Seeking to create a course where students can study the broad context of the space and time development of natural settings, we designed A Sense of Place, a field trip-based course that introduces students to the natural history of Tucson, Arizona, and its surrounding mountain ranges.

We (two geophysicists and a desert ecologist) joined forces to develop what we believe is an effective natural history learning experience. The course's success is tied to our decision to innovate in two ways: 1) holding Saturday field trips, and 2) opening the course to K-12 teachers from a local school district.

Most seminars consist of weekly evening meetings between a single instructor and 15 to 20 students to discuss some topic related to the expertise of that faculty member. Knowing, however, that geology and ecology are best appreciated in the field, we decided to incorporate a series of Saturday field trips. This approach provides students direct exposure to natural history that can be much more exciting than a classroom learning experience.

In addition, we added an outreach component that extends the course to K-12 teachers (limit of 10). The Sense of Place field trips introduce teachers to basic geological and ecological principles that they can use as tangible examples in their primary and secondary earth science, biology, and ecology classes.

### Course Format

A Sense of Place is one of many First Year Experience Seminars developed by the University of Arizona to give incoming students an opportunity to interact with faculty in small group settings. The seminars foster an environment where students can more easily meet new people and build relationships that make the large campus feel more friendly.

Our course is offered as a pass/fail credit and consists of four all-day Saturday field trips, each preceded by a Tuesday evening lecture session. Designed for students with little or no background in geology or biology, we emphasize teaching students to make careful and objective observations of their surroundings and to interpret the observations in the context of geologic and ecological systems.

In a university course on natural history, undergraduates and K-12 teachers make four Saturday field trips to observe local natural history. Undergraduates practice to carefully and objectively describe the landscape while K-12 science teachers learn about the local geology and ecology that they teach in their earth science, biology, and ecology classes.

Making observations teaches students basic scientific method, and it can foster an appreciation for science in our everyday lives (Bouthette 1992; Hobson 1996; Franck 1996). Many people are wary of or dislike science (Tobias 1992), and, in the case of natural history, some students fail to grasp its complexity, which is often more subtle than is portrayed in textbooks. Field-based science courses are one way to greatly improve attitudes toward science (Kern and Carpenter 1984; Manner 1995) and enhance student learning (Benz 1962).

Tucson has an unusual geologic setting and diverse ecology that are particularly suited for a field-based course. However, many aspects of our course can be adapted to other locations. This article describes the pedagogy of the course, offers recommendations for others interested in implementing similar courses, and discusses the benefits of such a course.

**ONLINE EXTENSION**

To see an example of site visits in the Tucson, AZ, region, NSTA members can log in to JST's website at http://www.nsta.org/pub/jst.
Teaching Methods

We recommend that instructors begin by reading the literature for a description of some of the challenges and rewards of field trips ranging from campus walks to cross country adventures (Paldy 1988; O’Neal and Skelton 1992; Beiersdorfer and Davis 1994; Switzer 1995; Francek 1996; Buchwald 1997). Our experience has led us to create our own list of guidelines for developing a field trip-based course.

1. Examine your local natural history to discover both its fundamental and special features. We have no formula for doing this, but the field trip example described at J CST’s web site (www.nsta.org/pubs/jcst) presents a model.

2. Build in a few classroom meetings to provide background and context. You will determine the content of the sessions by the background of the audience you attract.

3. Make student observations a central feature of field trip activities. We have found this to be the most important pedagogical component of our trips.

4. Prepare visual aids to provide insight into regions examined during the trips. Field trips are visual experiences that can be enhanced tremendously using well-designed posters illustrating fundamental scientific concepts.

5. Pay attention to timing and logistics of field trips. Time invested in field trip planning will be rewarded with smooth, safe trips that maximize education potential.

Prior to each Saturday field trip, the course meets for two hours on Tuesday evening. The purpose of this meeting is to introduce necessary scientific background for the upcoming field trip. Lectures concentrate on one or two basic geological and ecological principals that will come up during the field trip. For example, on the Tuesday evening preceding our field trip to the Tucson Basin, we introduce some fundamentals of Basin and Range tectonic extension. These fundamentals explain much of the topography that is easily observed on the field trip three days later.

Each field trip has four stops. Travel time between stops averages about 20 minutes, so we have about 90 minutes at each site. The first 20 minutes is a student observation period. We do not tell participants why we stop at a particular location. Instead, we direct their attention toward the most important features. Students sketch features that catch their eye and write a paragraph about what they see. We have found that we must repeatedly emphasize that the objective of the observation period is not to “get the right answer,” rather to make careful observations, look for patterns, and record them.

Many students are conditioned to immediately seeking a right answer during the observation period. We have to undo this conditioning and get them to realize that the first step to understanding their environment is to become a critical and careful observer. Those observations can lead to questions and interpretations about how the landscape evolved into its current state. Having participants record their own observations also makes them more acute observers and gets them invested in trying to understand the landscape at hand. We tell students that astute observations that are poorly recorded are of little scientific value whereas even basic observations that are well documented can be valuable.

In addition, the students’ writing and sketches provide us with critical insight into their thought processes and their ability to integrate concepts over the semester (Coles 1991). Furthermore, the sketching and writing encourages more careful observation that would otherwise not occur.

From course evaluation statements and discussions with students, we are convinced that the student observation period is essential. Students have stated that they are sometimes perplexed by why we are at a particular field trip location. Especially when they are at a familiar location, they are initially skeptical that there could be anything of real scientific interest at such a place. Eventually, they come to understand that there is always more than initially meets the untrained eye at each field trip stop.

