Sonoran Desert Discovery ECOL464/564

31 August 2009
Bonine & Alvarez

Reading Assignments:

For Saturday 12 Sept:
Handouts on website
Choose species to “present” (list on website, tell Tiffany choice today)
   Natural History of species (5 min in the field)
First writing assignment due (hardcopy)

Monday 14 Sept:
Choose a Sonoran Desert topic (not a species) and find a scientific paper about it.
Bring the abstract of the paper and be ready to say a few words about the topic and the paper. Email the citation to Tiffany before class.

Read the Dewey book, Experience and Education.
Excerpts on website from Pritchard’s Ways of Learning 2009
   p. 19, 117, Chs 4, 5, 8
Peruse ASDM and Evolution links
   http://www.desertmuseum.org/center/
   http://evolution.berkeley.edu/evolibrary/home.php
Packrat
Turkey Vulture
Mexican Jay
Pleasing Fungus Beetle
Butterflies
Saguaro
Ocotillo
Brittlebush
Prickly Pear
Oaks
Grasses
Yuccas
Agaves
Ponderosa Pine
Douglas Fir
Alligator Juniper
Corkbark Fir

**Sonoran Desert Discovery:**
(Biosphere 1 of Biosphere 2)
ECOL 464/544 (3 credits)

Schedule for Fall 2009:
We will meet on most Mondays from 1830-1900h in Student 247. Four Saturday events are mandatory. The first (12 Sept) will be an all-day, 2-hour excursion. The others will be approximately 9am-4pm leaving UA for BS and then returning to UA. Additionally, you will spend five hours sometime during the last few weeks of classes visiting with a 1-12

Field Trip

**Workshops 25**

Celebration

This course has no Final Exam, but if you are getting honors or graduate credit your supplemental work is due by 1:00p Wed 16 December to your instructor.
Due dates (sometimes electronically):

Workshop Topic (developed in concert with classmates and instructors) (a-c in template; 25 points) – via email 25 Sept to both instructors

Introduction and Background (e in template; 75 points) – Friday 02 Oct (email)

Outreach Goals (who will you teach what at Biosphere 2?) (h in template; 25 points) – Hardcopy 10 Oct (w/ ‘Outreach Goals’)

Tools and Approach to achieve educational goals (what will your workshop comprise?) (j-n in template; 75 points) – Hardcopy 10 Oct (w/ ‘Outreach Goals’)

Workshop in lesson-plan format (see below), including modifications for two different audiences and improvements based on feedback (completed template to be posted on our course website; 150 points – peer grading to be included) – bring to class 19 Oct

Assessment (did your workshop achieve your educational goals?) (written results from o in template after your first public presentation; 50 pts) – w/in 10 days of 1st presentation (email)

Refinement of workshop (after assessment and feedback from your first public interaction) (what did you change in the template and why?; 50 points) – >48 hrs before 2nd presentation

Summary Evaluation and Recommendations (what worked and didn’t work in your workshop? what would you keep, what would you change?; 50 points) – 23 Nov in class (to discuss)

Please turn in all previous work with each new submission so that improvement and progress can be noted.

Some excellent examples of outreach modules are available at Dr. Katrina Mangin’s UA Marine Discovery website (http://marinediscovery.arizona.edu/lessons.html).
Five groups-mostly pairs, a few groups of three.
We will try to finalize by end of 12 Sept Mt Lemmon trip.
Try to pair with someone with different expertise/background.

Discussion

What should the public know about biology, especially in the realms of ecology and evolution? Why?

What should the public know about the Sonoran Desert?
What is Ecology?

