YUSO 2017 Ecology Exam Answer Key

<u>Part 1</u>

1.

    a. <u>Increase</u> **(1 pt),**

        <u>Explanation</u> of increase: most of the individuals in the population are younger than the reproductive age and very few are older than the reproductive age (also acceptable: most of the individuals are young) **(1pt)**

    b. <u>Calculation</u> (**2pts**)

        From graph -- approx. 85 females of reproductive age (45 + 10 + 15 + 10 + 5)

        Given – each female produces a litter of 2.5 pups

        85 x 2.5 = <u>212.5 pups</u> (correct answer = **1 pt,** work shown = **1 pt**)

2.

    a. <u>Calculation</u> (**2pts**)

        50/197 = <u>25.4% birth rate</u> (correct answer = **1 pt,** work shown = **1 pt**)

    b. <u>Calculation</u> (**2pts**)

        20/197 = <u>25.4% birth rate</u> (correct answer = **1 pt,** work shown = **1 pt**)

    c. <u>Calculation</u> + <u>Explanation</u> (**2pts**)

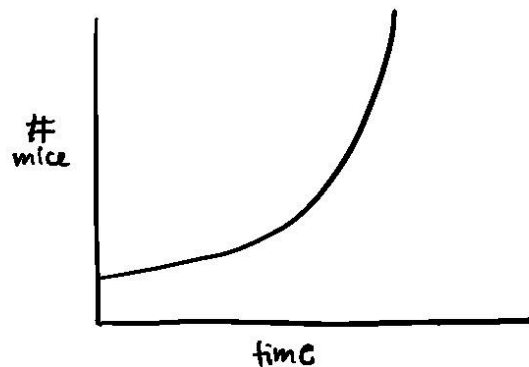   immigration rate = 23/197 = emigration rate, so only birth and death rate count towards growth rate (**1pt** for explanation)

        growth rate = birth rate – death rate =

        25.4 – 10.2 % = 15.2 % OR (50-20)/197 = 30/197 =

        <u>15.2% growth rate</u> (**1pt** for correct answer and work)

3.   <u>Graph</u> of a J-shaped curve, exponential growth (**1pt**). Exact numbers not necessary,

      (-.5pt) if axes are not labeled

Doubling Time calculation (**1pt** for correct answer)

$A_f = A_o(e)^{rt}$,

$2 = e^{rt}$

$t = \ln(2) / r$

$t = 4.6$ semesters = <u>18.4 months</u>

may also use the rule of 30.

$70/15.2 = 4.6$ semesters = <u>18.4 months</u>

4. <u>cultural carrying capacity</u> (**1pt**)

<u>Example</u> (**1pt**): deer hunting , exterminating coachroaches, etc.

any scenario in which humans reduce the numbers of a species population because they disturb the human population, even if there are technically enough resources to support the species at current or higher levels (ie, the population is below the biological/ecological carrying capacity k)

5.

a. <u>Type I</u> (**1pt**)

<u>Graph</u> (**2pts**): **1pt** for curve shape, **1pt** for correctly labeled & accurately scaled axes
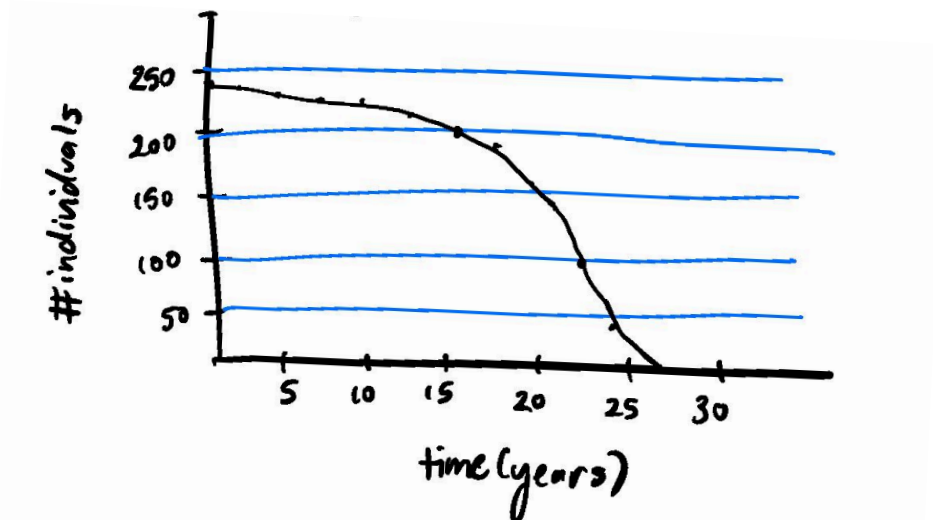
b. <u>definition</u>: cohort is a group of organisms of the same species all born during the same time period (**1pt**)

c. <u>example</u> of a k-selected species, *anything long lived with low mortality until later in life, eg.* humans (**1pt**)

definition: k-selected species invest more in each offspring, are adapted to stable environments, a greater proportion survives to adulthood (**1pt**)

