Why do Zebras Have Stripes?

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PLAINS ZEBRA
(Equus quagga)

Mountain Zebra
(Equus zebra)

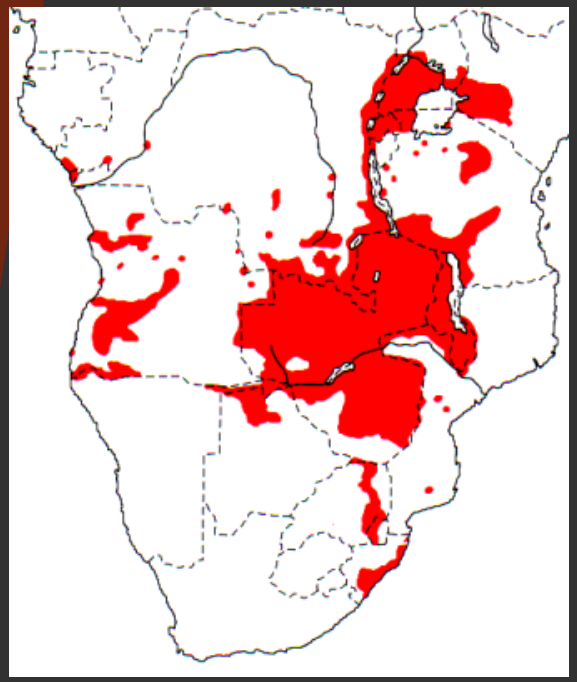
Grevy's Zebra
(Equus grevyi)
"Imperial Zebra"

Hypothesis #1 : Predation Evasion

based on the idea that stripes are an optical illusion for animals of prey and would confuse them

Hypothesis #2: Biting flies

Tabanis Fly distribution



TseTse Fly Distribution

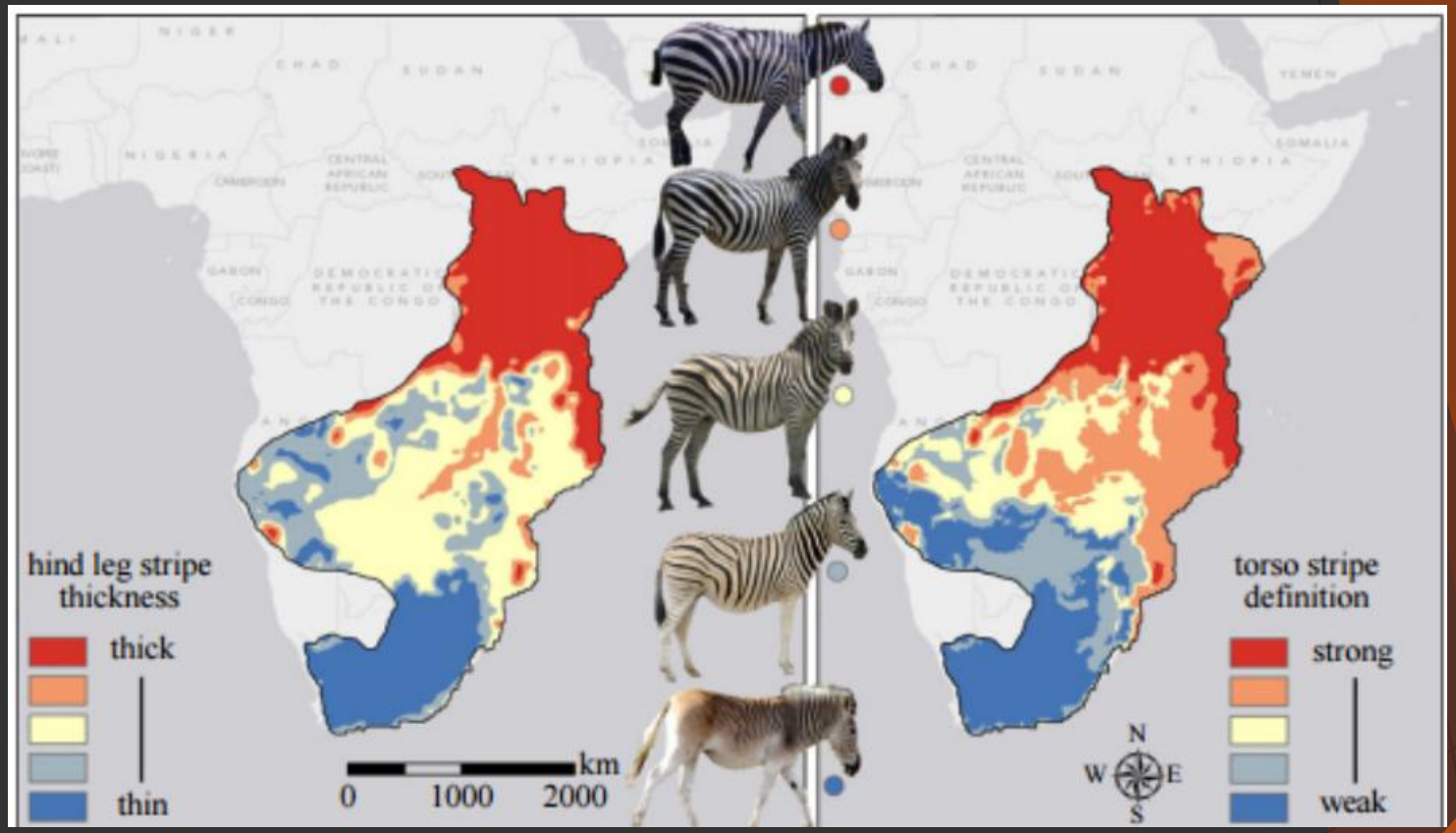
- stripes may break up the silhouette of the body against a strong background, or create an optical illusion that confuses flies

