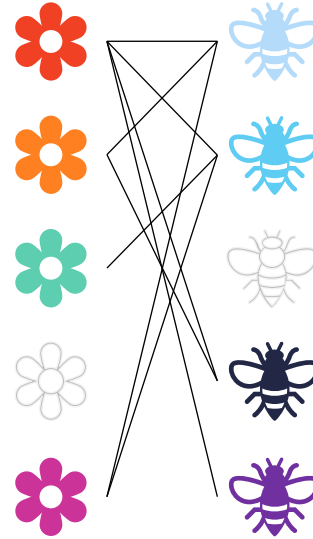
# Example – $\beta_{os}$

## Network 1



		POLLINATORS			
		A	B	C	D
PLANTS	A	1	1	1	1
	B	1	1	0	0
	C	1	1	0	0
	D	1	0	0	0

## Network 2



		POLLINATORS			
		A	B	D	E
PLANTS	A	1	1	1	1
	B	1	0	1	0
	C	0	1	0	0
	E	1	1	0	0

$a = 5$  – number of interactions shared between two communities

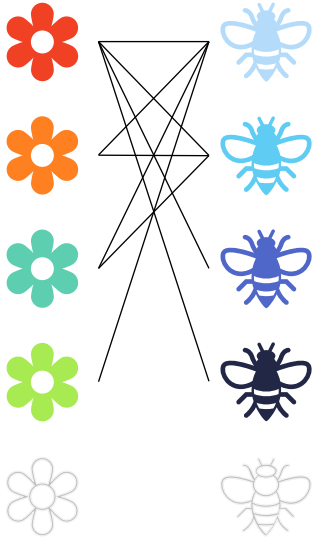
$b = 2$  – number of interactions unique to community 1

$c = 1$  – number of interactions unique to community 2

$$\beta_{os} = \frac{5 + 2 + 1}{(2 \times 5 + 2 + 1)/2} - 1 = 0.23$$

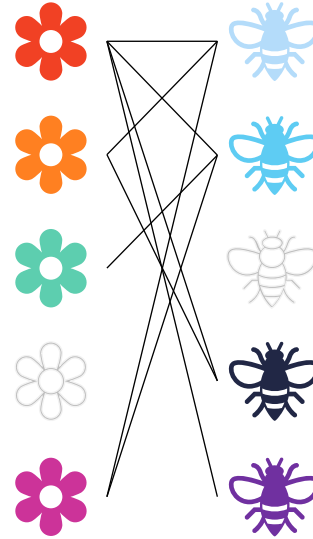
# Example – $\beta_{ST}$

Network 1



		POLLINATORS			
		A	B	C	D
PLANTS	A	1	1	1	1
	B	1	1	0	0
	C	1	1	0	0
	D	1	0	0	0

Network 2



		POLLINATORS			
		A	B	D	E
PLANTS	A	1	1	1	1
	B	1	0	1	0
	C	0	1	0	0
	E	1	1	0	0

$$\beta_{WN} = 0.44$$

$$\beta_{OS} = 0.23$$

$$\beta_{ST} = \beta_{WN} - \beta_{OS} = 0.21$$