- Study of the distribution and abundance of organisms.
- Study of the myriad interactions among organisms and their environment.
- Includes both biotic and abiotic interactions/components.
For Monday 31 August:
*A Natural History of the Sonoran Desert* (Phillips & Comus, eds., 2000)

**Pages:** 1-2  
**Introduction**

- Two countries
- Five states
- 320,000 km²
- 130 mammal spp.
- 500 bird
- 20 amphib
- 100 reptile
- 30 freshwater fish
- 3500 native plants
- 17 native cultures

**Mutualisms**

**Diversity**

**Biological complexity**

**Value**

**Conservation**

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For Monday 31 August:
*A Natural History of the Sonoran Desert* (Phillips & Comus, eds., 2000)

**Pages:** 3-18  
**Biomes and Communities of Sonoran Desert**

**Climate**

- Biseasonal rainfall, five seasons

**Biomes (plants)**

- Tropical affinities

**Sky islands**

- Climate change

**Riparian communities**

- 5% area 90% birds

**Is the Sonoran Desert in Tucson a “desert”? Why or why not?**

- PET/P = 4.3 (potential evapotranspiration/precipitation)

**Desert:** A place where water is (severely) limiting to life most of the time.

**Horse latitudes**
Globally Important Patterns

1. **Solar Energy**
   - More energy hits at the equator than at the poles. This energy drives 2→3.

2. **Wind Patterns**
   - Predictable based on earth’s rotation

3. **Precipitation Patterns**
   - Generally generated by wind patterns

4. **Ocean Currents**
   - Also driven by wind patterns

Because of solar energy and wind
→ common patterns of air flow

Where are the world’s **hot deserts**?
HOT DESERT

**Temperature**

- Range 9.5°C
- Khartoum, Sudan 15.5°N

**Precipitation**

- Annual total: 15 cm

*LIFE 8e, Figure 52.F (Part 1)*

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e.g., Hadley Cells

*Precipitation near equator.*
Ocean Currents Driven 
Primarily by Wind

El Niño
is an oscillation of the ocean-atmosphere system in 
the tropical Pacific

http://kids.earth.nasa.gov/archive/nino/intro.html
Biome character driven by climate

Adiabatic Cooling

• As increase in **altitude**, atmospheric pressure decreases.

• As pressure **decreases**, temperature decreases. \( (PV=nRT) \)

• As **temperature** decreases, air can hold less water.

• RESULT: At higher altitude get cooler, **wetter** conditions.
Fir Forest in age of Global Heating?

- 1000 feet elevation →
- 3°F drop in temperature →
- ~300 miles toward Canada

\[ \text{e.g., Mt Lemmon} \]

Rain Shadow

- When combine altitude with prevailing winds…

\[ \text{1. Prevailing winds pick up moisture over water bodies.} \]
\[ \text{2. On the windward side of the mountain, air rises and cools, releasing moisture in the form of rain or snow.} \]
\[ \text{3. On the leeward side of the mountain, air descends, warms, and picks up moisture, which results in little rain.} \]

\[ \text{Southern Arizona} \]

\[ \text{In the region surrounding Tucson, it is possible to travel less than an hour from desert to pine forest. Generally speaking, each 1,000 foot rise in elevation is equivalent to crossing some 300 miles toward the nearest pole. The regions of different flora found in the mountain areas are not separated or isolated from one another, but blend together as they ascend. On the windward, leeward, north, south, east, west slopes, these bands appear at somewhat lower elevations than in the warm, sunny south slope.} \]
Why do seasons exist?
For Monday 31 August:
A Natural History of the Sonoran Desert (Phillips & Comus, eds., 2000)
Pages: 25-28 Monsoon etc.
and Zepeda poem, Wind
[optional: Floods of 1993]
Type 6: Southern Plains/Four Corners High

This is the most common severe thunderstorm pattern for southeast and south central Arizona, especially early in the monsoon. In this situation the monsoon ridge sets up over the southern Plains and extends west to the Arizona-Utah border. A secondary high usually develops near the Four Corners region. When this happens, mid-level temperatures across southern Arizona cool, low-level moisture increases from the south or west, and winds between 15,000 and 20,000 feet increase out of the east. This causes thunderstorms to tilt slightly, and allows them to maintain themselves for longer periods of time while organizing into lines or clusters. If the lower levels of the atmosphere are rather dry, straight line winds and dust storms are a major concern. If the lower layers are moist, flash flooding becomes a problem as well.

