

UNIVERSIDADE FEDERAL DO PARÁ
PROGRAMA DE PÓS-GRADUAÇÃO EM ECOLOGIA
CONVÊNIO UFPA/EMBRAPA
SELEÇÃO PARA O CURSO DE MESTRADO - 2020

NORMAS DE APLICAÇÃO DA PROVA ESCRITA

1. A prova tem duração de 04 (quatro) horas;
2. Há uma tolerância máxima de 15 (quinze) minutos para iniciar a prova; se houver atraso no início da prova, o tempo será compensado, cumprindo o prazo definido no item 1;
3. As respostas devem ser escritas em **caneta azul ou preta**, nas folhas de resposta em anexo à prova. Responda **cada questão em uma folha separada**. Caso o candidato necessite, folhas suplementares deverão ser fornecidas exclusivamente pelo(s) examinador(es);
4. O candidato **NÃO** deve escrever seu nome na prova e deve colocar seu **CPF (alunos Brasileiros) para os estrangeiros colocar o ID** em **todas as folhas**;
5. Se houver necessidade de se ausentar da sala, o candidato será acompanhado por uma pessoa indicada pelo examinador.

ATENÇÃO

As três primeiras questões são OBRIGATÓRIAS e duas outras são de livre escolha. NÃO devem ser respondidas mais de cinco questões (somente as cinco primeiras respostas serão corrigidas e consideradas). Cada questão vale 2,0 (dois) pontos.

Comissão de Seleção do Mestrado
Coordenador do Programa de Pós-Graduação em Ecologia
UFPA/EMBRAPA

Exame de seleção para o mestrado do PPG em Ecologia - 2020

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QUESTÕES OBRIGATÓRIAS (questões 1, 2 e 3)

Questão 1 (obrigatória) – Desde a primeira vez que foi usado há quase um século, o termo nicho ecológico foi ganhando significados distintos, cada um apoiado em uma base conceitual própria. O primeiro conceito é associado a Grinnell, o segundo a Hutchinson e o terceiro a MacArthur & Levins. Leia o texto abaixo.

The recess/role niche concept developed by J. Grinnell is based on the idea that there exists a set of habitat characteristics and food types to which species have to adapt: the ecological niche of a species is its “role”, “place” or more literally “recess in an ecological community. On the other hand, the population-persistence niche concept, formulated by Hutchinson, focuses on the species rather than on the environment. It is a quantitative description of the range of environmental conditions that allow a population to persist in some location. Hutchinson’s niche can have as many different environmental dimensions as necessary to characterize those conditions. Hutchinson labeled his concept the cumbersome “n-dimensional hypervolume”. J. Chase and M. Leibold have extended Hutchinson’s concept including the effects of the species on environmental conditions, but the improved model still brought the operational difficulty of measurement. Then, R. MacArthur and R. Levins formulated an operational concept called the resource-utilization niche. Like the population-persistence niche, it is quantitative and multidimensional, but it focuses entirely on what members of a species population in some locality actually do, in particular, how they use resources. Many dimensions, broadly classified as habitat, food type and time, can be used to describe the populations’ resource use. Indeed, this concept is a precisely formulated description of the natural history of the species.

(Adaptado de Schoener, T. W. 2009. *Ecological Niche in The Princeton Guide to Ecology*).

Como base no texto acima e em seu conhecimento prévio sobre a teoria de nicho, nomeie e diferencie os três conceitos.

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Questão 2 (obrigatória) – A figura abaixo representa o perfil vertical de variáveis físico-químicas do Pacífico Norte (retirado de Hayward, 1991), conforme detalha a sua legenda.

