Cameras, competition and creativity: assessing 1st year ecology in the field

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Abstract

The great outdoors is the laboratory for most studies in ecology. This article reports on the use of cameras, competition and creativity as novel ways to assess learning during a one-day field trip for a large (~600 students) introductory biology/ecology course. Among the assessment activities, students find and photograph examples of various types of ecological interactions, create a dichotomous plant key in the lab and apply it in the field, and evaluate the potential impact of various environmental change scenarios on ecosystems. The activities and accompanying assessment foster higher order thinking (such as application, evaluation and synthesis) and better retention of knowledge because students create their own context for concepts and content, which have traditionally been learned by rote approaches. This article provides practical advice on how to implement this type of assessment.

Introduction

The great outdoors is the laboratory for many studies in whole organism biology and ecology and as such is an authentic learning environment in these sub-disciplines. Similar to practical and laboratory classes, field experiences are rated by students as among the highlights of their undergraduate degree and constitute a signature pedagogy (Bowen & Roth, 2007; Gurung, Chick, & Haynie, 2009). Field trips help to make educational experiences more relevant, memorable and meaningful for students by engaging and even entertaining them (Rickinson, Dillon, Morris, Choi, Sanders, & Benefield, 2004; Scarce, 1997) and by immersing students in places where "the materials for instruction can be observed and studied in their functional setting" (Krepel & Duvall, 1981). Cost cutting by universities and the logistical challenges of undertaking field trips with large classes (over 300 students) are placing pressure on instructors to better justify or to remove these learning experiences from undergraduate curricula (Burke da Silva, 2014). Consequently, if field experiences are included in introductory biology courses they are commonly conducted on campus. One response to the pressure to justify the expense and logistics involved is to design field experiences that maximise benefits to student learning and to evidence the benefits. The focus of this article is to describe the design for a field trip in introductory biology that improves upon the learning benefits of traditional style field experiences and caters for upwards of 600 students.

Traditional field work in introductory undergraduate biology courses has involved show and tell type activities, simple observations and activities with set procedures and pre-determined outcomes using a deductive approach (known as an expository learning design; Domin, 1999). Analogous to recipe-style laboratory classes, such instructional approaches limit student learning, with students often unclear as to the objectives and relevance of what they have done and unable to contextualise its meaning (Hofstein & Lunetta, 2004; McGarvey, 2004). Given the complexity of a) interactions within and among species, b) ecological processes and environmental factors, and c) the various influences on structures and forms of whole organisms, such instructional approaches severely limit opportunities and motivation for students to relate the biology they are learning to issues of relevance to them. Traditional assessments associated with such field activities tend to engage only lower levels of learning (such as remembering and understanding in the revised Bloom's taxonomy of learning objectives; Krathwohl, 2002) and preclude higher levels including contextualisation, inductive reasoning and creative thinking.

As a consequence of a restructure to our first year biology courses we took the opportunity to introduce a field experience for first year students (where there was previously none). We wanted to address the following two questions:

1. How can a field trip experience that sensitises students to the complexity of ecological issues be provided to a large number of students?
2. How can such a field trip be assessed to motivate and guide students in their learning?

The field trip design showcased in this article is innovative for its scale (500-650 students), cost efficiency, contextualisation of basic biology skills and assessment methods. Student learning is contextualised through the linking of basic observations and plant identification practice to themes of ecological systems and human impact. The assessment combines self-guided and discussion tasks to motivate students and facilitate opportunities for higher order thinking (such as application, analysis, evaluation and creativity; Krathwohl, 2002). As far as we are aware, this field experience is the only one currently conducted off campus with such a large number of students in Australia. The article describes the learning outcomes and approaches used to achieve them, their educational underpinnings, and the assessment tasks. We also outline our logistics under a separate sub-heading in an effort to assist interested parties to adopt similar approaches.

Context for the field trip

Course and university details

The one-day field trip and associated assessment is part of a first semester, first year biology course (= unit of study) at the University of Queensland called BIOL1030 *Global Challenges in Biology*. The University of Queensland is a research-intensive university in Australia and most students in the course are enrolled in a Bachelor of Science (although up to 11 different degree programs are represented). The majority of students in the course are aged between 17 and 23 years (mode = 17) with more than 90% of students permanent Australian residents.

