BI328
CONSERVATION BIOLOGY
Fall 2020

REVIEW QUESTIONS: THE BIODIVERSITY CRISIS

1.   Define what a species extinction and its consequences are.

2.   Describe the difference between a species being globally extinct, extinct in the wild, extirpated, and functionally extinct.

3.   List the two mechanisms resulting in global change in species diversity. Contrast these with the two mechanisms resulting in local/regional change in species diversity.

4.   Define what a mass extinction event and what the background extinction rate are.

5.   Give a testable hypothesis for a mass extinction rate and use that to argue whether or not we are currently experiencing the "6th mass extinction".

6.   Give a brief description of the current accelerated loss of biodiversity and contrast that to the five mass extinctions our planet experienced in geological history.

7.   List the five major categories of drivers of biodiversity loss. Contrast them in terms of their contributions to biodiversity loss across broad categories of vertebrates and habitats.

8.   Compare and contrast spatial and temporal designs to monitor biodiversity. Argue which one you think is more informative.

9.   Compare and contrast the observed global pattern of biodiversity loss with the local/regional change in species diversity.

10.   Define what intrinsic vulnerability is and list the four major factors that contribute to the intrinsic vulnerability of a species.

11.   Compare and contrast demographic and environmental stochasticity and explain how they can contribute to species extinction.

12.   Population size, density and growth rates are important parameters determining the demographics of a population. For each briefly assess how they can increase vulnerability to extinction.

13.   Habitat, range, and connectivity among populations are important ecological characteristics that may contribute to the likelihood of a species going extinct. Explain.

14.   Argue whether having migration and/or a dispersal stage as part of the life history of a species increase or decreases the extinction risk of a species?

15. The triangular life history model groups individuals into opportunistic, periodic, and equilibrium species based on the optimization of three demographic parameters, generation time, juvenile survivorship, and fecundity. Opportunistic species are characterized by short generation times, low juvenile survivorship, and low fecundity. Equilibrium species are characterized by high juvenile survivorship, long generation times, and low juvenile survivorship. Finally, periodic species are characterized by high fecundity, low juvenile survivorship, and long generation times. Argue how you would rank these life history strategies by level intrinsic vulnerability of the species.

16. List important life history parameters to consider when assessing the intrinsic vulnerability of a species, indicate how they increase/decrease intrinsic vulnerability. You can create a table where you list the parameter and then use arrows to indicate if intrinsic vulnerability increases/decreases as that parameter increases/decreases.

    e.g.

parameter	intrinsic vulnerability
age-at-maturity ↑	↑

17a Elephants generally have small population and their life history is characterized by a late-age-at maturity, high parental care, and long generation time. By contrast, squirrels are abundant throughout their wide geographic range. Their life history is characterized by a short generation time, and high fecundity. Argue which species has the higher intrinsic vulnerability.

17b Plot twist: The British red squirrel has a geographic range extending from Siberia to Ireland and despite its overall abundance decreasing it is categorized as a species of least concern by the IUCN. Since the introduction of gray squirrels from North America this invasive species frequently outcompetes native red squirrels and (ironically) transmits a squirrelpox virus lethal to native red squirrels which are now only found in a few small population in southern Scotland. Argue whether you think the British red squirrel is correctly categorized by the IUCN.

18. Define habitat loss/destruction, habitat fragmentation, and habitat degradation.

19. List the main drivers of habitat loss.

20. Briefly describe how land-use change results in habitat loss and describe how variation in the land-use intensity may have differential impacts on the biodiversity.

21. Compare and contrast habitat loss and habitat fragmentation in terms of their impact on biodiversity.

22. Briefly describe the main effects of habitat fragmentation on biodiversity.

23. List the four parameters used to describe habitat patch configuration and briefly describe their relationship to habitat loss (you may sketch a figure but make sure to label axis).

24. Briefly explain how habitat patch size and number affect biodiversity (remember "explain" means you need to describe the effect + give a "why").

25.   Briefly describe the term Extinction Threshold.

26.   Describe the relationship of edge habitat, loss of biodiversity and patch size & number.

27.   Define what edge effects are and use an example to explain how they result in additional degradation of the remaining habitat patches.

28.   List the three main groups of species that may benefit from edge effects; describe one of the parameters using an example.

29.   The isolation of of habitat patches is a function of the geographic distance between them and the parameters of the matrix separating them. Explain.

30.   Briefly describe three ways that patch isolation and barriers negatively affect organisms potentially increasing their extinction risk.

