

Please restrict your response to the space available; do not extend your answers to the back of the paper. Answer directly and fully - don't beat around the bush. The point values for each question are given in parentheses. Any notes you added to printouts of Wanda Weatherly's notebook are allowed in answering the exam. All page references refer to Wanda's notebook.

1 (16). "Location 4" on page 302 is the climate diagram for Baghdad, Iraq. Please answer the following with "True" or "False" with regard to that climate diagram.

FALSE According to the climate diagram, Baghdad is a summer-wet environment.

TRUE According to the climate diagram, there are periods of the year when precipitation exceeds potential evapotranspiration.

FALSE According to the climate diagram, Baghdad freezes in the winter.

FALSE According to the climate diagram, we would expect Baghdad to be a grassland.

2 (8). Should the vegetation in "location 1" be similar to the vegetation in Baghdad, Iraq? [Yes or No] Why or why not?

3 pts, Yes

5 pts, Both climate diagrams are absolutely consistent with a desert environment, although there is some evidence of summer rain in location 1 (Bagdad, CA) and not in Baghdad, Iraq. We would expect to find a desert biome in both locations because of the strong role of the climate in shaping vegetation structure through natural selection.

3 (8). What is the expected vegetation type in "location 2"? On what ecological basis do you make that decision?

8 pts, The vegetation expected for Location 2 should be a deciduous forest for three reasons:

- **precipitation greatly exceeds potential evapotranspiration throughout the growing season, which favors a forest biome**
- **growing season temperatures are warm favoring an Angiosperm forest over a conifer forest, because of the greater potential for evapotranspiration**
- **winter temperatures are warm enough that we would not expect frozen soils, such as might occur in boreal forests**

This climate diagram is consistent with what I would expect for any of the three Bagdad locations found in the eastern deciduous forest (FL, NY, and PA).

4 (8). Do you expect to find naturally occurring C₄ grasses in Baghdad, Iraq? [Yes or No]. Provide the correct explanation for your answer.

3 pts, No

5 pts, We would not expect to see C₄ grasses naturally occurring in Bagdad, Iraq, because at the time of the year when it is hot (summer), there is no precipitation. Instead we would expect to see winter-growing C₃ grasses.

5 (12). Please correctly align the climate diagrams on page 304 with the appropriate vegetation and field station description on page 303. For vegetation types, simply refer to them in order (i.e., 1, 2, 3). There will be at least one climate diagram for which there is no field station; in this case enter “no field station”

3 pts each

Field station (1, 2, 3, or no station)	Climate diagram on page 304
Station 1, home of the Lobos	Location 5
Station 3, home of the Cowboys	Location 6
Station 2, home of the Runnin’ Rebels	Location 7
No station, actually home of the Aztecs	Location 8

6 (10). My cousin Vinnie argued that location 6 was clearly a Mediterranean-climate region because that location received winter rains. Therefore, he predicted that location 6 was the home of the Aztecs in the Mountain West Conference. Is Vinnie correct? [Yes or No] Provide the correct justification for your answer.

3 pts, No

7 pts, Location 6 is not a Mediterranean climate region for two reasons:

- **winter time temperatures are too cold to maintain active plant growth in winter**
- **precipitation is greatest in the summer (precipitation is about the same as expected evapotranspiration) and therefore not dry as expected for a Mediterranean climate**

Location 6 is Laramie, Wyoming, home of the Cowboys.

7 (4). If I was to visit the campus for location 11 (outside of the Mountain West Conference), what dominant vegetation type would I expect to see in the natural areas of this region?

4 pts, C₄ grassland with occasional trees; College Station, home of Texas A&M

8 (4). My cousin Vinnie also argued that location 9 was clearly a region dominated by boreal forests. Is he correct? [Yes or No]

4 pts, No; Fayetteville, home of the Arkansas Razorbacks

9 (6) Do you expect the net primary productivity of the vegetation to be greater in location 6 or 11? Provide the correct justification for your answer.

2 pts, Yes

4 pts, We learned that net primary productivity was linearly related to evapotranspiration in most non-tropical ecosystems. Therefore, since location 11 has a far greater precipitation and evapotranspiration rate than location 6, we would expect net primary productivity to be greater.

10 (10). Related to the statements on page 306, how is anticipated future climate change going to impact the lower and upper distributions of coniferous trees along the Wasatch Front?

5 pts, We expect the upper distribution limits of tree to increase in elevation for each species as cold, wintertime temperatures that limit bud survival are increased by climate change.

5 pts, We expect the lower distribution limits of each tree species to increase in elevation because the increased soil water deficits and enhanced evapotranspiration rates in summer will cause increased plant water stress, leading to increased mortality rates.

11 (10). The governor's aide thinks that the distribution of riparian trees along the Wasatch Front will not change in the next century, assuming that water availability in our canyon streams remains constant. Is she correct? [Yes or No] Provide a correct justification for your answer.

3 pts, No

7 pts, We expect the upper distribution limits of tree to increase in elevation for each species as cold, wintertime temperatures that limit bud survival are increased by climate change

12 (8) Contrast air temperature patterns during the growing season in alpine versus arctic tundra.

4 pts, Growing season air temperatures are higher in alpine tundra habitats than in arctic tundra habitats.

4 pts, Diurnal temperature fluctuations are higher in alpine tundra habitats than in arctic tundra habitats.

Bonus (6) The governor noticed while camping with his family that there were clear differences in the distribution of conifer tree species along the Wasatch Front when compared to the Uinta Mountains. For example, ponderosa pine and lodgepole pine are common in the Uintas, but uncommon along the Wasatch Front. I suggested that winter snowpack depth and soil nutrient differences between the Wasatch and Uintas played a big role in limiting tree distribution such as with ponderosa pine and lodgepole pine. Am I correct or not? Provide the correct justification for your answer.

No, you are not correct.

The absence of lodgepole and ponderosa pines in the Wasatch and their presence in the Uintas is associated with differences in summer rain. Both trees tend to occur only in regions with summer precipitation that allow the species to avoid extreme soil moisture deficits in summer. There is more summer rain in the Uinta Mountains than in the Wasatch Mountains.

By the way, location 10 is the home of the UCLA Bruins, a team that beat BYU in the 2007 football season.