MAKING NATURAL RESOURCE ECONOMICS RELEVANT FOR A HIGHLY DIVERSIFIED STUDENT CLIENTELE

Steve Harrison
School of Economics
The University of Queensland

The economics of natural resources has become an area of considerable interest for tertiary students in recent years, with subjects in this area introduced in various degree programs. This is a subject area where the interest of students in the natural world and environmental issues can be capitalized upon to gain student enthusiasm, provided the practical relevance of the economic theory for government and industry can be conveyed. A number of innovations have been trialed in teaching a third year undergraduate unit in economics of natural resources at The University of Queensland. The unit attracts students from a variety of backgrounds, including students in economics, commerce and natural resource management degrees, study abroad and exchange students, and postgraduate students from developing countries. Specific measures trialed to capture student interest and maximize morale in the subject have included provision of a large set of dedicated reference materials, use of guest lecturers, a class debate, use of newspaper clippings, a resource-type focus for lecture topics, and an opportunity for specialization in topics. Students exhibit particular interest in land rights issues, economics of renewable resources and economics of outdoor nature-based recreation. Survey evidence indicates a favourable attitude to lecture support materials.

1. INTRODUCTION

Particularly in the last decade, natural resource economics and environmental economics have become major university teaching areas. This paper reports experiences and experiments from lecturing in a third-year undergraduate subject titled 'ECON3710 – Economics of Natural Resources'. This 'course' (the current name for a subject at The University of Queensland), which was introduced in 1992, has an economics subject code and is taught from the School of Economics. It is a one-semester course with two hours of lectures per week, and has prerequisites of introductory microeconomics. When the course was introduced in 1992, the enrolment was about 20 students, growing to about 30 students (with about 40 enrolled in 2003). Overall third-year enrolments in the School of Economics have grown slightly over the last decade.

The teaching philosophy adopted is that what is most critical is to engage students in the subject topics – to capture their interest and motivate further inquiry – rather than to attempt to convey a large amount of factual information in the
classroom. The rationale is that once students are involved in the subject, they will be prepared to work independently, seek out information spontaneously, and think critically on the topics, as well as taking part in class discussions. Students are provided with comprehensive printed lecture notes on all topics, reducing the emphasis in lectures on transfer of information and allowing for interaction both between lecturer and class and between students. The lecture sessions provide an opportunity to raise controversies and to engage the students in debate. Classes are judged to be successful if there is some lively interchange of opinions, and unsuccessful if there is a high absentee level amongst students (though of course some students will choose to rely on the comprehensive course materials made available).

Over the last few years, a number of measures supporting the lectures have been trialed. Printed lecture notes are supported by a substantial collection of papers targeted specifically at the subject, in the university library. Other support measures include provision of concept lists with lecture notes, provision of newspaper clippings, and a class debate.

In this paper, the student clientele for the natural resource economics course is first outlined. The nature and scope of the subject (ECON3710), and consultation and assessment procedures, are then outlined as background information. Lecture support measures are next explained. Approaches adopted to encourage student interaction in class are then discussed. Survey evidence of student attitudes to lecture support measures, and topic preferences as revealed through assessment, are then presented and reviewed. Concluding comments follow.

2. THE STUDENT CLIENTELE

Economics of Natural Resources draws students from a variety of backgrounds, who are enrolled in a variety of degree programs, as indicated by enrolment statistics for the last two years (Table 1). Notably, those studying for the single B.Econ. degree make up less than a quarter of the class, the enrolment being dominated by students undertaking combined or parallel degrees (often including a B.Econ.), postgraduates students from developing countries, and study-abroad students (particularly the USA and Scandinavia). The heterogeneous backgrounds of students, while making for an interesting mix of opinions and interests, poses difficulties for arranging lecture material to suit the needs of all class members.