The course is structured so as to highlight the relevance of organismal biology and ecology to students through unpacking the biology that underpins global challenges such as food and water security and sustainability, environmental and climate change, and the biodiversity crisis. Senior high school biology is not a pre-requisite to enrol and roughly half of the students do not have this background. The field trip introduces new content as well as reinforcing content previously learned. The assessment associated with the field trip is worth 10% of the final grade and links with laboratory and lecture content. More details about the course can be found at
http://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=76924.

Aims and structure of field trip

The objective of the field trip is to introduce students to the complexity of the relationships between organisms and how these relationships feed into ecological processes that enable ecosystems to function. This theory is otherwise learned from textbooks and is difficult to teach successfully in non-didactic lecture formats or in laboratory classes. Our intent was to shift student thinking from memorisation of facts to a contextualised understanding, and to have students observe that ecosystems and the relationships within them are complex and may appear disordered and unstructured ('messy').

In the lecture series preceding the field trip, students learn the characteristics of various groups of organisms (such as fungi, angiosperms, vertebrates, insects, etc.). They are also taught basic observation skills in their laboratory classes and prepare a dichotomous key to be used on the field trip. Students develop the key from samples (e.g., branches, potted specimens) of ten species. The aims of the laboratory class are to introduce important plant and leaf features, foster detailed observation skills, and to learn to distinguish static, repeatable and measurable characteristics from subjective characteristics. Students receive feedback on their plant key from tutors before the field trip. In laboratory classes that follow the field trip we revisit the idea of 'messy' ecosystems and introduce students to ways of simplifying them and reducing variables through experimentation and correlative studies in order for students to experience how inquiry through these approaches can provide better insight into the inter-relationships between organisms and ecological processes.

As recommended by Orion (1993) in his model of good practice in field trip design for learning, our field trip is an integral part of the course of study and is situated as early as possible in the learning sequence (about a third of the way into the semester) to enable concrete realisation of abstract concepts. Table 1 lists the activities and stages of the field trip. In the week prior to the field trip, students complete an online quiz for which they are required to look up and provide a definition for each of 12 types of ecological processes and interactions, and then identify each of these from abstract, written scenarios. The online quiz is a hurdle task that does not contribute to student grades. Students may make multiple attempts at the quiz and must score 100% on the definition questions in order to attend the field trip. During the field trip, students walk 6 km through a mix of eucalypt and rainforest in Brisbane Forest Park. The walk is divided into four stages, each of which has a different but related focus. Students conduct the walk in groups of eight accompanied by a tutor (usually a postgraduate student studying ecology) and complete a series of tasks with increasing independence from their tutor throughout the day. We encourage students to work in the same groups as in their laboratory classes, thus fostering stronger friendships and focus through shared experiences and peer learning (Boud, Cohen, & Sampson, 2014; Rickinson et al., 2004). Stage 1 of the field trip establishes the knowledge base for the day where tutors work closely with students demonstrating, explaining and discussing the concepts required for the rest of the day. The assessment tasks are mostly integrated across the day, with the exception of Stage 1, and involve plant identification using a dichotomous key created by the same students in previous laboratory classes (Stage 2, worth 10% of the field trip mark), a time-limited photographic hunt (Stage 3, worth 60% of the field trip mark), and group discussions (Stage 4) from which students write a 250 word summary and complete a post field trip quiz in the week following the field trip (Stage 5, worth 30% of the field trip mark). An extension activity, as well as a sausage barbeque, is available at the end of the walk for groups that complete the tasks early or whose interests are piqued.

Table 1. Description of the stages and activities for the field trip.