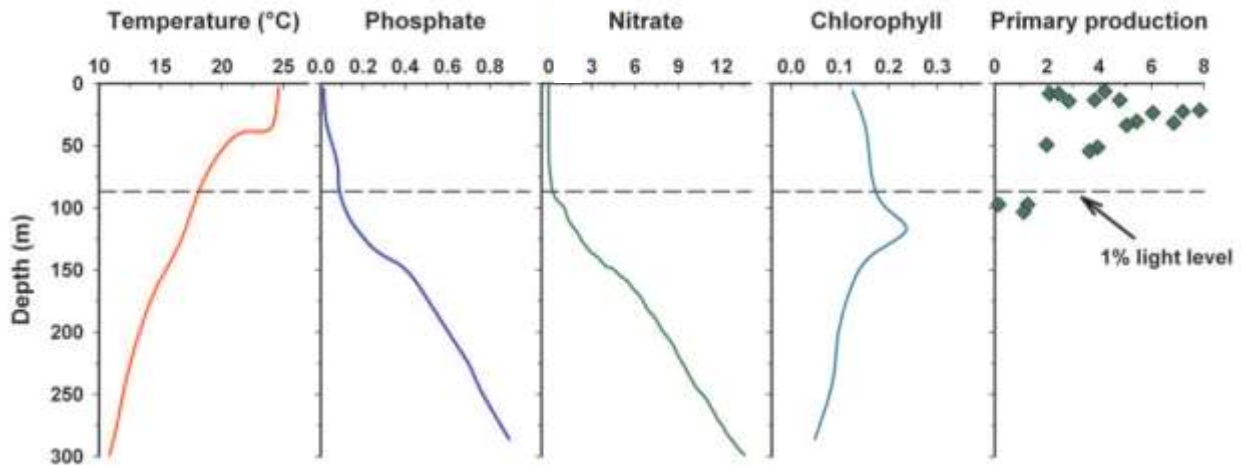


Figure 15.5 Vertical distributions of temperature, nutrients and production in the upper layer of the North Pacific Central Gyre during summer. The curves are an average of several vertical profiles made at a single location (28°N, 155°W) shown by the asterisk in Figure 15.4. The dashed line illustrates the depth of 1% of surface light. Nitrate—a critical limiting factor in the ocean—is depleted to undetectable levels above the 1% light level, and most of the primary production takes place above this depth. Maximum primary production occurs about 20 m below the surface waters. (From Hayward 1991.)

(Fonte: Hayward, T.L. 1991. *Primary production in the North Pacific Central Gyre: a controversy with important implications. Trends in Ecology and Evolution* 6: 281–284.)

Baseado nessa figura, responda às seguintes questões:

- Qual das variáveis físico-químicas apresenta maior escala numérica?
- Desconsiderando a produção primária, quais variáveis foram correlacionadas entre si?
- Qual a profundidade aproximada em que a luminosidade atinge 1% do valor de superfície?
Qual o valor aproximado da temperatura média nessa profundidade?

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Questão 3 (obrigatória) – Leia o texto abaixo:

“Humans are a very curious species. We are always asking questions. But the way we formulate a question is very important when we think about science and research. Here we will layout how to form a science research question and the concepts needed to formulate a good research question.

In order to inquire about the world, produce new information, and solve a mystery of about the natural world, we always use the scientific process to inform research questions. So, we need to keep in mind the steps of the scientific process.

First, clearly define your ecological levels of organisation and your variables.

What is an ecological level of organisation? Defined in ecologic terms, it is from individuals to ecosystems. And what is a variable? A variable is any factor, trait, or condition that can exist in differing amounts or types (e.g. length, quantity, temperature, speed, mass, distance, depth, etc.).

So, using different combinations of these two components, we can create three different types of research questions: descriptive, comparative, and correlative. These three types also match three of the modern research methodologies.”

(Fonte/adaptado: Orias, N. & Trejos, C. How to write a science research question. Available in: <https://www.ecologyproject.org/about/blog/how-to-write-a-science-research-question>).

Acessado em 19/11/2019.