3. DEFINING THE SUBJECT COVERAGE AND EMPHASIS

Students can relate readily to natural resources and the environment, probably more so than to some of the more abstract or commercial areas in economics. When students elect to study natural resource economics, they generally have a strong interest in sustainable management of renewable natural resources. They have heard through the media various reports on degradation of the nation's natural resources, such as the problems of degrading river systems (e.g. the Murray-Darling Basin in Australia), deforestation including land conversion, reduced fisheries catches, and carbon dioxide emissions from coal-fired electricity generation. The subject is attractive for exchange students, particularly from Europe and the
TABLE 1
PROGRAM AREAS OF STUDENTS ENROLLED IN ECONOMICS OF NATURAL RESOURCES AT THE UNIVERSITY OF QUEENSLAND, 2001 AND 2002

<table>
<thead>
<tr>
<th>Program</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001</td>
</tr>
<tr>
<td>B.Econ.</td>
<td>7</td>
</tr>
<tr>
<td>B.Nat.Res.Econ.</td>
<td>6</td>
</tr>
<tr>
<td>B.A.</td>
<td></td>
</tr>
<tr>
<td>B.Info.Tech.</td>
<td>1</td>
</tr>
<tr>
<td>Combined or parallel degree</td>
<td>8</td>
</tr>
<tr>
<td>M.Nat.Res.Econs.</td>
<td>1</td>
</tr>
<tr>
<td>Study abroad</td>
<td>8</td>
</tr>
<tr>
<td>Incoming exchange</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
</tbody>
</table>

USA, who tend to be well versed in resource degradation issues, and for whom the course appears to be particularly compatible for credit against home country degree programs.

The challenge is to direct this inherent interest in the direction of economic theory and rigorous analysis rather than to popular science, while preserving the students' inherent interest. The challenges of redirecting focus was brought home starkly when once reading a computer science report on the difficulty of re-educating computer 'hackers' so that they become information system design specialists. Students may enter programs with a good deal of preconception and misinformation. In the case of natural resource and environmental economics, such preconceptions could arise from 'indoctrination' about the evils of logging, from accounts of dying rivers in the media, and even from the school education system.

The need to gain the interest of students has implications for subject design and content. A heavily mathematical treatment, not uncommon in natural resource economics teaching in North America, would almost certainly be a turn-off for the majority of Australian economics students, and in any case many of these students do not have a strong mathematics background. Since this is a first course in natural resource economics, it is necessary to acquaint students with some specific concepts, such as characteristics of property rights to natural resources, public versus private goods, renewable versus non-renewable resources, privatization of natural resources, conflicting stakeholder interests, and compensation for the takings of resource property rights. Students also gain familiarization with the major current controversies of natural resource management. A constraint is to minimize overlap with other subjects in natural resource, environmental and ecological economics taught within The University of Queensland.

In order to engage students in the subject, it has been found that there are
advantages in having lecture topics built around particular resource types. After the initial introduction (to the key concept of a resource, property rights characteristics, takings and compensation), the lectures in ECON370 cover a series of resource types, namely: forestry, fisheries, water, energy, minerals, and outdoor nature-based recreation. This resource-based approach provides a convenient framework to which students can readily relate. For each of the six resource topics, issues of historical use patterns, supply, demand, efficient pricing, optimal exploitation rates, and policy reform are examined. When covering these topics, key concepts which form the pillars of an economic treatment of the management of natural resources must be conveyed. These include, for example, the Faustmann formula for the optimal economic rotation of a forest (discussed in detail by Pearse, 1990), the biomass and cost models for open-access and managed fisheries (based on Schaefer, 1957), and the Hotelling model for optimal extraction rate of a non-renewable resource (as summarized by Anderson, 1991).

4. CONSULTATION WITH THE LECTURER AND STUDENT ASSESSMENT

Students are encouraged to raise any issues during and immediately after lectures, and much consultation takes place in the classroom immediately after the lecture. As well, students are encouraged to use electronic mail for communication, for which the lecturer response time is generally less than half a day. Direct submission of projects by email is encouraged, in which case comments can be made (in blue) within the document, which is then returned electronically to the student. Students are permitted to submit draft reports by email for comment.

