

Sonoran Desert Discovery:

Biosphere 1 at Biosphere 2, ECOL 464/564 (3 credits)

A multi-level educational offering that links the University of Arizona, biology, and the public.

- Course may be taken three times for up to 9 units of total credit.
- Prerequisites: ECOL182 or equivalent biological/ecological background. Ecology 302 and other EEB courses will be very helpful, but are not required.

Syllabus, Fall 2009

Goals:

1. Develop a flagship outreach program to expand educational opportunities for southern-Arizona residents (kindergarten to retiree) and visitors to learn about biology, ecology, and ecosystems. This will be done through exploration of our unique Sonoran-desert and sky-island biomes, and by leveraging the visibility, expertise, & facilities of B2, EEB, & the UA.
2. Engage UA students in teaching and outreach while furthering their ecological education.
3. Foster increased dialogue between UA faculty and students in both formal and informal settings.

Concept:

UA students will develop and offer hands-on biology-education workshops to K-12 students, teachers, families, and the public at Biosphere 2. The format of the course is modeled after the successful UA Marine Discovery and Insect Discovery programs. Semester themes and individual topics will be chosen jointly by course instructors and enrolled UA students. Enrolled students will then work collaboratively with each other to generate and refine their educational offerings. Students will also consult experts on campus as they develop their workshops. Themes and topics will rotate each semester based on available interest and expertise, thereby attracting repeat visits from the public and allowing students to enroll in the course repeatedly. To expose students to various pedagogical approaches, students will be asked to visit with a local K-12 classroom early in the semester.

Students will work in groups of two or three to develop their topic in several dimensions: biological and scientific content, targeted audience(s), and format of the public interaction. The location of B2 invites topics well-served by short hikes and other outdoor activities. B2 facilities will accommodate anything from lecture and discussion, to presentation of preserved specimens and live animals, to incorporation of ongoing B2 research. Outreach workshops will be held on the weekend in order to maximize interaction with the public and to minimize conflict with weekday courses on the UA campus.

Enrolled students will practice their workshop(s) with their peers and instructors before engaging with the public. Evaluation of student learning and achievement will include 1) the scientific content of their workshop, 2) the appropriateness and effectiveness of the workshop presentation, 3) incorporation of feedback from peers, instructors, and participants, 4) participation in class meetings and discussions, and 5) written assignments. By the end of the semester, students will have increased their understanding of ecology, biology, and a specific content area within these disciplines in the Sonoran desert. Students will also learn how to develop and teach age- and background-appropriate lessons that improve the public's understanding of local biology and global ecology. (Enrollment in ECOL 497A is a logical next step after this course.)

Fall 2009 – Reptiles and Amphibians (tentative)

Each semester we choose a theme around which we can develop focused outreach workshops that will teach biological, ecological, and/or evolutionary principles in engaging ways. For example, invasive species and their implications could be addressed using bullfrogs as a model organism. Adaptations could be taught by comparing lizard and snake taxa from different habitat types in the Sonoran Desert, or by comparing the Sonoran Desert taxa to those from other biomes. Community ecology could focus on any of the different subsets of herpetological diversity in our area. Energy and nutrient flux could be explained using the high density of terrestrial ectotherms that supply much of the base of the vertebrate food chain. The number and ways of using a theme to impart the principles mentioned above are only limited by the imagination.

Meeting Times

Mondays 1630-1800h in Shantz 247 (<http://iiewww.ccit.arizona.edu/uamap/staticLarge/SHNTZ.html>)

Workshops: On Saturdays at Biosphere 2 (see schedule below). Transportation will be provided between UA campus and B2.

Field Trip: All day Saturday 12 September is a mandatory field trip that will introduce you to the Sonoran Desert, Biosphere 2, and this Sonoran Desert Discovery course.

Classroom visit: You will spend two hours sometime during the first few weeks of the semester visiting a K-12 biology/ecology classroom.

Faculty expert: You will also meet twice (or more) with a faculty expert regarding your topic and your workshop. See below for details.

Other work will be accomplished with your peers outside of scheduled class time.

Instructors

Kevin E. Bonine, Ph.D., kebonine@u.arizona.edu

Office Hours: BSE 113, Wed 3-4pm, Thur 4-5pm, and by appointment.

