

2000 Exam 1 data

All 100 points on the upcoming exam will relate to the following data and observations. You are free to discuss these data and observations among yourselves and with the TA. Be familiar with what these data indicate regarding the plant community, species adaptations, and climate relationships we have been discussing in class.

My uncle Winthrop was a plant ecologist who was fascinated with the travels of Alexander von Humboldt (you know the one that the current is named after) and with that terrific novel "Travels with Charlie" by Steinbeck. So back in the 1980's, shortly after taking an early retirement, Winthrop and Spot (his pet dalmatian) set out in their Woodie station wagon to combine the adventures of both von Humboldt and Steinbeck. For over a decade Winthrop traveled extensively, collecting plant distribution, climatic, and ecophysiological data. Winthrop's goal was to write a scholarly publication linking climate and vegetation patterns, since he had always been fascinated by the pioneering publication by Livingstone and Shreve in the early 1900's. Unfortunately, after Spot died Winthrop got sidetracked and never finished his book, leaving it for us to figure out where he had been. We know a few details that help indicate where these data might have come from. First, Winthrop started his journey in Two Dot, Montana and traveled only by car. Like John Madden, he was afraid of flying. Since Winthrop's parents (Winona and Winston) had died on the Titanic, he was also afraid of traveling by ship. We did receive one postcard mailed from Santiago, Chile in which Winthrop raved about the fine wines there. So we know he traveled along the Pan American Highway during part of this journey.

The materials available in Winthrop's notebook consist of (a) a series of brief notes and comments about a location, (b) Raunkiaer life-form data, (c) climate diagrams, (d) microclimatic data, and (e) a few ecophysiological measurements on plants from selected locations. In some parts of his notebook, Winston did not fully label the data or climate diagrams to indicate their exact location.

Your task is to be prepared to indicate which ecosystem(s) and geographical region(s) could be associated with a particular data set or climate diagram, and then to be prepared to justify your reasoning. You should be prepared to interpret any climatic or ecophysiological data presented in the notebook pages. For the climate diagrams, you should be prepared to indicate what kinds of ecosystems or plant distributions should be found in that area. You should also be prepared to indicate where in his travels Winthrop might have been to experience a particular climate.

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Pages 62-69 of Winthrop's notebook are available as a PDF file (600 K)

(You will be allowed to bring this PDF printout and any notes you write on those pages into the exam)

Raunkiaer Life Form Categories

Phanerophytes (Ph)	Megaphanerophytes (Mg) = trees over 30 m tall
	Mesophanerophytes (Ms) = trees between 8 and 30 m tall
	Microphanerophytes (Mi) = trees and shrubs between 2 and 8 m tall
	Nanophanerophytes (N) = trees and shrubs between 0.25 and 2 m tall
Chamaephytes (Ch)	woody perennials with perennating bud between 0.01 and 0.25 m tall
Hemicryptophytes (H)	perennials with perennating buds at the surface (0 m)
Cryptophytes (Cr)	perennials with perennating buds below the surface of the soil
Therophytes (Th)	annual plants (perennating bud is the seed)

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Here are Raunkiaer life form data for some of the sites described on the following pages. I must remember to go back and complete collection of the missing life form data the next time I pass through these regions.

	# species	Ph	Ch	H	Cr	Th
Location 7226	256	3	___	___	___	65
Location 7227	233	52	50	51	21	59
Location 7228	187	19	___	___	___	75
Location 7229	152	___	___	___	___	___
Location 7257	626	___	___	___	___	___
Location 7258	255	12	54	55	44	90

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 Data from near location 7258, April 26

How does one explain the contrasting patterns of vegetation abundance on the north-facing and south-facing slopes here? North-facing slopes are dominated by a dense shrub vegetation which is about 2-3 m tall. Yet the south-facing slopes have a very sparse grass vegetation which reaches a total height of maybe 20-35 cm. Precipitation gauges that I have maintained on the two slopes for several years now show identical precipitation inputs through the year.