Seguindo as orientações de metodologia científica, responda às questões abaixo:

a) Enumere as informações, em ordem sequencial, de acordo com as etapas do método científico:

- () Conclusões;
- () Hipótese - possíveis respostas para a pergunta em questão;
- () Etapa experimental;
- () Dúvida sobre determinado fenômeno da natureza;
- () Levantamento de deduções;

b) Como mencionado acima, os três principais tipos de trabalhos ecológicos são descritivo, comparativo e correlativo. Provavelmente você utilizará um deles no seu mestrado. Com base nessas informações e no texto acima, i) escolha um dos tipos de trabalho e explique-o; ii) formule uma pergunta para ser respondida e hipótese (se for necessário); iii) aponte quais serão as variáveis mensuradas (variáveis resposta) e, iv) onde seria realizado esse trabalho.

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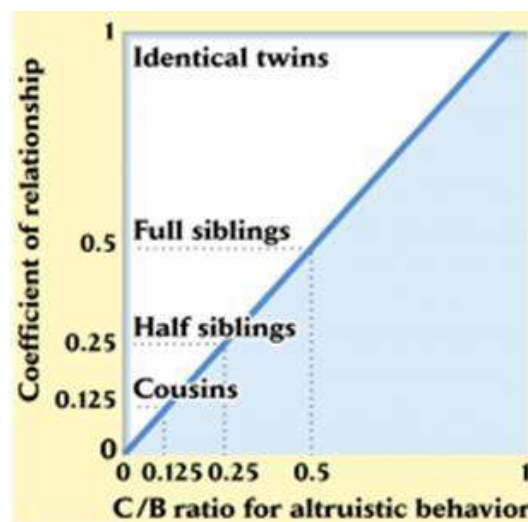
QUESTÕES OPTATIVAS (escolha e responda somente duas das quatro)

Questão 4 (optativa) - Com base no texto e na figura abaixo, responda:

- Explique e relacione os conceitos de aptidão inclusiva, seleção familiar e a regra de Hamilton.
- Sob que condições se espera que um comportamento altruísta possa evoluir?
- Qual região do gráfico indica tais condições? Explique.

“William D. Hamilton reasoned that an organism can promote the spread of its genes in two ways: directly, by producing its own offspring, and indirectly, by helping relatives to survive and reproduce. The sum of these two components is referred to as the organism’s inclusive fitness. The effectiveness of the indirect route is governed by the coefficient of relatedness, the probability that a randomly chosen allele carried by the helper is shared by the beneficiary as a result of descent from a common ancestor. Relatedness ranges from 0 for nonrelatives, to 1 for identical twins or members of the same clone. Changes in gene frequency resulting from both the direct and indirect pathways constitute kin selection.

The most famous effect of kin selection is that it can lead to the evolution of altruism, behavior by which an individual helps another at a cost to itself. Consider, for example, a bird that must decide whether to expend effort raising a son or daughter, or to help its parents to produce one more offspring – that is a brother or a sister. Foregoing breeding to help parents is common in several of cooperatively breeding species. In most familiar vertebrates, the coefficient of relatedness between parents and offspring is 0.5, because each parent has a 50% chance of passing a particular allele to a random son or daughter. Yet the coefficient of relatedness between sibling in these species is also 0.5. Therefore, an individual produces as many copies of its own genes by raising a sibling as it would by raising one of its own offspring.”



The calculus of kin-selected altruism is summarized by Hamilton’s rule. An animal is favored to perform an altruistic behavior if c , the cost to itself, is exceeded by b , the benefit to the recipient, multiplied by r , the coefficient of relatedness ($c < br$).

(Texto adaptado de Adams, T. W. 2009. Social Behavior in The Princeton Guide to Ecology. Fonte da figura: Ricklefs, The Economy of Nature).