Tel: 626-0092, Home: 751-1349 (please call before 9pm or after 7am)

Graduate Teaching Assistant: **Tiffany Alvarez**, tda@u.arizona.edu

Office Hour: Tues & Fri 1-2pm in Shantz 503, and by appointment.

Course Materials (The two required texts are available at the UA bookstore:)

Phillips, Steven J. & Patricia Wentworth Comus (eds.) 2000. ***A Natural History of the Sonoran Desert***. Arizona-Sonora Desert Museum & University of California Press. 639 pp. ISBN: 9780520219809

Dewey, John. 1997. ***Experience and Education*** (Paperback). Free Press. ISBN: 9780684838281

Other readings will be made available electronically on course website. Please check 464/564 course website regularly for updates, changes, and/or additions.

Web Site

We will maintain a course website (http://eebweb.arizona.edu/eeb_course_websites.htm) with readings, assignments, schedules, announcements, etc. Check 464/564 website for updates. We may also use a **D2L website** (<http://d2l.arizona.edu/>) for posting grades.

Course Work	Total Semester Points: 1000
Attendance	100
Participation (including 50 pts for your assessment of peers)	200
Essays (~3 pages, five at 40 points each)	200
Outreach Workshop (details below)	500

Honors (200 additional points; total of 1200)

This course is available for honors credit by contract. Please discuss with your instructors, and get approval for, the enhancements you propose to warrant honors credit. All work will be due by the regularly scheduled final exam.

564 (200 additional points; total of 1200)

Students enrolled for graduate credit (564) have two options:

1. Propose a project appropriate for graduate credit in this course. If we agree that your proposed project is outstanding then you will be free to pursue it. Otherwise...
2. Outreach Packet (modified from Tiffany Alvarez proposal):
 Choose an age group such as elementary, middle, or high school level.
 Tailor an outreach packet that would be submitted to teachers before a prospective outreach visit. The packet would allow teachers to brief students on the topic before the visit, provide the teacher with supplemental material for use during the presentation and after, and include an evaluation form to assess the effectiveness of the outreach endeavor.
 Packet Requirements:
 1. General background information about the topic that will be presented so the teacher can brief his/her students prior to the visit...think short synopsis. This could be one paragraph, up to a page, depending on the content of the presentation.
 2. A schedule that breaks down the time frame of the visit, so the teacher has a heads-up for the day of the program.
 3. A brief section of requests to the teacher for the day of the visit. This could include: appropriate indoor/outdoor space for the presentation, a request that the teacher make copies ahead of time of worksheets the presenter will provide in the packet, and even pencils and paper. (The goal is to cut down on the bulk of supplies the presenter would need to bring.)
 4. Also in the packet should be included an in-depth ecological report on the topic to be presented. This should be at least 2 pages, and broken down by headings, such as: Natural History, Range, Specialized Behaviors, Adaptations, Habitat Requirements, etc. (It should be written in an age-appropriate manner for the targeted audience, but still detailed and scientifically informative).
 5. With the report above should be an annotated reference/resource list germane to the outreach topic. Please use the citation format of the journal *Ecology*. (e.g.: McNaughton, S. J., D. G. Milchunas, and D. A. Frank. 1996. How can net primary productivity be measured in grazing systems? *Ecology* 77:974–977.)
 6. Provide age-appropriate materials that can be used either before the visit, during the actual presentation as part of a game or activity, and color pages, craft ideas, and any other supplemental follow-up activities for the teacher to execute later. These can be created *de novo* or modified from materials found at educational websites, in textbooks, etc.
 7. Create an evaluation form that can either be filled out by the teacher, or the teacher as well as all the students (depending on the age group chosen). This form will allow for improvement of future programs.

Potential packet & program topics might include:

1. A plant or animal native to the Sonoran Desert
2. An ecological concept such as: predator-prey relationships, symbiosis, or another phenomenon in nature
3. A contrast/comparison topic such as: reptile vs. amphibian
4. A skills workshop such as: GPS training, weather/climate monitoring, or another practical biological training class. (This option might be appealing as a 'concept put into practice').

Grading

We expect top-notch, senior-level and graduate work in this class. Most of you will work hard to earn the grade you want. Remember that you are going to be interacting with faculty, experts, teachers, and the public. You are therefore representing the University of Arizona, Biosphere 2, your generation, scientists, etc. Strive to be professional, well-informed, and organized in all of your interactions.