31.   Give a brief description of what a metapopulation using a brief definition and listing key characteristics.

32.   Explain how habitat fragmentation forcing species into a meta-population structure can increase extinction risk as a whole

33.   Metapopulations are characterized by source-sink dynamics. Explain what this means and argue how this effect can allow a population affected by habitat fragmentation to persist despite local extirpations.

34.   Give a brief description of how metapopulation theory can be applied to conservation.

35.   Habitat fragmentation has resulted in species A being restricted to a series of small, highly isolated habitat patches. By contrast, species B has several suitable habitat patches available that are connected by dispersal, though in some locations there have been local extirpations due to stochastic effects. In both cases, the local populations are small and some habitats have been further degraded by pollution. Compare and contrast these two species and their local populations in terms of their extinction risk.

36.   Briefly describe the causes, process, and effects of soil erosion & sedimentation on biodiversity & human well-being.

37.   A patch of tropic rain forest can be valued for its direct value as provisioning ecosystem service or its indirect value as a regulating ecosystem service. Describe its value in the context of habitat degradation to argue whether you think higher value should be placed on the provision ecosystem or regulating ecosystem service.

38.   Briefly explain the process of desertification using an example (be sure to describe causes & effects).

39.   Desertification, biodiversity loss, and climate change are linked through multiple positive feedback loops. Explain what a positive feedback loop is using one of these inter-connected mechanisms as an example (use an example if that is helpful for you).

40. List six major categories of pollutants.

41. Compare and contrast pollution and habitat degradation.

42. Compare and contrast point and non-point sources of pollutants using specific examples for each and argue which group of sources you think has a greater impact on ecosystems.

43. Use an example to explain the process of biomagnification.

44. Use toxic metals as an example to explain the difference of sublethal and lethal effects of pollution.

45. List a range examples of pharmaceutical and personal care products and explain how they enter the environment.

46. Describe what a bioindicator is using aquatic invertebrates as an example.

47. Explain what nutrient run-off is, explain how it leads to eutrophication and so-called dead zones, list ecosystems typically affected by dead zones, and describe how it impacts biodiversity (give two specific examples of affected taxonomic groups).

48. List the four main ways plastics impact biodiversity (especially in marine systems).

49. Describe what microplastics are, their sources/how they enter the environment and outline two major ways they can impact organisms.

50. List the four main causes of oil spills.

51. List direct and indirect impacts of oil spills on biodiversity, use examples of which type of organisms and/or ecosystems may be affected.

52. Argue why you think some species may recover more quickly from an oil spill like Exxon Valdez than others.

53. Briefly describe what dispersants are and how they are used to mitigate oil spills and use an example to explain how they may do more harm than good.

54. Explain the difference between lethal and sublethal effects and argue which you think will have the greater impact on biodiversity (consider long vs. short-term impacts).

55. Give a brief definition of overexploitation and list the different groups of resources that may be affected.

56. Argue why overexploitation is the second largest driver of biodiversity loss after habitat loss/destruction.

57. Define what a common-pool resource is and list three examples. Use one of these examples to explain the concept of the tragedy of the commons.

58. List 5 reasons for overexploitation.

59.   Briefly define the three types of overexploitation.

60.   Define what subsistence overexploitation is and briefly outline why it is having an increasing impact on biodiversity.

61.   Define what recreational exploitation is and list the two major categories.

62.   Contrast two widely-held but opposing opinions that recreational hunting is beneficial for biodiversity and conservation efforts versus recreational hunting being harmful to species being hunted.

63.   Argue whether trophy hunting harms or benefits local biodiversity and local economies (remember argue means you should list arguments on both side and come to a conclusion based on those).

64.   List the three major categories of commercial exploitation.

65.   Compare and contrast recreational and commercial fisheries (consider points such as impact, locations/affected ecosystems, habitats, targeted species/fish within a population).

66.   Briefly describe the current status of global patterns of overfishing.

67.   Fishing pressure (unsustainable yields) may lead to a fisheries collapse. List three other factors that frequently co-contribute. Use an example to describe one mechanism in detail.

68.   Briefly explain why there is a well-documented link between overharvesting and extinction in terrestrial species while there are only few verifiable extinctions of marine fish due to overexploitation (i.e. explain why exploited marine fishes may be less or terrestrial species more vulnerable).

69.   List four ways fishing impacts more than just the target species. Briefly describe two of these mechanism in more detail.

70.   Briefly describe the four main regulatory measures that can be used to regulate a fishery.

71.   Explain the difference between an quota-based versus an area-based catch share program (remember this includes defining what each of these is).

72.   Briefly define what the maximum sustainable yield is and how it can be used to limit overexploitation. Briefly outline problems with the concept of MSY.