Assessment is by semester 'projects' and an end-of-semester exam. A compulsory written project or assignment, on any one of three set topics, is due early in the semester, and carries 20% of the overall mark. A second and optional project is due late in the semester, also carrying 20%, leaving a 60% weighting on the end-of-semester written exam. For this second project, the student may choose the subject, but an abstract must be approved to ensure the topic is consistent with the lecture objectives. This second project is undertaken on a 'no jeopardy' basis: a mark out of 20% is awarded, but if the exam percentage is higher than the project percentage than the project is not counted and the exam carries 80% of the marks. A third element of progressive assessment is a debate, again optional and, on a no jeopardy basis and carrying 20% of the subject mark. The total progressive mark is limited to 40% (a School of Economics requirement for undergraduate courses), so students cannot gain credit for both the optional project and the debate. The end-of-semester examination is of two hours duration and four questions out of seven are to be attempted (one per topic), with internal choice in some questions, being designed to provide some opportunity for specialisation.

---

1 In essence, each of these takes a capital theory approach and considers continuing to hold the resource versus liquidating the asset and investing the proceeds.
5. LECTURE SUPPORT MEASURES

A number of measures to reinforce the lecture presentations have been developed in the subject over time. The mix of measures has been relatively stable for the last three years, though the following outline of these measures applies specifically to the year 2002 offering.

1. **Printed lecture notes:** Printed notes developed by the lecturer are made available on the subject introduction and all seven lecture topics (dealing with characteristics of property rights to natural resources and an application to Native Title in Australia, and the six specific resource types). These notes are comprehensive and are to some extent an alternative to the prescribed textbook.

2. **List of concepts on lecture topics:** At the end of most printed lectures, a list is provided of the concepts introduced in the lecture. In class, after covering the topic the group is asked if they are still uncertain of the meaning of any of these concepts, and reinforcement explanation is provided where necessary.

3. **Subject-specific reference materials:** An extensive collection of articles and reports relative to the subject is available in the 'high-use' area of the university social sciences and humanities library.

4. **Discussion questions:** Towards the end of the semester, a list of approximately 40 discussion questions is issued, and it is made clear that the end-of-semester examination will contain questions similar in intent to these. The list effectively covers the whole course, and is provided as guidance and encouragement for students when carrying out consolidation study at the end of the semester.

5. **Newspaper clippings:** Each year, articles in major newspapers which deal with natural resource management issues highly relevant to the lecture topics are identified and made available to students. These are often articles which have been published within the last week, and convey the message that the topics being studied are highly relevant to public policy.

6. **Guest lectures:** Resource economists – from government and industry, and advanced doctoral degree students – are invited to present occasional lectures in the subject. In year 2002, three guest lectures were presented. These lectures are designed to convey the message that the respective topics have practical relevance and to give students some indication of the nature of professional careers in natural resource economics. It is made clear that topics of visiting lecturers will only be examinable if printed notes are provided, which reduces stress and allows students to approach these sessions constructively.

7. **Semester projects:** These include the mandatory and optional projects as listed above. Project reports of approximately 1500 words are either printed or submitted as an attachment to an electronic mail (email) message.

---

2 Lecture notes have not been placed on the Web, because of concerns over rights to intellectual property in relation to material drawn from current research projects.
Specifications are provided for layout, in terms of structure and headings, and for references.

8. The class debate: The class is given a choice between three topics of current controversy. In 2002 these were: (a) 'There should be greater privatization of natural resources in Australia'; (b) 'When grazing leases expire for land with high ecological values, the land should be immediately resumed by the Crown for uses such as national parks and indigenous title land'; and (c) 'Water authorities should resume greater quantities from allocations for irrigation and divert these to environmental flows'. A vote leads to the choice of topic, 'environmental flows' being chosen in 2002. The debate involves two teams of three members, to speak for six minutes each, and a chairperson (to introduce participants, keep time and provide a brief overall summary of the arguments presented).

6. ENCOURAGING ACTIVE STUDENT PARTICIPATION

A risk in providing ready resource material is that students will simply skip classes and work independently on this material, undermining the classroom sessions. A critical issue is classroom morale; if this is high then students are likely to attend classes regularly. Important elements of classroom morale appear to be confidence in the lecturer and lecture material, a friendly classroom atmosphere, and collegiality between students.