Stage & duration of the field experience	**Activity objective and description**
Preparatory online quiz	Define 12 ecological terms and answer related questions. Example: a species of brown beetle obtains food from sucking the sap of a plant. The plant is protected from other predators by the beetle. Is this an example of a) competition, b) predation, c) mutualism or d) parasitism?
Stage 1: Introduction to ecological processes and interactions in the field (1.5 hours)	Tutors assist students to see examples of ecological processes and species interactions by showing and explaining examples along the first section of the walk. Aim: build students' independence in these observations. Tutors and students identify and discuss the 12 processes and interactions from the quiz.
Stage 2: Plant Identification (1.5 hour)	In groups of four and independent of tutors, students use their dichotomous key to identify eight specific plants marked with a coloured tape in the natural environment at various points along the walk. As a back-up students have access to an official plant key. If this is used, to obtain their marks students are required to discuss how and why the back-up key is better than the one they created. Importantly, two of the flagged plants on the walk are not included in either plant key. Students receive marks for correctly reporting that these two plant species cannot be identified.
Stage 3: Photographic Hunt to record Biodiversity and Ecological Interactions (1.5 hours)	Students are provided with a list of 30 different ecological interactions, ecological processes or organisms (with common or scientific names) to photograph. In groups of four, students photograph as many of these examples as possible in 90 minutes along the final 3 km section of the walk. Students are encouraged to use local field guides such as *Wildlife of Greater Brisbane* (Queensland Museum, 2007) and *Wild Plants of Greater Brisbane* (Queensland Museum, 2003) to assist them. The tutors act as guides for safety, to ensure that students finish on time and to record whether or not the groups have used field guides correctly in the process. Once groups arrive at the end of the walk they show their photos to a marker (usually academic staff) and individual students in the group describe and discuss the content of randomly assigned photos. Group marks are allocated during this process.
Stage 4: Conservation and management of Ecosystems (1 hour)	Tutors facilitate a discussion on the management and conservation of the Brisbane Forest Park (in which the walk took place) using the issues and concepts students learned during the day. Students are provided with one of four scenarios based on the four major threats to biodiversity globally: habitat destruction, introduced species, over-exploitation and disruption to species interactions. Students are asked to discuss the scenario and how it impacts upon other organisms and processes within the ecosystem in light of what they learned during the day. This requires students to think contextually about the interdependence of the organisms in this ecosystem and to realise that disturbing one species affects many others. Based on the discussion students are then asked to suggest realistic management strategies to address the issue.
Field extension activity	We make available a range of real scats, skulls and bones from various species found locally (e.g., koala, rat, fox, possums). Students are shown how to use the field guide *Tracks, scats and other traces* (Triggs, 2004) to identify the species and are given examples to try themselves. Tutors and students then discuss how indirect signs of organisms can help to determine their presence or absence in an area. Not assessed.
Stage 5: Post quiz & discussion summary	In the week following the field trip students submit a 250 word written summary of their scenario discussion, which is assessed according to the criteria in Appendix 1. As part of the planned evaluation students will also answer a number of scenario questions similar to those in the pre-trip quiz.

We have prioritised fun, creativity and experiential learning in our approach because these have been shown to enhance student learning and motivation as described below. Students are encouraged to use their creativity in both the photographic hunt and scenario discussions (illustrated in Figure 1) to find, identify, describe and synthesise interactions among various organisms and processes. Students must be more accurate in their descriptions than in the quality of their photographs to obtain marks associated with the photographic hunt.

Figure 1. Stage 4 of the field trip. Tutors discuss with students scenarios of human activities that lead to biodiversity loss and the implications for ecosystem processes and species inter-relationships. (Photo R. Wilson.)

Field trip logistics

Careful consideration is always required for the logistics and costs of running field learning experiences, particularly for large classes. In this section we outline some of the strategies we have used to manage the logistics and costs in our context.

From a learning perspective, access to enough suitably knowledgeable tutors or demonstrators is vital to the success of the activities described here. Good tutors will constantly question and discuss with students examples and broader implications of human activities throughout the day and also have a sound working knowledge of local flora, fauna and environmental and ecological issues. Tutors are also the largest expense of the field trip, with a tutor:student ratio of 1:8. We hold a preparatory meeting with tutors and provide them with a handout to discuss common understandings and examples of concepts relevant to the day, as well as marking criteria to ensure students receive equitable experiences and knowledge across groups. The effort and expense of doing this is greater in the first year(s) of implementation, but reduces over time with returning tutors. Experienced tutors help to mentor new tutors in the lead up to and during the field trip, with opportunities at several points along the walk for tutors to meet. The ratio of tutors to students could be reduced with careful consideration of both occupational health and safety requirements as well as design of the Stage 1 learning activities. With the exception of the written summary, all assessment is completed on the day by tutors and lecturing staff.

Location of the field site is also a consideration in terms of access, variation in habitats, suitability for large numbers of students and transport costs. Our field site is within a state forest and includes both temperate rainforest and dry sclerophyll forest on slopes facing different prevailing weather conditions, thus presenting a variety of habitat types. It is located about 40 minutes' drive from the university campus and students are transported by bus and charged a $20 fee for transportation (in addition to course enrolment costs). An alternative assignment is provided for students who are unable to pay this cost or unable to attend the field trip for other reasons; typically around 5% of students complete the alternative option.