Last night a couple of college kids came through and camped close by. I talked about these vegetation differences while we roasted marshmallows, hoping that they would have a great explanation. One of the students threw out terms like convection, conduction, and reradiation to explain the vegetation differences on north- versus south-facing slopes (obviously an engineering student). Another student claimed that it was fire and how we needed to prevent fires from ruining the landscape. However, we cannot find any indications of fire and none have been reported in this area during the past 156 years (perhaps he was an environmental studies major). A third student claimed something even more strange - - grazing (perhaps she was an economics major). While there were deer at the site in the past, none have been seen for at least 45-55 years. Well, perhaps someday I'll have that answer.

The next morning over coffee we talked about about the annuals dotting the landscape. The students had noticed that the all of the annuals on south-facing slopes had their leaves at heights of 20-30 cm, whereas the annuals on north-facing slopes had their leaves at heights of 3-15 cm.

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 Data from location 7228, April 27

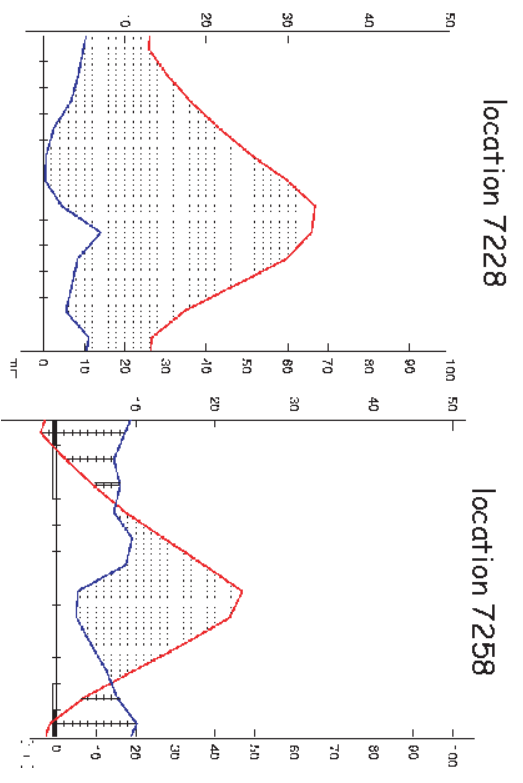
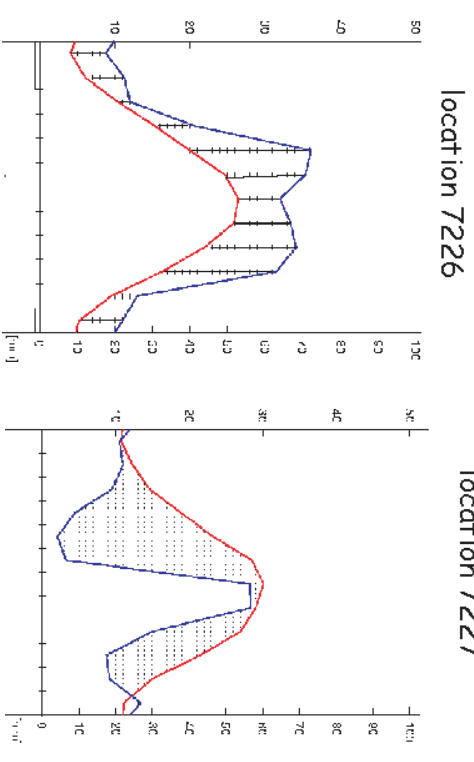
There are some absolutely remarkable plants at this location. *Albi seenya* and *Albi darnd* are two closely related shrub species occurring at this location. The two species occur at slightly different locations. The shrubs are similar in height (0.5 m), both occur in sunny locations, and both have a similar leaf area index of about 2.0. I was very fortunate to collect measurements at a time of the year when both species were metabolically very active.

The measurements reported below were collected between 11 a.m. and 12 noon, Weather conditions were perfect: air temperature of 35 °C, a relative humidity of 20%, and a gentle breeze.

	<i>Albi seenya</i> leaves	<i>Albi darnd</i> leaves
leaf temperature (°C)	32.9	33.0
leaf water potential (MPa)	-1.1	-2.8
leaf conductance (mol m ⁻² s ⁻¹)	0.32	0.11
leaf absorptance (400-700 nm), %	85.2	34.1
leaf width (mm)	26	40
leaf angle from horizontal (°)	15	16

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These are climate diagrams of the places I visited last July.



Notes on location 7226, July 24th

Oh, what a memorable day. If only I was back in Utah for that great annual celebration which takes place today. I really do enjoy celebrating Karl Malone's birthday, especially after he and John Stockton took "us" to the Finals a few years back.