73.   Compare and contrast the concepts of a native (indigenous species), an introduced species and an invasive species (invasive alien species) is; consider whether a species could fall into more than one category.

74.   A non-native species arriving in a new habitat/ecosystem must overcome three barriers (filters) to be able to establish itself (colonize that habitat). Briefly describe each one and argue which you think is the greatest barrier to successful colonization.

75.   Dispersal limitations are the greatest barrier to successful colonization. Describe what has caused an rapid increase in invasive/introduced species in the last 100 - 200 years.

76.   Explain why most species fail to persist and successfully colonize a new habitat even when they are intentionally introduced.

77.   List the four main ways species overcome the biotic barrier and are able to successfully establish themselves in a new environment. Use an example to describe one mechanism in detail.

78.   Use an example to explain how invasive species may lead to species extinctions. Make sure to explicitly state factors that made species that went extinct vulnerable and factors that allowed the invasive species to have such a dramatic impact.

79.   Briefly explain how invasive species may actually increase biodiversity. Argue whether or not you would consider this a positive impact on biodiversity.

80.   The direct impacts of invasive species broadly fall into four categories. List all four categories and use a specific example to describe one mechanism in detail.

81.   Lionfish have rapidly invaded the Gulf of Mexico and the Caribbean in the last 10 years. List key characteristics to explain what has made them such successful invaders and describe the direct and indirect impacts they have had on the ecosystems they invade.

82.   List two ways invasive species can impact an entire ecosystem. Use a specific example to explain one of these in detail.

83.   Describe how invasive species can have a large negative impact on local/national economies. List three examples.

84.   List three reasons species are intentionally introduced with intended positive impacts.

85.   List the four major categories of risk management for invasive species. Briefly describe the different steps/phases of a invasive species becoming established in an ecosystem and explain how the focus of management strategies will differ at each stage (relate this back to the four categories you listed).

86.   List four characteristics of successful eradication programs and briefly explain how they contribute to a successful program.

87.   The result of anthropogenic climate change is a global, simultaneous change of abiotic parameters. List six categories to organize components of climate change, list two examples for each category.

88.   The impact of climate change is experienced across all levels of biodiversity from genes, species to ecosystems. List six categories to organize the types of responses, list two examples for each category.

89. Changing climate is altering conditions of native habitats, as a result species will either go extinct (die) or they must have the ability to adapt or migrate. Briefly describe the three major ways species can respond to persist despite an altered climatic niche.

90. Climate models use three types of predictors, spatial, demographic/life history, and recent trends. List three examples of parameters in each category and argue which type of predictors are more or less powerful predictors (argue includes stating which you think are better predictors and why).

91. List the four major categories of documented responses to climate change.

92. There is a range of documented cases of populations decaying (decreasing), some even resulting in local extirpations. Use two examples to explain two different mechanisms that can result in populations not being able to persist.

93. Briefly explain what a geographic range expansion/shift is (remember, this includes describing what a range expansion looks like, general patterns and explaining the mechanism behind it).

94. Describe what a geographic range expansion is and explain the difference between a cold edge expansion (leading edge expansion), and a warm edge contraction (trailing edge contraction).

95. Use an example to explain how climate change may alter the fitness of a species through altered phenologies and resulting population asynchronies. Be sure to define both 'phenology' and 'population asynchrony' for your explanation.

96. Briefly describe what a regime shift is.

97. Use an example to explain how climate change may result in a regime shift (this includes defining what a regime shift is and the explaining the mechanism for the example you choose).

98. Climate change impacts biodiversity which in turn will impact ecosystem functioning and the provided ecosystem services. Use an example to explain how climate change negatively impacts human well-being and positively impacts human well-being through changes in ecosystem services.

99. List thee major strategies to manage & mitigate the effect of climate change on biodiversity. Use and example to explain one of the strategies in detail.

100. List two major ways we can use biodiversity to mitigate the effects of climate change. Use an example to explain one strategy in detail.

101. Compare and contrast the concepts of ecosystem resilience and ecosystem resistance.

102. Define what a regime shift is. Explain what a tipping point is in the context of a regime shift, list the four criteria to define a tipping point.

103. Use an example of a regime shift/tipping point to explain what a regime shift/tipping point is. This should include assessing the impact of specific drivers and the mechanisms of the tipping

point as well as a clear definition of what a regime shift/tipping point is and how this example exemplifies those.

104.   Tropic Coral Reefs are a prominent case study of a regime shift/tipping point. One of the main drivers is climate change. Explain how an increase in atmospheric CO_2 has a direct and indirect effects on coral reefs. List other drivers of biodiversity loss in coral reef systems.