6. example of density-independent factor: natural disasters, pollutants, temperature changes, etc. *any factor dependent on pika population* (**1pt**)

example of density-independent factor: food availability, # of rock crevices (nesting space), disease, etc. *any factor independent of pika population* (**1pt**)

7.

a. predation (**1pt**)

b. parasitism(**1pt**)

c. commensalism(**1pt**)

d. mutualism (**1pt**)

e. predation (**1pt**)

f. mutualism (**1pt**)

8. two biotic factors (**2pts**) involved in the N cycle:

bacteria fix nitrogen, plants take up nitrogen from bacteria in soil and water, animals eat plants, bacteria break down animal and/or plant matter (**1pt for two factors, 1pt for explanation of role in community**)

two abiotic factors (**2pts**) involved in the N cycle:

nitrogen compounds in the soil/ water returns to the atmosphere as N_2 gas, lightning creates soil nitrates, runoff put nitrates into the water, nitrous oxide is produced by fossil fuels, nitric acid falls from the sky as rain (**1pt for two factors, 1pt for explanation of role in community**)

Part 2

1.

a)

i. primary consumer (**1pt**) do not accept 'consumer'

ii. primary consumer, secondary consumer (**1pt**) must list both

iii. secondary consumer, tertiary consumer, quaternary consumer (**1pt**) – also acceptable is 'secondary and tertiary'

iv. primary consumer (**1pt)**

v. secondary consumer (**1pt)**

 b) <u>Calculation </u>(**1pt** correct answer)

  using the 10% rule, 234 kJ available to pika → 23.4 kJ available to the pine marten → <u>2.34 kJ (2340 J)</u> available for the bobcat

   1pt for calculations or explanation

c) <u>Calculation</u>(**2pts**) of energy available to the bobcat eating the pika directly, by the 10% rule

 <u>23.4 kJ (23400 J)</u> available (**1pt** correct answer**)**

 <u>Comparison </u>of values: 10 times as much energy is available to the bobcat if it eats the pika directly rather than pine marten (**1pt)**

d) <u>Explanation</u> (**2pts**) Bobcats are not a mountain lion's primary prey because it is more efficient for the mountain lion to eat animals lower in the food web. By the 10% rule, eating a bobcat is analogous to eating 10 pikas, when factoring in the number of bobcats present in the landscape compared to the number of pikas.

 1pt for mentioning energy efficiency

 1pt for referring to 10% rule, relative biomass of predators and prey, or something like

2. <u>two characteristics:</u> arctic tundra has permafrost, but alpine doesn't, difference in elevation, well-drained soil in alpine but not arctic tundra; arctic tundra located only in the northern hemisphere (high latitude), but alpine tundra on mountaintops all over the world

 (**2pts** for any two of these or comparable)

3. **2pts** for all correct, **1.5** for two correct, **1pt** for one correct

 A. tundra

 B. deciduous forest

 C. taiga

4.

 a. tundra (**1pt)**

 b. tundra (**1pt)**

c. deciduous forest or taiga (**1pt** for either)

d. taiga (**1pt)**

e. taiga (**1pt)**

f. deciduous forest (**1pt)**

5.

a. <u>definition:</u> species richness is number the of species present. (**1pt)**

13 species are present, so <u>S = 13</u> (**1pt)**

b. <u>Calculation</u>

$$D = 1 - (\frac{\Sigma\, n\, (n-1)}{N(N-1)})$$

From the table, $\Sigma\, n\, (n-1)$ = 33946

N = 305

N(N-1) = 92720

Thus, $D = 1 - (\frac{33946}{92720})$

= <u>0.634</u> (**1pt** for correct answer, **1pt** for equation, **1pt** for plugging in correct numbers)

c. <u>Calculation:</u> given n(bunchberry) = 100,

$\Sigma\, n\, (n-1)$ = 12340

N = (305 – 78) = 227

N(N-1) = 51302

$D = 1 - (\frac{12340}{51302})$ = 0.759

<u>D would increase</u> (**1pt**) <u>because</u> the number of species is more equal (**1pt**)

<u>No effect</u> on species richness (**1pt**)

<u>Because</u> the number of species stays the same (**1pt**)

6. <u>Species A is prey</u> and <u>species B is the predator</u> (**1pt**)

   <u>Explanation</u> (**1pt**): accept either

   - Species A has more individuals/greater biomass, which is characteristic of a species lower on the food web/ at a lower tropic level (can refer to 10% rule) **OR**
   - The population changes in species A are predictive of those of species B – that is, the predator's population numbers "follow" those of the prey

7.

   a. (2pts): <u>deciduous forest</u> (**1pt**) <u>adaptation example</u> (**1pt**)

   - o   ability to climb trees
   - o   gray color: camouflage
   - o   thick fur in the winter
   - o   strong teeth to eat seeds and nuts / acorns
   - o   ability to rotate ankles to climb down trees
         (**1pt** for any of the above adaptations)

   b. <u>taiga</u> (**1pt**) <u>adaptation</u> (**1pt**)