Please re-familiarize yourself with policies against plagiarism, cheating, etc., and the UA Student Code of Academic Integrity: <http://deanofstudents.arizona.edu/policiesandcodes> Students violating the student code of academic integrity may be penalized by failing the relevant assignment, failing the course, or being expelled from the university.

Many assignments will be due electronically. All assignments are due *no later than the beginning of class* on the due date, unless otherwise noted. Late assignments will be penalized 10% for each day they are late (this includes being late to class on the due date). Do not expect any 'make ups' or 'extra credit'. We realize that you have lives (cars do break down, people die, stuff happens). In exceptional cases, and if arrangements are made in advance, we will consider your unique situation.

Grades will generally be distributed as follows (any potential curving of final grades will not "hurt" you, but can only help you):

≥ 90%	A	80-89%	B	70-79%	C
60-69%	D	≤ 59%	F		

Keep in mind the following, adapted from J.M. Williams (1993, Clarifying grade expectations, *The Teaching Professor* 7(7):1):

The "A" Student--An Outstanding Student

- * Attendance: "A" students have virtually perfect attendance. Their commitment to the class resembles that of the instructor.
- * Preparation: "A" students are prepared for class. They always read the assignment. Their attention to detail is such that they occasionally catch the instructor in a mistake.
- * Attitude: "A" students have a winning attitude. They have both the determination and the self-discipline necessary for success. They are curious and they show initiative. They do things they have not been told to do.
- * Talent: "A" students have something special. It may be exceptional intelligence and insight. It may be unusual creativity, organizational skills, commitment--or a combination thereof. These gifts are evident to the instructor and usually to the other students as well.
- * Results: "A" students make high grades on assignments--usually the highest in the class. Their work is a pleasure to grade.

Students with Disabilities:

If you anticipate the need for reasonable accommodations to meet the requirements of this course, you must register with the Disability Resource Center (<http://drc.arizona.edu/>; Disability Resource Center 1224 East Lowell Street Tucson, Arizona 85721, Phone: (520) 621-3268 V/TTY Fax: (520) 621-9423, E-mail: uadrc@email.arizona.edu) and request that the DRC send the instructor official notification of your accommodation **by the beginning of the 3rd week** of class. Please plan to meet with us by appointment or during office hours to discuss accommodations and how the course requirements and activities may impact your ability to fully participate. All related discussions will remain confidential.

Attendance

You are expected to attend each class session prepared and **ready to contribute**. Ask yourself if you have read the assigned material. Did you retain enough to do well on a short quiz? Did you take notes on your reading? Can you ask intelligent questions or provide meaningful insights?

All holidays or special events observed by organized religions will be honored for those students who indicate affiliation with that particular religion. Absences pre-approved by the UA Dean of Students office will be honored.

Class meeting suggestions:

In addition to paying attention and turning off electronic devices such as iPod and cell phone, please consider employing these suggestions (modified from Guy McPherson) during class discussions:

1. Listen carefully to others before speaking
2. Challenge and refute ideas, not people
3. Focus on the best ideas, not on being the best, or "winning"
4. Before adding your own contribution, practice listening by trying to formulate in your own words the point that the previous speaker made
5. Speak whenever you wish (without interrupting!) even though your ideas may seem incomplete
6. Avoid disrupting the flow of thought by waiting until the present topic reaches its natural end before introducing a new issue
7. If you wish to introduce a new topic, warn the group that what you are about to say will address a new topic and that you are willing to wait to introduce it until people are finished commenting on the current topic
8. Give encouragement and approval to others
9. Always be prepared to ask an intelligent question of the current speaker if called upon – this helps you to stay mentally engaged.

Please be aware of the UA policies against threatening behavior by students:

<http://policy.web.arizona.edu/~policy/threaten.shtml>

Coursework Details

Class Meetings

We will meet on Monday afternoons to discuss the readings and prepare our workshops. Please plan to participate actively in all aspects of our meetings. If you do not want to engage and discuss, then this is probably not the course for you. You will also spend considerable time working on your own or in small groups outside of scheduled class sessions. Four Saturday meetings are also planned. See schedule below.