The 6 kilometre walk takes place along a public bushwalking trail. As such, each year we obtain a permit from the governing body and limit the number of people using the track each day (which is also a benefit for other logistical reasons such as the number of tutors required per day). We take approximately 100 students per day and repeat the activity five or six times to cater for the 500 - 600 students enrolled in the course. Many of the tutors attend repeat trips, so we typically have a pool of about 16 tutors and rotate them so that no single tutor is teaching on more than three consecutive days. Students complete online risk assessment and emergency contact forms at the time of paying for the field trip (usually no later than two weeks prior to the trip).

Over the years we have found that there is always a significant proportion of students who attend the field trip under-prepared despite ample repetition of 'what to bring' messages in advance. Consequently we have a few strategies pertaining to food, water and rain gear that may be useful for readers to know. We always carry a supply of large garbage bags as make-shift rain gear and we begin the walk near a café and encourage anyone who did not bring sufficient food or water to purchase requirements there; we also pre-warn the café owners of our arrival. We have one of the university student societies host a sausage sizzle at the end of the walk, where for a small donation students can obtain food and drink. This event has the added benefit of familiarising first year students with campus societies and socialising.

Learning Outcomes, Approaches & Assessment

The specific learning outcomes for the field experience that are assessed are outlined in Table 2, but the learning outcomes of the field trip extend beyond these academic outcomes. A surprisingly high proportion of students enrolled in the course have little to no experience being immersed in natural environments. This is evident through how ill-prepared many students are for variable weather conditions and for the absence of shops from which to purchase food and water, as well as their inexperience coping with organisms including mosquitoes and leeches. The field experience introduces students to important professional skills and standard field work practices, such as completing risk assessment and emergency contacts forms, the need to prepare for, and strategies to cope with, adverse field conditions, and working in areas where mobile phone and internet reception are patchy or non-existent. For those students who have had little or no exposure to natural environments, or those who have but without the biological context, informal feedback from students via tutors and on course evaluation surveys indicates that the experience of spending a day immersed in the environment leaves a lasting impression which is more often than not positive.

This first semester, first year field trip builds towards a number of threshold learning outcomes for biology graduates (VIBEnet, 2013), the details of which are described in Table 3. Unlike many upper-level field experiences in tertiary education, this field trip does not target scientific inquiry and problem solving skills beyond skilled observation and basic reasoning. The field trip differs from most senior high school ecology field studies in that students are encouraged to integrate different ecological ideas and concepts and link them with bigger picture societal issues of management of biodiversity and/or human activities.

Table 2. Learning outcomes and associated evidence of learning (assessment tasks) for the field trip.

Learning outcome	**Evidence of learning / assessment task**
Recognise in the context of their natural environment: a) a wide range of organisms; b) a range of ecological interactions between organisms; c) links between ecological interactions and processes and human activity.	Students photograph items in the field from a 'photo hunt' list including: a) a selection of organisms; b) a selection of ecological interactions; c) signs of specific impacts of human activity on the ecosystem.
Use a field guide to: a) identify organisms and learn about their habitat, habits and characteristics; b) find common names for scientific species names.	Students demonstrate use of a field guide to: a) gather information about an organisms' habitat preferences, habits and features; b) determine both common and scientific names of species.
Describe: a) a range of ecological interactions between organisms in a natural context; b) characteristics of a functional and reliable identification key.	Students provide verbal descriptions of: a) the ecological interactions in photographic examples they collected from the natural environment; b) the similarities and differences between a plant identification key they created and an official plant identification key.
Use a dichotomous identification key to identify plants in their natural environment.	Students use a dichotomous key they have created from samples in a laboratory setting to identify species of whole plants in their natural environment.
Synthesise information about how: a) interactions among organisms influence organisms which are not directly involved in the interaction; b) interactions among organisms link to ecological processes; c) different ecological processes interact; d) human activities impact on various ecological interactions and processes. Recognise conservation and management implications of interactions between organisms and their environment (e).	Students discuss a scenario that involves a hypothetical human-mediated change (e.g., land clearing, introduced species, etc.) and provide written examples of how: a) the change influences organisms not directly involved in a specific interaction among organisms; b) interactions among organisms link to ecological processes; c) different ecological processes interact; d) human activities impact on various ecological interactions and processes; e) the impact of human activity on organisms and processes in the ecosystem can be minimised or reduced through practical actions.