After the student observation period, we collect the sketches and written descriptions from each student. We then have a mutual observation and discussion session that lasts about one hour. We begin this

Students examine the Tucson Basin and surrounding mountains ranges from the top of Tumamoc Hill, Arizona.
By exploring the special natural history features in their college community, students can gain an entirely fresh outlook on their environment.

session by asking for student volunteers to tell the others about their observations or questions that arose during their unguided observations. Some prodding is often required, but students eventually realize that we are honestly interested in what they saw and that their observations are not "right or wrong" in the usual classroom sense.

We were initially concerned that the teachers' presence might deter students from participating in discussions. In fact, we have found little difference between the willingness of the university students and teachers to volunteer their observations and interpretations during discussion. The teachers tend to push for deeper discussion, probably because they want to thoroughly understand the natural history concepts before presenting them to their students. The end result has been more stimulating discussions, which benefits all the students.

During the discussion session, we display a number of large, waterproof posters as visual aids to explain features at many field trip stops. These are important because geology and ecology are strongly based on visual observation. Indeed, it is this special aspect of these sciences that we explore in this field trip-based course. Figures on the posters range from geologic maps and cross sections to Landsat images and photomicrographs of rock thin sections. A theme that we reinforce through these posters is that understanding geology and ecology requires thinking across a range of scales both in space and in time.

Logistical Considerations

A number of logistical matters need to be considered in advance. A trial run of each field trip is essential. No matter how well you think you know the driving time from one field trip stop to another or how long it takes to walk from a parking area to a point on a trail, there is no substitute for a dry run. Also, because several instructors participate, you must decide how to divide discussion time and what features are within reach given time constraints. After going through this exercise once, we are almost always forced to trim down our discussion.

Land access is another major consideration. Many of our field trip stops are on public land. Even for these stops we inform National Forest Service or National Park Service officials about our plans several weeks in advance so that we can be advised of any changes in parking or hiking regulations. Stops on private land are always an adventure. Sadly, landowners have become less willing over the last decade to allow classes access to private property because of fear of litigation in the event of an injury or accident. There is no magic solution to such problems. Carefully explaining the special natural features of interest on the owner's property is the best approach. We have also found that giving the landowner an extra set of figures illustrating the significance of the natural history landmarks can be a key to access to their land.

A final logistical consideration that cannot be overemphasized is creature comforts. Studies have shown that providing students on field trips with explicit information about lunch, restroom availability, and the trip schedule significantly improves their ability to learn and recall information about the trip (Falk 1992). A large container of drinking water is an important consideration in our arid climate. We plan our field trip routes to include restroom breaks between each stop whenever possible. In almost all cases, we take our lunch break following the discussion at our second field trip stop. Moving to another location for lunch costs much time. With our generally agreeable weather, we arrange our lunch stops at viewpoints with the option of eating in vehicles if conditions call.

Attention to legal and safe parking locations and providing road logs are also important to remember. And never underestimate the ability of students to come poorly dressed for a field experience. We remind students that real shoes (preferably hiking boots) and adequate layers of clothes are necessary for their comfort, but we always carry an extra jacket to hand out to an underdressed or unprepared student.
Course Success
Participants in A Sense of Place almost invariably show a marked improvement in their abilities to make careful field observations. This progress is due in part because field observations must be practiced, and these field trips afford that practice in a variety of settings. We also comment on the written and oral observations made by participants and coach them on how to improve those observations and/or the recording of their observations.

One of us (RB) has incorporated observation activities into his introductory geology natural sciences lectures using satellite images or scenic slides. He found that students in A Sense of Place who interact with three-dimensional field environment will more quickly develop observational skills than students in the lecture course.

We try to develop connections between natural history features seen on the four field trips. Questions of comparison and contrast between features at different stops on the same trip or between field trips indicate that students are using higher-order cognitive skills. Although we have no formal, quantitative assessment mechanisms to evaluate the impact of participation in A Sense of Place on the university students or K-12 teachers, we do have abundant responses to student evaluations of the course and anecdotal tributes from the K-12 teachers. On a number of occasions, the undergraduates have told us that taking A Sense of Place has given them an entirely fresh outlook on their environment. One student who was a native of Tucson commented that he had observed the surrounding mountains and even hiked through them with some regularity. Before attending A Sense of Place, however, he had no idea of the richness of the geological and ecological heritage at his feet.

Our K-12 teachers are very appreciative of the insights they receive through our course. They always remark about how relevant this learning experience is because it offers them powerful local examples of many geological and ecological principles. They know first-hand the power of relevance and local examples in their teaching.

Teaching A Sense of Place has reinforced for us the effectiveness of field experiences for integrating scientific concepts and teaching the scientific skill of observation. Even students with very limited backgrounds in the subject can learn the fundamental principles of natural history through the field trip experiences, which also boost interested beginners up the learning curve quickly. Our observations are consistent with Butzow and Butzow (1989) who suggest that science concepts offered within the context of a story can enable students to understand and remember those concepts more clearly.

With limited effort, any geologist or ecologist can gather specific aspects of the local geology or ecology to offer an introductory course for nonmajors. Most of the preparation is in developing the teaching materials and dealing with the logistics of field trips.

We have found developing and teaching A Sense of Place very rewarding. We encourage others to design similar field-based natural history learning experiences. By exploring the special natural history features in your college community, you can give students a sense of the geology and ecology in their own backyards.

References