   - o   needles to prevent snow from breaking branches
   - o   needles to reduce evapotranspiration/water loss
   - o   ability to grow in acidic soils
   - o   cones to disperse seeds
   - o   extracellular freezing tolerance
   - o   layered twigs to protect against frost/cold
          (**1pt** for any of the above adaptations)

   c. <u>tundra</u> (**1pt**) <u>adaptation</u> (**1pt**)

   - o   thick fur coat to keep warm
   - o   feet adapted for burrowing
   - o   fat to keep warm
   - o   coat becomes paler in winter to blend in
   - o   small extremities in proportion to body to retain heat
         (**1pt** for any of the above adaptations)

   d. <u>deciduous forest</u> (**1pt**) <u>adaptation</u> (**1pt**)

   - o   breathe through skin – well suited to moist environment
   - o   foraging in leaves

- o pulse feeding strategy (can gorge and fast)
- o can drop tail to evade capture

Part 3: Human Impact on Ecosystems

1. (**2pts**) for satisfactory <u>explanation</u> (includes elements listed below):

Invasive spp. *tend to be fast growing, produce abundant seeds (r-selected), grow in a variety of locations/conditions, have few or no natural predators.*

- these traits enable them to propagate rapidly
- can quickly occupy gaps and crowd out other species

2. (**4pts**)

<u>two positive impacts</u> (**2pts** for any two of the below impacts)

- lower greenhouse gas emissions
- little to no water pollution
- water efficient
- no air pollution
- wind is not nonrenewable/finite
- alternative to negative effects of other energy sources

<u>two negative impacts</u> (**2pts** for any two of the below impacts)

- threat to migrating birds and bats
- noise pollution
- habitat disturbance from building and maintaining turbines

3. (**2pts**) <u>two benefits</u> of climate change for forests:

- more CO_2 available for photosynthesis
- longer growing season

(**2pts** if both are listed, **2pts** if at least one is listed and fully explained, **1pt** if one is listed and not explained)

4. (**2pts**) satisfactory <u>explanation</u> of why pikas are vulnerable to climate change:

- native habitat of the pika is alpine tundra
- Alpine tundra habitat is degraded and lost due to climate change
  - o As temperature rises, amount of alpine tundra decreases, and pikas and other species are forced towards the poles or to higher elevations (ie up mountains).

Tundra species are especially susceptible to temperature driven habitat loss as tundra, the coldest biome, is the first to disappear

5.

a. (**2pts**): <u>Example:</u> pertinent organism listed and <u>effect</u> of habitat fragmentation on named organism given – **1pt**

potential effects:

- Not big enough range for area-dependent spp./large predators
- Danger crossing boundaries
- Positive impacts on edge-dwelling spp.

<u>demonstrated understanding</u> of habitat fragmentation – **1pt**

habitat fragmentation — existing habitat is broken up

b. (**2pts**): <u>Example:</u> pertinent organism listed and <u>effect</u> of habitat loss on named organism given – **1pt**

<u>demonstrated understanding</u> of habitat loss – **1pt**

habitat loss – existing habitat is destroyed (developed into infrastructure, converted into other habitat type)

c. (**2pts**): <u>Example:</u> pertinent organism listed and <u>effect</u> of habitat degradation on named organism given – **1pt**

<u>demonstrated understanding</u> of habitat degradation – **1pt**

habitat degradation – habitat remains but is rendered lower in quality due to pollution, invasive spp,, tourism, pathogens, climate/temperature changes, natural disasters, etc.

6. <u>algal blooms</u> (**1pt**)

<u>cause</u> of blooms (**1pt**): excess of growth limiting nutrients, esp. phosphates

<u>human contribution</u> to algal blooms (**2pts** for at least one factor and satisfactory explanation)

- Agricultural runoff
- Pesticides
- Soil erosion
- Animal feces (livestock)
- Climate change (warmer water facilitates blooms)

7. (**9pts**)

a. (**2pts**) <u>genetic bottleneck</u> (**1pt)**

<u>explanation/definition</u> (**1pt**) if the entire population is restored from a few individuals, there is less diversity in the collective gene pool, which makes the species less adaptable and robust, and more vulnerable to disease

b. <u>strategy</u> (**1pt** for any below or comparable)

- Ban lead shot
- Regulate lead shot
- Subsidize alternative ammunition
- Regulate the pickup and disposal of hunter's kills

<u>example</u> of two interest groups (**2pts**):

- Hunters
- Salesmen of lead products
- Conservationists
- Tourists
- Locals
- Native tribes
- The local government

<u>how</u> the two interest groups would be affected (**2pts**):

- Hunters: more expensive ammo from other metals
- Salesmen of lead products: loss of revenue
- Conservationists: increase in condor population
- Tourists: more condors, more attractive to travel to California
- Locals: potential improvement in water quality, increase in revenue from tourism
- Native tribes: increased access to feathers used in ceremonies
- The government: increase in revenue from tourism and effect on funds for condor protection

<u>Open ended answer</u> (**2pts**): <u>how</u> to accommodate the needs of the named interest group

2pts for a well-reasoned, feasible plan