Initially, thunderstorms on Type 6 days form on the mountains and spread east to west or southeast to northwest. Thunderstorms at the Mogollon Rim and in the White Mountains tend to remain where they develop, while the storms in the mountains of southeast Arizona or northern Sonora tend to move into the valleys and eventually the low deserts. As these storms move progressively farther to the north or west, they typically encounter a more stable atmosphere and dissipate. When a Gulf surge is underway, though, the atmosphere remains unstable as the storms move into the lower deserts. In these instances, storms may continue to travel all the way to the Colorado River Valley.
For Monday 31 August:
*A Natural History of the Sonoran Desert* (Phillips & Comus, eds., 2000)
Pages: 71-85  Geologic Origins

- Basin and Range
- Block Faulting
- Aquifer, water storage
- Bajada, Alluvial Fan, Pediment
- Soil Origin
- Dinosaur Fossils!
Subsidence-fissure that opened July 23, 1976, near the Picacho Mountains

Subsidence in the Tucson Basin
For Monday 31 August:
*A Natural History of the Sonoran Desert* (Phillips & Comus, eds., 2000)

Pages:
- 119-126, 525: Biodiversity & Pupfish
- 529-531: Reptiles & Amphibians
- 577-585: Rattlesnakes
Quitobaquito
Wind

The wind was whipping my clothes harshly around me, slapping me, hurting me with the roughness. The wind was strong that evening. It succeeded in blowing my clothes all around me. Unlike others I revel in it. I open my mouth and breathe it in. It is new air. Air coming from faraway places. From skies untouched, from clouds not yet formed. I breathe in big gasps of this wind. I think I know a secret, this is only the opening act of what is yet to come.

I see it coming from a long distance away. A brown wall of dust and dirt, moving debris that is only moments old, debris that is hundreds of years old. All picked up in a chaotic dance. The dust settles in my nostrils. It clings to the moisture in my mouth. It settles on my skin and fine hairs. Memories of father and how he sat in front of the house watching the wind come. First he would smell it, then he would see it. He would say, “Here he comes.” much in the same way as if he saw a person on the horizon. He would sit. Letting the wind do with him what it will, hitting him with pieces of sand. Creating a fine layer all over him. Finally when he could not stand it any longer he would run into the house, his eyes shut, shut against the tears getting ready to cleanse his eyes. We all laughed at his strange appearance. He also reviled in this wind. This was as close as he could get to it, to join it, to know it, to know what the wind brings. My father would say, “Just watch, when the wind stops, the rain will fall.”
The story goes.
Wind got in trouble with the villagers.
His punishment was that he should leave the village forever.
When he received his sentence of exile,
Wind went home and packed his things.
He packed his blue winds.
He packed his red winds.
He packed his black winds.
He packed his white winds.
He packed the dry winds.
He packed the wet winds.
And in doing this he took by the hand
his friend who happened to be Blind.
Rain.
Together they left.
Very shortly after the villagers found their crops began to die.
The animals disappeared,
and they were suffering from hunger and thirst.
To their horror the people realized they were wrong
in sending Wind away.
And like all epic mistakes it took epic events
to try to bring Wind back.
In the end it was a tiny tuft of down
that gave the signal that Wind was coming back.
With him was his friend, Rain.
He brought back the dry wind.

The Floods of 1993 and Others

Old trees uprooted,
grasses, twigs, and branches,
all forced,
all pointing with limbs in the same direction,
as if telling us,
the one that did this to us went that way.
Barrel cactus,
hanging in an unctuouslike manner,
upside down in between tree trunks and large branches.
They silently scream.
“My roots are still good, put me in the rocky soil.”
The screams are inaudible.
Even if every curved thorn joins in

The Department of Transportation and Flood Control,
201 North Stone Avenue, Tucson, Arizona.
Emergencies after 5 pm. call.
Inquires.
Flooding.
Road Maintenance.
Administration.
Community Relations.
Flood Control and Planning Development.
Operations Maintenance Division.
Emergencies after 5 pm. call.
Emergencies after 5 pm. call.
Permits.
Flood plain.
Grading.
Highway use.
Hillside.
Property management.
Emergencies after 5 pm. call.
Emergencies after 5 pm. call.
Please leave a message after the song.