Some of the elements contributing to confidence in the lecturer include confidence in the lecturer's knowledge of the subject, a belief that the subject coverage is sound, a feeling that the lecture sessions are worth attending in terms of increased understanding of the subject, and a judgment that the assessment methods are fair. A number of the lecturer's publications are included on reference lists to establish credentials in natural resources economics (e.g. Tisdell and Harrison 1999; Harrison et al. 2000; Harrison and Herbohn 2001; Cook and Harrison 2002).

A particular challenge involves bringing about interaction between students, which is critical to developing sound classroom dynamics. One strategy employed in this regard is having a number of questions to put to the class each week, on issues of controversy in natural resource management. Examples are:

• What does 'ownership' mean in terms of property rights to natural resources?
• What limits to property rights would apply to an urban resident on an acreage block?
• What are some of the multiple uses of a forest?
• Should water users be charged increasing-block or decreasing-block prices?
• Should an electricity supply system be designed to provide 100% certainty of supply?

Some debate options in previous years have included: (a) 'Stricter controls are needed over logging of native forests in Queensland'; (b) 'The need for load-shedding reflects poor management of the Queensland electricity supply and distribution industry'; and (c) 'A system of charges should be introduced for day visits to National Parks in Queensland'.
• What are the arguments against charging day visitors for entry to national parks?

If students start to argue the case on such issues, this is regarded as a successful outcome.

7. CAPTURING INTEREST IN SPECIFIC TOPICS

Various devices are used to capture the interest of students in the subject generally, and in the various topics.

7.1 Creating opportunities for specialization

Students are told that some degree of specialization in their study of the subject is permissible, once essential background concepts on natural resources and property rights are covered. Choice is provided in project work, with one out of three topics to be selected for the first project, and with students designing their second project subject to having the abstract approved by the lecturer (which typically involves some exchange of email messages).

The view could be taken that providing substantial choice in projects and in exams makes the course a soft option. However, in the broad field of natural resource economics, it is difficult to argue that there is a specific body of information or methodology which all students must master. Flexibility for specialization allows students to pursue their individual interests in a supportive environment. It is difficult to judge the effect of opportunity for specialization on the distribution of students' grades, but anecdotal evidence suggests that it is the more able students who take greatest advantage of the opportunity.

Choice of topics appears particularly important for overseas (undergraduate exchange and postgraduate) students, for whom this subject supports their overall program interests. Students from the USA appear particularly interested in water resources, being familiar with water supply and quality problems of the Colorado River. Those from South-east Asia, where deforestation has been severe, have particular interests in forestry.

7.2 Demonstrating relevance to government and industry

Each lecture topic includes a policy section, and in some cases management reforms are featured (especially for water industries and fisheries). Arranging topics by resource types assists in establishing relevance, although at the cost of having some repetition of theoretical principles. Considerable credibility for topics is provided by the guest lecturers, and newspaper extracts further validate their relevance.

---

4 The alternative of dividing topics according to theoretical principles, and then drawing examples from various resource types to illustrate these principles, would be less interesting for students. Notably, the resource areas are grouped as to 'renewable biological', 'renewable flow' and 'non-renewable' resources, such that some general principles can be applied within groups.
7.3 Stressing linkages with research and consultancy activities

Examples to demonstrate points in lectures are drawn where possible from research projects. This includes reference to Australian projects on water and energy, and overseas work carried out by the lecturer and postgraduate students, including research into forest management in the Philippines and Vietnam. This approach is taken to illustrate the contemporary importance of the issues, and to give students insights into research they might engage in if undertaking higher degree study.