Educational Underpinnings

Many of the concepts in ecology can be learned from textbooks, in the laboratory or in a biologically simple environment such as campus gardens, but ecosystems are notoriously complex, so much so that humans have so far been unable to create a self-sustaining closed ecosystem (attempts include the Biosphere 2 project by NASA; Marino & Odum, 1999). The ability to understand and simplify this complexity is at the core of organismal, ecological and environmental biology, and is an important skill for biology graduates whether they go on to careers in biology or to become biologically responsible citizens. There is rapidly growing evidence from studies in school education and informal education (such as ecotourism, zoos, etc.) that experiential learning *in the natural environment* is extremely important in developing environmental knowledge, attitudes and behaviours, particularly over the long term (Bogner, 1998; Rickinson, 2001; Ballantyne, Fien, & Packer, 2001; Dillon et al., 2006; Ballantyne & Packer, 2009; Ballantyne, Packer, & Falk, 2011; Farmer, Knapp, & Benton, 2009; Palmberg & Kuru, 2000; Wells & Lekies, 2006). Experiential aspects of a field trip can be enhanced by approaches that encourage interaction between students and the environment (Orion, 1993); our design encourages such interaction during all stages of the field trip.

Table 3: Learning outcomes and activities for the field trip mapped against the threshold learning outcomes for biology (VIBEnet, 2013).

Threshold Learning Outcome for Biology	Stage of field trip	Learning activities and outcomes
1.2 Demonstrate a coherent understanding of biology by explaining the role and relevance of biology in society.	Stages 4 and 5	Understanding of the role and relevance of biology in society is fostered and demonstrated during group discussion of management implications of changes to an ecosystem in response to human practices.
1.4 Recognise and appreciate the significant role of biodiversity in sustaining life on our planet.	Stages 1, 3 and 4	This theme runs through the entire course, including the field experience. Students learn and recognise interactions among species and how these integrate into processes of ecological functions in Stages 1 and 3 and relate this to consequent management practices and impacts of human activity in Stage 4.
1.3 Recognise that biological knowledge has been acquired by curiosity and creativity and demonstrate creativity in thinking and problem solving.	Stages 3 and 4	Creativity is encouraged through the photo hunt in Stage 3 and the discussion of solutions to management problems in Stage 4. Curiosity is encouraged by tutors throughout the day.
2.1 Exhibit depth and breadth of biological knowledge by demonstrating a well-developed understanding of identified core concepts in biology.	Stages 3, 4 and 5	Students exhibit depth of knowledge about species interactions and processes during the photo hunt in Stage 3 and breadth of knowledge during the discussion in Stage 4.
2.2 Exhibit depth and breadth of biological knowledge by demonstrating that these 'core concepts' have interdisciplinary connections both within science and other disciplines.	Stages 4 and 5	Students discuss the conservation and management implication of a scenario where an ecosystem is subject to one of the main causes of biodiversity loss.
3.4 Select and apply practical and/or theoretical techniques.	Stage 2	Students demonstrate use of a field guide and a dichotomous identification key.
4 Effectively synthesise and communicate biological results using a range of modes (oral, written, and visual) for a variety of purposes and audiences.	Stages 3, 4 and 5	Students communicate biological observations by visual means (photos) and verbally in discussion groups.
5.2 Work effectively, responsibly and safely in individual and peer or team contexts.	All stages	All activities during the field trip are conducted in groups or 8 or 4. Students must work together to complete tasks.
5.3 Demonstrate knowledge of the regulatory frameworks and ethical principles relevant to their sub-disciplinary area within biology and apply these in practice.	All stages	Students complete workplace health and safety risk assessments and associated documentation prior to attending the field trip and touch on ethical principles during discussions of human impacts on ecosystems in Stage 4.

In addition to the emphasis on experiential learning, the design of the field experience deliberately focused on higher level learning activities within Bloom's taxonomy such as applying, evaluating and creating (Krathwohl, 2002). The move away from expecting students to memorise definitions to an emphasis on application of skills and demonstration of knowledge through creative activities such as the photo hunt and scenario discussion are consistent with strategies identified as promoting deeper approaches to learning (Entwistle & Entwistle, 1991). For example, engagement by students is encouraged through increasing independence, the photo hunt provides scope for discovery (Bruner, 1960; Rogers, 1969) and taps into intrinsic motivation (Marton & Säljö, 2005; Ramsden, 2005), and the discussions emphasise principles and concepts rather than facts (Hounsell, 2005). Deeper learning facilitates longer term retention of knowledge and more thorough understanding of a topic (Houghton, 2004).

