**Winners and Losers of Climate Change**

**(adapted with permission from “Drowsy Drosophila: Rapid Evolution in the Face of Climate Change”, Jennifer Broo, Jessica Mahoney, and Julie Bokkor, co-creators,** [**https://www.cpet.ufl.edu/wp-content/uploads/2014/12/Chpt1\_Drosophila2017.pdf**](https://www.cpet.ufl.edu/wp-content/uploads/2014/12/Chpt1_Drosophila2017.pdf)**)**

*Instructions: Use Table 1 below to complete the Species Vulnerability Matrix on the next page. The underlined words are defined on the attached Glossary.*

**Table 1: Traits associated with species’ heightened sensitivity and lowered adaptive capacity in response to climate change**

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| **SENSITIVITY** |
| **a.Specialized habitat and/or microhabitat requirements**  As environments change due to climate change, species that rely less on specific conditions are likely to be more resilient because they will have a wider range of habitat options available to them. Species with life stages that require different habitats (such as frogs, whose tadpole stage requires water) are likely to be more sensitive to change. |
| **b.Environmental tolerances or thresholds (at any life stage) that are likely to be exceeded due to climate change**  Species that rely on specific environmental conditions (e.g., temperature, precipitation, water pH or oxygen levels) are likely to be particularly sensitive to climatic changes. However, even species that can tolerate a wide range of environmental conditions may already be close to thresholds beyond which their body functions quickly break down (.e.g, drought tolerant desert plants). |
| **c.Dependence on environmental triggers that are likely to be disrupted by climate change**  Many species rely on environmental triggers or cues to initiate specific stages in their life cycle (e.g., migration, breeding, egg laying, seed sprouting, hibernation and spring emergence). While triggers such as day length and lunar cycles will be unaffected by climate change, those driven by climate and season may alter in both their timing and magnitude, leading to a mismatch between life cycle stage and environmental factors (e.g., mismatches between when food becomes available in the spring and hatching dates of organisms that rely on that food source.) |
| **d.Dependence on interactions between different species that are likely to be disrupted by climate change**  Climate change can cause changes in where species are found, their life cycles, and how many individuals there are in a population. These changes may affect their beneficial interactions with other species (e.g., with prey, pollinators, hosts and symbionts) and/or those that may cause declines (e.g., with predators, competitors, pathogens and parasites). Species are likely to be particularly sensitive to climate change if, for example, they are highly dependent on one or more specific resource species and are not able to substitute these for other species. |
| **e.Rarity**  Many rare species will be more sensitive to climate change than common species. Rare species include those with very small population sizes, as well as those that may be locally abundant but are not found in many geographic locations. |
| **LOW ADAPTIVE CAPACITY** |
| **f.Poor dispersal ability:**  Intrinsic dispersal limitations: Species that aren’t able to spread very quickly, or aren’t able to spread very far, (e.g., land snails, and raindrop splash-dispersed plants) have lowest adaptive capacity since they are unlikely to be able to keep up with a changing environment.  Extrinsic dispersal limitations: Even if a species is able to spread quickly and/or a greater distance, its movement and/or successful colonisation may be reduced by physical barriers along their routes. These include natural barriers (e.g., oceans or rivers for terrestrial species), human-caused barriers (e.g., dams for fish) and unsuitable habitats or conditions (e.g., ocean currents and temperature gradients for marine species). Species for which no suitable habitat is likely to remain (e.g., Arctic ice-dependent species) also face an extrinsic dispersal limitation. |
| **g.Poor evolvability**  Species’ potential for rapid genetic change will determine whether evolutionary adaptation can happen quickly enough to keep up with changes to their environments. Species with low genetic diversity tend to have less variation that could help a species adapt to the new climatic conditions. Species with long generation lengths (e.g., large animals and many perennial plants), are likely to pass on genetic change too slowly to respond significantly to climate change. |

**SPECIES VULNERABILITY MATRIX**: *Check any of the following boxes for each species if the factor is contributing negatively towards the species’ continued success, given the current impact of climate change. Column e, “rarity”, has been completed for you for all 8 species.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **A.specialized habitat** | **b/c.Environ-**  **mental tolerances/**  **dependence on environmental triggers** | **D.interspecific interaction dependence** | **e.Rarity** | **f.Poor dispersal ability** |  |
| **African Reed Frog** |  |  |  |  |  |  |
| **Asian Tiger Mosquito** |  |  |  |  |  |  |
| **Four Toed Lizard** |  |  |  | x |  |  |
| **Coral** |  |  |  | x |  |  |
| **Fantail Warbler** |  |  |  |  |  |  |
| **Common Coqui** |  |  |  | x |  |  |
| **Poison Frogs** |  |  |  | x |  |  |
| **Hornbill** |  |  |  |  |  |  |

**POST ACTIVITY QUESTIONS:**

1. Calculate the total risk factor for each species by adding the number of checked boxes. Write this number in the blank right-hand column of the matrix. Order the species based on highest to lowest vulnerability below.
2. Any species with 3 or more check marks in the matrix is considered a “loser” in response to climate change. Did any of the species categorized as a “loser” surprise you? What about the “winners”? Why?

**GLOSSARY**

* *Resilient:* able to withstand or recover quickly under difficult condition
* *Threshold:* a limit beyond which something does not work any more
* *Trigger*: an event that causes something else to happen
* *Initiate*: to start something
* *Lunar cycles*: the 29-day cycle of moonlight, from a dark new moon to a growing crescent, full moon, and shrinking crescent. Many organisms respond to these cycles of the moon.
* *Magnitude*: size or amount
* *Symbiont*: an organism that lives together with and relies upon another organism
* *Pathogen*: an organism that causes illness
* *Dispersal ability*: the ability to spread out, move, or be moved to many locations