7.4 Raising the interest levels in particular topic areas

Some points of focus which have been found to provoke student interest in the various lecture topics are as follows:

- **Selling property rights**: A key tenet of the subject is that property 'ownership' is a meaningless concept for examining sustainable resource utilization, and that property is best examined in terms of a bundle of user rights characteristics (e.g. in terms of comprehensiveness, physical extent, transferability, excludability, divisibility and duration). An effective vehicle for generating interest in this theory has been to ask students to analyse the impacts of the Mabo and Wik decisions and the Ten Point Plan on property rights of indigenous Australians, graziers and miners. Students can relate to the overturning of the earlier legal fiction of terra nullius, and the complexities of resolving disputes about indigenous land rights.

- **Proving an interest in forestry economics**: This is an area where considerable research into socio-economic issues has taken place by a local research group as members of the Rainforest Cooperative Research Centre, which conveys relevance to students. An effort is made to address preconceived anti-logging views, to convey trade-off issues in multiple-use forestry, and to explain that plantations and not protected forests make a net positive contribution in carbon sequestration.

- **Key interest points in water resources**: Aspects which capture interest include the evolution of a 'mature water economy'; the need for reforms in the WSD (water, sewage and drainage) industry, pricing reforms for irrigators and urban users, such as increasing block prices; and efficiency versus wider beneficiaries arguments of intersectoral transfers and environmental flows.

- **Key interest points in fisheries resources**: Some of the issues which appeal to students include the difference between the maximum sustainable yield (MSY) and economically optimal harvest rate; the inefficiencies of effort and gear restrictions; and the pros and cons of individual transferable quotas (ITQs).

- **Focus of interest for mining economics**: Points to capture student interest include the concept of 'sustainable mining' as an oxymoron, the fact that known economic reserves of non-renewable resources may in fact increase over time, and the concept of an optimal extraction path for a non-renewable resource.

- **Key areas for generating interest in energy economics**: Students typically have a strong interest in renewable energy sources. Fortunately, a regular and dynamic visiting lecturer is able to motivate strongly the interest of students in the Australian electricity supply industry and in recent reforms.
• Engendering interest in outdoor recreation economics: This is probably the easiest topic in which to gain an enthusiastic class audience—particularly amongst international students who seek to travel to rainforest areas during their stay in Queensland. Many students are automatically interested in this topic, and relate easily to the concept of a market for outdoor recreation services, user-pays issues and alternative pricing arrangements. Current School of Economics research on the economic evaluation of proposed long-distance walking tracks in the Wet Tropics (e.g. Cook and Harrison 2002) provides a focus of examining recreation supply and demand, the travel cost method of demand estimation, and benefit transfer methods.

8. STUDENT ATTITUDES TO LECTURE SUPPORT MEASURES
A questionnaire was distributed in the class of 2002 to determine student attitudes to the eight specific measures adopted in the subject outlined above. Students were asked to provide a ranking on a five-point Likert scale for each support measure, in terms of interest and teaching effectiveness. The response categories were: Little or no effect; Slight effect; Moderate effect; High effect; Very high effect. Specifically, the question asked was:

The following measures have been used to support the teaching objectives in ECON3710. Would you please rank each of these measures on a five-point scale (1 for least effect through to 5 for greatest effect) in terms of their impact on your interest in the subject and as learning support, by circling appropriate numbers.

The questionnaire was administered in the second last week of the teaching semester. Of the 30 students enrolled in the subject, 22 were present at this lecture. The frequencies and summary statistics are provided in Table 2.

It is to be noted that the quantitative results do not provide a criterion of total impact of each measure, in that some measures are a much more major input in the subject than others. For example, the semester project requires a large time input by students, while the concept lists are a brief checking procedure at the completion of coverage of individual topics. However, the scores do provide an indication of how highly the students regard the measures, in relative terms.

The highest interest factor was guest lecturers. Printed lecture notes, concept lists and semester projects ranked equally after this, followed by discussion questions and newspaper clippings. The subject-specific reference collection and class debate ranked approximately equal last.

In terms of contribution to learning, the printed lecture notes ranked particularly highly, with a mean score of 4.7 on the five point scale. These were followed by concept lists, guest lecturers and semester project. Next were the discussion questions and reference collection, followed by newspapers, with the class debate a poor last.