Location 7226 was just so fascinating. The vegetation type is essentially the same as when I visited here last spring. Yet there seems to be little overlap in the species that were active then versus the plant species that are active now. The unusual thing is that many of the leaves now seem to have a Kranz anatomy, but I do not recall any of the leaves with this anatomy type when I sampled the plants last spring.

As I look across the landscape here, I cannot help but feel how happy the pioneers must have been when they saw "compass" plants every once in a while. Given the lack of relief, this is one sure way to know which way to head the wagons on the trail westward.

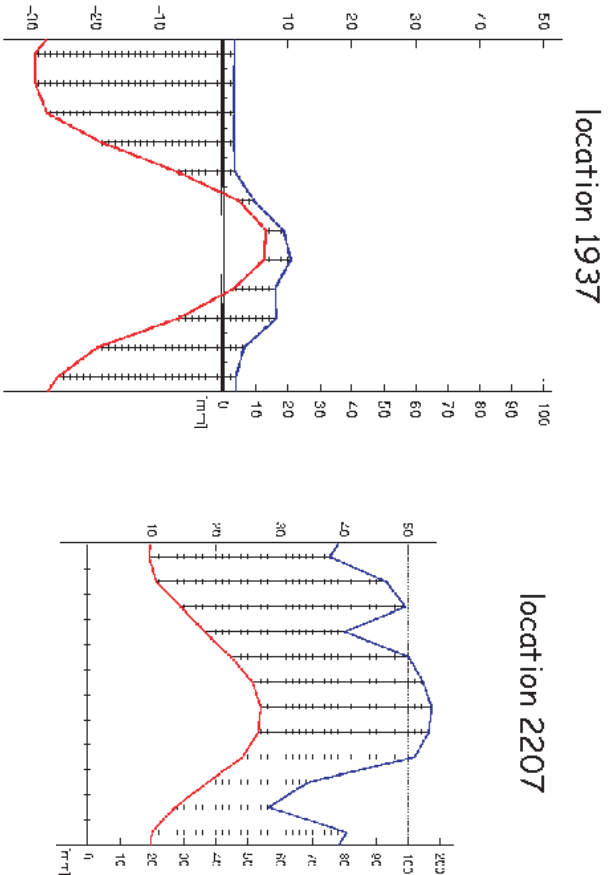
Notes on location 7227, July 27th

How strange it is to be in the beautiful land, where the diversity of life forms is so high. If it had not been for that wonderful class I took from Dr. Cottam so many years ago, I would never have understood why the life form diversity is expected to be so high in this region. His lecture on this landscape was one of the few "Cereus" lectures he ever gave. Yet what I never remembered from his lectures is the explanation for why many of the same seasonal Kranz anatomy patterns that I observed at location 7226 also appear here at location 7227. Oh well, I'll try to remember to review my old lecture notes the next time I pass through Salt Lake City.

I spent most of today talking to locals and eating local cuisine. They were all excited over how wet it has been this year. [You know how people like to talk about the weather.] It seems that this year's rainfall has been more than 300% above the average value, which is surprising given how dry it had been for the last two years! For someone who grew up on the east coast near Boston where it is always wet in the summer, this climate does seem strange. Maybe I'll never understand why.

Another unexplained observation I need to explore further is the explanation for the vegetation patterns on the hills here. It seems like the north-facing and south-facing slopes have a very distinct difference in the kinds of plants that occupy each of the two slopes.

These are climate diagrams of the places I visited last August.



Well driving from location 2207 to location 1937 has been some serious driving for me. Even Spot has been complaining about how long I have driven without stopping to enjoy the surrounding countryside. However, the drive was worth it. I can't even recall seeing such a lovely landscape as I now get to camp at here in location 1937. Funny things is that the humidity at location 1937 is not all that different than it was at location 2207. And just as surprising, the mosquitoes are really, really bad in both places!

What a contrast in vegetation types though. How could anyone every confuse these two locations?

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Microclimate data that I collected at location 2207

Time of measurements: 12 noon

Conditions: clear skies, calm winds

Height above bare ground (cm)	Air temperature (°C)
57	31.4
32	32.2
18	35.3
10	39.7
4	46.8

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