

Short Communication

Reinventing The Wheel: Teaching Restoration Ecology Without the Ecology

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Restoration ecology is ‘the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed’ (Clewell *et al.*, 2005). Restoration can range from returning the system to its ‘natural’ state through to restoring some ecological functionality to a system (Hobbs and Cramer, 2008). The University of Western Australia offers an undergraduate degree in Restoration Ecology. As part of the degree first year undergraduate students must complete the unit ‘Introduction to Restoration Ecology’. This unit aims to introduce students to the general concepts of ecological restoration.

As part of the assessment for ‘Introduction to Restoration Ecology’ students were required to develop a restoration plan using the Society for Ecological Restoration International (SERI) guidelines (Clewell *et al.*, 2005) and then implement the plan. The SERI guidelines for developing and managing ecological restoration projects cover areas from conceptual planning through to evaluation and publicity (Clewell *et al.*, 2005). Planning and implementation of an ecological restoration may take many months or years, and may be well above the abilities of a number of first year undergraduates, therefore old bicycles were used as a teaching tool to develop the students understanding of the steps required to plan and implement a restoration project. Students were given the goal of restoring a bicycle that then had to safely negotiate a distance of approximately 500m on a tarmac surface over a set course. The emphasis was not restoring the bicycle to a pristine state, but rather planning and restoring the functionality of the bicycle.

The bicycles when initially purchased were in poor condition but still relatively functional so some functionality had to be removed *i.e.* seats and front wheels were discarded and brake cables were removed before the bicycles were given to the students (Figure 1). Students were directed to the bush mechanics website (www.bushmechanics.com) for inspiration on how objects (in the case of the bush mechanics — cars) functionality can be restored without necessarily restoring the object to initial state.



Figure 1a&b: The initial state of two bicycles used in the restoration project

Assessment of the exercise was worth 20% of the unit mark. The mark for the assessment was broken down to 20% for the restoration of the bicycle and its ability to accomplish the goals set, 5% for creativity/lateral thinking in the restoration of the bicycle and 75% for the written report. The students worked in pairs for the restoration project sharing the mark for the physical restoration but were assessed individually on their restoration plans.

The use of an object such as a bicycle to help students learn about the process of ecological restoration has several benefits. Firstly a bicycle is a common object with which all students will be familiar. The students in this unit have only just begun their degrees so their knowledge of ecosystems and their restoration is extremely limited, by utilising an item they are already familiar with the students can concentrate on learning the process of restoration rather than learning about the system they are restoring. Secondly, a bicycle is a relatively simple object which can be fixed in the majority of cases without any specialist tools or knowledge. If the students did not have the knowledge or the tools they had to source them from somewhere (in most cases family or friends). In the majority of ecological restoration projects no single person will have all the knowledge required and all the resources. The third benefit of this exercise is the time taken. To properly plan and implement the restoration of an ecosystem can take many months or years, this assessment was completed in less than four weeks. Finally, the cost for running this exercise was minimal, each bicycle was purchased from the local recycling facility for AUD\$2. Students were also offered an additional budget of AUD\$5 for any additional parts if required, as it was none of the students used the additional budget.



Figure 2a&b Two of the completed restoration works (note number of wheels and number of frames in Fig 2a).

The end results of the restoration project showed initiative and imagination (Figure 2). Most of the students coped well with interpreting guidelines designed for a biological system to an abiotic system. Although, guidelines such as 'Identify and list the kinds of biotic interventions that are needed' did cause some issues. Responses to these points ranged from 'Not applicable' through to some students examining abiotic interventions as an alternative.

One future improvement for this exercise will be to change the timing of the actual implementation of the plan. In all cases the students conducted their restoration and then wrote their restoration plans after the restoration work was complete - this defeats some of the object of the exercise. In future the students will be required to submit their plans before they are given access to the bicycles.

Student feedback on the exercise was positive, with most enjoying the 'hands on' aspect of the project and the teamwork involved. In particular the students enjoyed the extension of the 'novel ecosystem' concept to an inanimate object.

Restoration of inanimate objects has been used in the teaching of restoration ecology before (e.g. Lundholm and Larson 2004). Lundholm and Larson used the restoration of artefacts as a metaphor for restoring ecosystems. They gave students the option of restoring an artefact of their choice and then students were assessed on 'how the restoration of the object is similar to or different from ecological restoration. The bicycle exercise differs in that it aims to give the students experience in developing a restoration plan and then implementing it rather than carrying out restoration of an artefact and comparing it to a biological system.

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