Although empirical data on the learning benefits of fieldwork at an undergraduate level are scarce (Burke da Silva, 2014), academics who teach in the field attest to its learning value and the data that does exist suggests it improves student learning (see for example Braun, Buyer, & Randler, 2010; Fuller, 2006; Scott, Goulder, Wheeler, Scott, Tobin, & Marsham, 2012). Field based courses commonly come under scrutiny from administrators for their disproportionately high grades across the majority of students. Concerns over distinguishing between high and low achieving students can be addressed by either combining a field experience assessment with other assessment types across the semester (our approach) or altering the activities so that they engage higher level (hence more challenging) tasks than would typically be possible in a less complex learning environment.

Assessment in our field trip has primarily been designed as a motivator for students rather than a summative evaluation of capability, whilst still providing evidence of learning. Self-directedness and enjoyment are among the top motivating factors for students in higher education (Martin, 2009; Sogunro, 2015; Warburton, 2003). Self-directedness, the use of technology familiar to students (Kennedy, Judd, Churchward, & Gray, 2008; Kirkwood & Price, 2005) and the notion that millennial students are intuitively visual learners (Coates, 2007) informed the design of the photo hunt activity. Whilst creativity is not a specific criterion for assessment of the photo hunt, creativity is reflected in the large diversity of examples and scenes captured by students to represent the ecological interactions on their photo hunt list, many of which are not examples discussed by tutors. The assessment of the photo hunt focuses on the ability of students to provide a verbal justification of the ecological interaction or organism represented in the photo that is biologically sensible and reflects an accurate understanding of the target concept.

The design of the written assessment in Stage 5 of the field trip aims to provide students with an opportunity for informal feedback on their thinking through discussion with peers and a tutor prior to the summative written task (Boud et al., 2014; Ramsden, 2005). Writing is widely recognised as a valuable tool for learning and individual reflection (e.g., Panitz, 2001), and the written summary of this discussion not only helps students to reflect upon what they have learned during the day and to link concrete examples of ecological interactions and processes with consequences of human impacts, but also permits assessment of individual student learning.

Effectively designed outdoor learning experiences are also known to improve students' social skills (Rickinson et al., 2004). Peer activities enhance this by bringing social currency into learning to raise the overall standard of knowledge and learning as students share ideas and information (Boud et al., 2014). Aside from Stage 1 of the field trip, all activities are student driven, student centred and involve peer-to-peer interaction.

Conclusions

Analogous to laboratory learning in other science disciplines, field-based learning in ecology and whole organism biology is an authentic, motivating experience for students (Rickinson et al., 2004). The benefits of these activities can be enhanced by incorporating innovative activities together with assessment that extends beyond show and tell or recipe-style activities with known outcomes. Field experiences are relevant to workplace practices in these disciplines, influence environmentally responsible behaviours and attitudes, and can lead to a deeper understanding of the complexity of the natural environment than classroom learning.

The example showcased in this article is widely adaptable and illustrates that it is possible and valuable to incorporate such a field trip into large undergraduate classes. Future directions will include collecting evidence of the learning benefits of field experiences relative to comparable learning experiences in other settings such as online, classroom or laboratory. Data formally evaluating the field experience is currently being sought in the form of student performance on pre- and post-excursion quizzes, as well as tutor and student perspectives.

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Appendix 1

Marking criteria for Stage 5: the written summary based on students' discussions held at the end of the field trip. The discussion focusses on one of a variety of scenarios of a human impact (e.g., habitat loss, invasive species, etc.) on a local ecosystem.

Criterion	**Detailed description for students**	**Possible Mark**
Discussion focuses on the chosen question.		2
Discussion demonstrates detailed understanding of the inter-relationships amongst several ecological processes and organisms.	Ensure you draw upon the topics you have covered in other parts of the field trip. You may also like to draw upon what you've learned in prac and lecture classes.	8
Discussion puts the ecological interactions and organisms into the context of the appropriate environment.	Have you made clear links between the ecological processes and organisms and how they fit into the environment for your topic?	5
Management suggestions address the question and are realistic.		5
Total		**20**