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Questão 5 (optativa) - Baseado no texto abaixo e em seu conhecimento sobre funcionamento de ecossistemas, responda às questões:

“Litter decomposition in terrestrial ecosystems has a major role in the biogeochemical cycling of elements in the environment and represents a crucial pathway for nutrient return to the soil. Climatic features, like temperature, rainfall, humidity, and seasonal variations associated to the litter composition affect the rate of litter decomposition. Leaf tissue can account for more than 70% of above ground litter fall in forests, and the rest is composed of stems, small twigs and propagative structures. “Litter mass loss” or “decay” is the sum of carbon dioxide (CO₂) release and discharge of compounds, which contains both carbon compounds and nutrients. Litter decomposition proceeds through numerous mechanisms, especially heterotrophic consumption of organic composites in litter. Rainwater leaching and the activities of small insects do not lead straight to CO₂ release to the atmosphere, even though they support litter decomposition. The CO₂ released through microbial decomposition can add more than 20% to soil surface CO₂ efflux, which is known as soil respiration. In advance, nitrogen (N), phosphorus (P) and calcium (Ca) released from plant litter through decomposition are accessible for plants and microbial uptake. This review summarises the role of microbes and plants in the litter degradation process and also the importance of nutrient cycling and the mineralisation process.”

(Fonte/adaptado: Krishna, M.P., Mohan, M. 2017. Litter decomposition in forest ecosystems: a review. *Energ. Ecol. Environ.* 2(4): 236–249.)

- a) O que são ciclos biogeoquímicos?
- b) Como ocorre o processo de decomposição da serapilheira?
- c) Quais fatores influenciam no processo de decomposição?

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“COMMUNITY ECOLOGY is the study of patterns in the diversity, abundance, and composition of species in communities, and of the processes underlying these patterns. It is a difficult subject to grasp in its entirety, with the patterns of interest seemingly contingent on every last detail of environment and species interactions, and an unsettling morass of theoretical models that take a wide variety of forms.”

(Fonte: Vellend, M. 2010. *Conceptual Synthesis in community ecology. The quarterly review of biology*, 85: 183-206.)

A busca por avaliar e compreender a distribuição da biodiversidade é um dos principais focos da Ecologia de Comunidades. Ao longo do tempo várias teorias e hipóteses tem sido proposta para tentar explicar porquê alguns lugares possuem maior ou menor biodiversidade que outros. Um pesquisador ao realizar um estudo no bioma Amazônico encontrou grande similaridade na composição de espécies entre duas áreas estudadas, ou seja, as espécies que foram encontradas em uma região também foram registradas na outra. Com base na teoria de Ecologia de Comunidades, o que poderia explicar esse resultado? Justifique sua resposta.

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Questão 7 (optativa) - Leia o texto abaixo:

“The Red List process developed by the International Union for Conservation of Nature (IUCN) plays an important role both as the global standard for extinction risk assessment and, indirectly, in catalysing conservation activity. The IUCN process utilises criteria with quantitative thresholds based on population and distribution size and rate of decline in order to classify taxa into Red List threat categories. Criterion A “Reduction in population size” depends solely on measures of population decline over a (potentially short) time-period of the most recent 10 years or three generations, whichever is longer, hereafter referred to as the “10-year rule” for simplicity. Thus widespread and common species, with large population sizes and ranges, can qualify as being threatened with extinction on Red Lists if they are undergoing rapid decline. Criterion A is justified because even large populations would eventually be driven to extinction by continuing decline, especially as other negative feedback loops may come into play at low population densities (e.g. Allee effects, genetic inbreeding), but also because the reduction in abundance of common and widespread species may be of particular significance to ecosystem structure and functioning.”

(Fonte/adaptado: Fox et al. 2019. Insect population trends and the IUCN Red list process. *Journal of Insect Conservation* 23:269-278.)

Com base no texto acima, responda:

- Sabendo que a flutuação da densidade populacional é uma regra para as populações naturais, quais são os fatores que podem atuar sobre a densidade de uma população?
- Populações de organismos pequenos e organismos grandes respondem da mesma forma a esses fatores? Justifique usando critérios ecológicos.
- Na sua opinião, o critério usado pela IUCN para avaliar o risco de extinção das espécies pode ser utilizado igualmente para avaliar espécies grandes (como mamíferos) e pequenas (como insetos)? Explique.