- Tsetse flies and other biting flies can negatively impact animals in a number of ways: both directly, through loss of time spent foraging and energetic expenditures that lead to weight loss, and indirectly, through the transmission of disease

Hypothesis #3: Thermoregulation

based on the idea that black and white stripes would heat up differentially, thus causing differential airflow between black and white stripes and creating eddies of air that would have a cooling effect

Striping Map



Hypothesis #4: Adaptive drivers of natural selection

- . The most consistently important variables were:
- isothermality (BIO3)
- mean temperature of the coldest quarter (BIO11).
- Maximum annual vegetation as measured by the Normalized Difference Vegetation Index (NDVIMAX)
- precipitation of the wettest month (BIO13) were also important for some characteristics.
- Estimated tsetse fly and lion distributions, by contrast, consistently failed to predict stripe pattern variation

Table 1. Random forest models, the percentage of variance they explain and their ability to predict stripe characteristics of zebra at new sites. (Models with significant predictive ability are in bold.)

		models		predictions	
body part	stripe characteristic	model	% variance explained	r^2	p
foreleg	number	BIO3 + BIO13	44	0.01	0.33
foreleg	**length**	**BIO11 + NDVIMAX**	**20**	**0.49**	**0.03**
foreleg	**thickness**	**BIO3 + BIO11**	**42**	**0.66**	**0.009**
foreleg	**saturation**	**BIO11 + NDVIMAX**	**37**	**0.42**	**0.05**
foreleg	**definition**	**BIO3 + BIO11**	**60**	**0.66**	**0.008**
hind leg	number	BIO13 + BIO15 + MAX	22	−0.10	0.57
hind leg	length	BIO3 + BIO11	13	0.36	0.07
hind leg	**thickness**	**BIO3 + BIO11**	**51**	**0.60**	**0.01**
hind leg	saturation	BIO11 + NDVIMAX	20	0.37	0.06
hind leg	**definition**	**BIO3 + BIO11**	**63**	**0.60**	**0.001**
torso	**number**	**BIO3 + BIO13**	**63**	**0.42**	**0.04**
torso	length	BIO3 + BIO11 + BIO13	51	0.20	0.15
torso	thickness	BIO3 + BIO11 + TREE	37	0.24	0.12
torso	saturation	BIO11 + BIO13	37	−0.01	0.37
torso	**definition**	**BIO3 + BIO11 + BIO13**	**40**	**0.45**	**0.04**
belly	number	BIO11 + BIO13 + NDVIMAX	45	0.03	0.31
belly	thickness	NDVIMAX	23	−0.11	0.62
belly	saturation	BIO1 + NDVIMAX	3	−0.02	0.38

- isothermality (BIO3)
- mean temperature of the coldest quarter (BIO11)
- Maximum annual vegetation as measured by the Normalized Difference Vegetation Index (NDVIMAX)
- precipitation of the wettest month (BIO13)