Workshops

Hands-on educational engagement with the public at Biosphere 2 is at the heart of this course. You and your peers will develop topics and workshops that convey important biological, ecological, and ecosystem principles to the public through the lens of the Sonoran Desert. You will present twice to the public, once with “families” and once with “scientifically literate adults” as your target audience. Therefore, you may be engaging with anyone from pre-kindergarten to retiree. Your workshop should include hands-on activities, discussion, visual aids, etc. We will work as a group to come up with excellent outreach tools. You will also consult with UA faculty and/or other local experts to focus the goals of your workshop, refine the facts you will present based on the latest scientific research, and inform the lessons you hope to impart. We expect that you will meet with your faculty consultant early in the semester and again in the middle of the semester. Note that you may have a small budget for obtaining supplies as you prepare your module. *You will need to spend considerable time outside of scheduled class time to develop your workshop.* An acceptable draft of your workshop must be approved before you present to the public.

You will turn in several items (often electronically) for instructor feedback and grades:

1. Workshop Topic (developed in concert with classmates and instructors)(a-c in template; 25 points)
2. Introduction and Background (e in template; 75 points)
3. Outreach Goals (who will you teach what at Biosphere 2?) (h in template; 25 points)
4. Tools and Approach to achieve educational goals (what will your workshop comprise?) (j-n in template; 75 points)
5. 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)
6. Assessment (did your workshop achieve your educational goals?) (written results from o in template after your first public presentation; 50 points)
7. Refinement of your workshop (after assessment and feedback from your first public interaction) (what did you change in the template and why?; 50 points)
8. Summary Evaluation and Recommendations (what worked and didn't work in your workshop? what would you keep, what would you change?; 50 points)

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>). Please refer to these early and often to get an idea of how to structure your workshop.

You will use the following **lesson-plan template** (slightly modified from one found on the UA Marine Discovery Website) as you develop your workshop:

- a. Project title or topic of activity
- b. Author(s) & date
- c. Summary of activity (approx. 100 words)
- d. Target audience (or grade levels)
- e. Introduction & background information (what is the science behind the workshop?)
- f. Credit for the activity (modified from a previous workshop or lesson plan?)
- g. Estimated time to do the activity
- h. Goals of activity
- i. National Science Education Standards (NSES)
 - i. two content standards that this lesson plan covers
- j. Materials needed
- k. Preparation and tips for presenter(s)
- l. Step-by-step procedure for the activity
- m. Images, work sheets, web links
- n. Items for discussion (or conclusion)
 - i. questions to participants
- o. Assessment
- p. Beyond the activities
 - i. Relate to and extend the complexity of the workshop
- q. Web Resources
- r. Additional References
- s. Key words/glossary
- t. Acknowledgements

Engagement with Experts

As described above, you will interact with UA faculty and/or experts of similar caliber elsewhere in the Tucson community. You and your peers and instructors will work together to identify appropriate experts to meet with twice during the semester.

You will also be visiting a K-12 classroom in Tucson to instigate your thinking and discussion about the realities of teaching and learning. Possible options include, but are not limited to:

- Angela Urbon, AP Biology, Environmental Biology, Amerischools College Preparatory Academy
- Margaret Wilch, Biology and Science, Biotechnology, Tucson High School
- BioME collaborations between UA science graduate students and local K-12 classrooms

You will need to get approval for your specific classroom visit from the instructors and make final arrangements on your own.

All of these experts are invited to join us for our Monday meeting/celebration 07 December. Location TBA.

Essays (approx. 3 typed pages each; 40 points each; 200 points total):

Part of your learning process necessitates critical reflection on what you have seen and done. To foster reflection and develop written communication skills, we are assigning five essays due at different points during the semester. You are expected to develop and support one or more arguments in your essay. Using logic and references in a well organized paper will result in the best essays that also merit the most points. Writing should be grammatically correct and free of typographical errors and other sloppy mistakes. Having others proofread your work, or visiting the campus writing center, will substantially improve the final product. Please follow the parenthetically cited reference formatting as seen in published scientific papers in the journal *Ecology* (<http://esapubs.org/esapubs/journals/ecology.htm>).

1. Choose a specific biological topic that is relevant to the concept of a 'sky island'. Describe and explain that topic to an audience of high-school students. Get instructor approval of your essay topic before you begin writing.
2. What research does your faculty consultant (expert) do? Why is knowledge of their field and its findings important to the public? [Please include detailed contact information for your expert(s)]
3. What did you learn about teaching biology from visiting 'your' classroom for two hours? In what ways did your visit highlight similarities and differences from the Dewey approach we have read about? [Please include detailed contact information for your teacher(s)]
4. You have spent a fair bit of time this semester actively engaged in teaching (and learning) biology. Discuss the similarities and differences between teaching and learning. How does the age or background of the student affect either teaching or learning, or both?
5. Topic to be announced later in the semester.