Printed lecture notes, the reference collection and the discussion questions ranked higher from a learning perspective than for stimulating interest. In contrast, the newspaper clippings and class debate were regarded more highly for stimulating interest than for promoting learning.
<table>
<thead>
<tr>
<th>Support measure</th>
<th>Printed lecture notes</th>
<th>Learning</th>
<th>Concept lists</th>
<th>Reference collection</th>
<th>Discussion questions</th>
<th>Newspaper/chippings</th>
<th>Interest</th>
<th>Guest lecturers</th>
<th>Semester projects</th>
<th>Class debate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role</td>
<td>Interest</td>
<td>Learning</td>
<td>Interest</td>
<td>Learning</td>
<td>Interest</td>
<td>Learning</td>
<td>Interest</td>
<td>Learning</td>
<td>Learning</td>
<td>Learning</td>
</tr>
<tr>
<td>Frequency distributions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>6</td>
<td>10</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>16</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Min</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Max</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mean</td>
<td>4.19</td>
<td>4.73</td>
<td>4.19</td>
<td>4.36</td>
<td>3.58</td>
<td>3.85</td>
<td>3.90</td>
<td>4.14</td>
<td>3.90</td>
<td>3.64</td>
</tr>
<tr>
<td>Rank</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Mean for measure</td>
<td>4.46</td>
<td>4.28</td>
<td>3.71</td>
<td>4.02</td>
<td>3.77</td>
<td>4.37</td>
<td>4.26</td>
<td>3.20</td>
<td>3.10</td>
<td></td>
</tr>
<tr>
<td>Rank</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Overall, printed notes are the most highly regarded, followed by guest lecturers. Semester projects and concept lists rank about equally next, followed by discussion questions. These are followed by newspaper clippings and the collection of reference papers. The class debate ranks last.

The ranking for the library reference collection and class debate are somewhat disappointing. A substantial proportion of students find the reference collection helpful, but some obviously make little or no use of this facility. One student commented on the questionnaire that he was not aware of their existence, though the collection had been listed in the subject outline and mentioned several times in class as a source for project material. The low ranking of the class debate raises the question of whether this lecture-support measure should be continued. In absolute terms, a mean score of over three for this component probably suggests it is worthwhile. The relatively low mean score may be due in part to the time at which this fell at the end of the semester, which suggests an earlier timing may be preferable. Some students who had completed the second and optional written project possibly felt aggrieved that others had gained marks with less effort by participating in the debate. This suggests that further comment on optional assessment measures and allocation of marks may be required in the course outline.

9. EVIDENCE OF HIGH INTEREST AREAS FROM ASSESSIBLE MATERIAL

Some indication of relative preferences for topics is provided by the choices made by students for projects and in the end-of-semester exam.

9.1 Choices of essay topics

Three options were allowed for the first essay: a discussion of the property rights implications of native title (such as the Mabo and Wik High Court Decisions and the Ten Point Plan legislation); problems and reforms in the Australian water economy; and compensation for the takings of natural resource interests. Numbers choosing each topic in the last two years are indicated in Table 3. These frequencies suggest a strong preference for the first two topics. In 2002, a guest lecturer talked on land rights of indigenous people in Cape York, which raised the interest level in this topic.

<table>
<thead>
<tr>
<th>Topic</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property rights</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Water economy</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Compensation for takings</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
TABLE 4
FREQUENCIES AND PERCENTAGES OF TOPIC CHOICES IN END-OF-SEMESTER EXAMINATIONS, 1999-2002