Bring a hardcopy (to turn in) of your essay to class on the appropriate day and be prepared to share out loud some of your writing with your peers and instructors.

Any concerns about scores on assignments and exams must be addressed within one week of the graded work being returned to you.

The information contained in the course syllabus, other than the grade and attendance policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Sonoran Desert Discovery: Biosphere 1 at Biosphere 2 ECOL 464/564 (3 credits)

Schedule for Fall 2009:

We will meet on most Mondays from 1630-1800h in Shantz 247. Four Saturday events are mandatory: The first (12 Sept) will be an all-day, ≥ 12 hour excursion. The others will be approximately 8am-4:30pm leaving UA for B2 and then returning to UA. Additionally, you will spend two hours sometime during the first few weeks of classes visiting with a K-12 Biology/Ecology classroom. You will also meet twice with a faculty/scientific expert regarding your topic. Meetings and preparation with your peers will also take place outside of scheduled class time.

See schedule posted on course website for changes as semester progresses.

Week 1

Monday 24 Aug – Introduction, Syllabus

Saturday 29 Aug – no meeting

Week 2

Monday 31 Aug – Sonoran Desert Introduction, Theme & Topic Discussion, Discussion of Readings (assignments on course website from required texts and other posted PDF files)

Saturday 05 Sept – no meeting

Week 3

Monday 07 Sept. - Labor Day, no meeting

Saturday 12 Sept. (7am – 8pm) – **All Day Field-Trip Orientation** (all students attend; Mt Lemmon Highway, Biosphere 2).

See website for readings, handouts, and assignments.

Continue to discuss topics. Choose workshop pairs/groups.

(Essay 1 Due - hardcopy)

Week 4

Monday 14 Sept. – How to teach science. Further discuss workshop topics.

See website for readings & assignments.

Saturday 19 Sept. – no meeting

Week 5

Monday 21 Sept. – Finalize workshop topics, Discussion.

See website for readings & assignments.

Saturday 26 Sept. – no meeting

Week 6

Monday 28 Sept. – Workshop preparation, Discussion

See website for readings & assignments.

(Essay 2 Due – via email)

Saturday 03 Oct. – no meeting

Week 7

Monday 05 Oct. – Workshop preparation, Discussion

See website for readings & assignments.

Saturday 10 Oct. – 8am-4:30pm – **B2 Mock Workshop Day** (all students attend)

See website for readings & assignments.

Week 8

Monday 12 Oct. – Workshop reflection, preparation, Discussion

See website for readings & assignments.

(Essay 3 Due – via email)

Saturday 17 Oct. – no meeting

Week 9

Monday 19 Oct. – Workshop preparation, Discussion

See website for readings & assignments.

Saturday 24 Oct. - **B2 Workshop Day** (#1)

[Note that for the workshop Saturday visits (8am-5pm) to B2, not all students will go each Saturday. You will be expected to go twice over these five weeks; two different workshops will be held each Saturday. Signup earlier in the semester.]

Week 10

Monday 26 Oct. – Workshop feedback, preparation, Discussion

See website for readings & assignments.

Saturday 31 Oct. - **B2 Workshop Day** (#2)

Week 11

Monday 02 Nov. - no meeting

Saturday 07 Nov. - **B2 Workshop Day** (#3)

Week 12

Monday 09 Nov. – no meeting

(Essay 4 Due – via email)

Saturday 14 Nov. - **B2 Workshop Day** (#4)

Week 13

Monday 16 Nov. – Workshop feedback, Discussion

See website for readings & assignments.

Saturday 21 Nov. - **B2 Workshop Day** (#5)

Week 14

Monday 23 Nov. – Semester Summary Discussion

See website for readings & assignments.

(Essay 5 Due – likely as hardcopy)

Saturday 28 Nov. – no meeting (Thanksgiving Weekend)

Week 15

Monday 30 Nov. – no meeting

Saturday 05 Dec. – no meeting

Week 16+

Monday 07 Dec. – **Celebrate** with faculty/scientific consultants & teachers. Location TBA

This course has no Final Exam, but if you are getting honors or graduate credit your supplemental work is due by 1400h Wed 16 December to your instructor.