<table>
<thead>
<tr>
<th>Year</th>
<th>Property rights</th>
<th>Forestry</th>
<th>Fisheries</th>
<th>Water resources</th>
<th>Energy</th>
<th>Mining</th>
<th>Outdoor recreation</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequencies, 1999</td>
<td>16</td>
<td>14</td>
<td>17</td>
<td>15</td>
<td>16</td>
<td>5</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Frequencies, 2000</td>
<td>29</td>
<td>20</td>
<td>9</td>
<td>26</td>
<td>13</td>
<td>5</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>Frequencies, 2001</td>
<td>26</td>
<td>15</td>
<td>24</td>
<td>28</td>
<td>8</td>
<td>7</td>
<td>23</td>
<td>33</td>
</tr>
<tr>
<td>Frequencies, 2002</td>
<td>25</td>
<td>22</td>
<td>16</td>
<td>20</td>
<td>12</td>
<td>4</td>
<td>13</td>
<td>28</td>
</tr>
<tr>
<td>Percentages, 1999</td>
<td>66.7</td>
<td>58.3</td>
<td>70.8</td>
<td>75</td>
<td>66.7</td>
<td>20.8</td>
<td>37.5</td>
<td>100</td>
</tr>
<tr>
<td>Percentages, 2000</td>
<td>90.6</td>
<td>62.5</td>
<td>28.1</td>
<td>81.3</td>
<td>40.6</td>
<td>15.6</td>
<td>78.1</td>
<td>100</td>
</tr>
<tr>
<td>Percentages, 2001</td>
<td>78.8</td>
<td>45.5</td>
<td>72.7</td>
<td>84.8</td>
<td>24.2</td>
<td>21.2</td>
<td>69.7</td>
<td>100</td>
</tr>
<tr>
<td>Percentages, 2002</td>
<td>89.3</td>
<td>78.6</td>
<td>57.1</td>
<td>71.4</td>
<td>42.9</td>
<td>14.3</td>
<td>46.4</td>
<td>100</td>
</tr>
<tr>
<td>Mean percentage</td>
<td>81.3</td>
<td>61.2</td>
<td>57.2</td>
<td>78.1</td>
<td>43.6</td>
<td>18.0</td>
<td>57.9</td>
<td>100</td>
</tr>
</tbody>
</table>

Just over half of the class submitted the second and voluntary project report in year 2002, for which the choice of topic was by negotiation with the lecturer. The distribution of student numbers between topics was: forestry economics 5; fisheries economics 5, energy economics (including renewables) 3; mining economics 1; and land economics 1.

9.2 Choice of examination topics
In the end-of-semester exam, one question is included on each natural resource topic. In all, there are seven questions, of which any four are to be attempted. While factors such as perceived degree of difficulty and extent of algebraic derivations required will affect choice of question, the frequency with which students answer questions across topics provides an indication of the areas of greatest interest. An analysis of examination records yielded the information in Table 4.

There is naturally variation in student choices due to the relative degree of difficulty of the question in each topic between years. However, some pattern of choice is apparent. Interest in renewable resources would appear to be greater than that in non-renewable resources. (When opportunity is provided to write on renewable energy, the proportion of students choosing the energy economics question tends to increase.) It would seem that students tend to steer away from the more mathematical areas, including the derivations of optimal extraction rates (Faustmann formula in forestry, Hotelling model in mining, and optimal harvest rate models in fisheries). Over the four years there are no clear trends in interest in particular topics.

10. CONCLUDING COMMENTS
Capturing the interest of students in a subject area presents a challenge for lecturers. A number of measures may be adopted to support this goal. Experimentation with support measures, and checking of stated ratings of measures on a Likert scale and preferences for topics revealed in assessment vehicles, provide an indication of the
degree of success of these measures. In a case study in the teaching of natural resource economics, printed lecture notes were highly regarded by students, and (carefully selected) guest lecturers well received. Writing essays, where some choice of topic was provided, was well regarded as a learning support. A class debate was of some interest value but was not regarded as a particularly useful learning exercise. Class attendance rates averaged about 70%, being lowest immediately prior to the due date for assignments in this and other subjects in which class members were enrolled. Overall, the objective of capturing student interest appeared to have been achieved, with students personally commenting that the subject was an interesting one, and providing gratifyingly high subject and lecturer ratings in annual teaching evaluations. Students displayed strong inherent preferences for some topics over others, with property rights and the economics of water resources and outdoor recreation resources proving popular, but not economics of mining and energy resources (mainly non-renewables).

Ideally, the testing of preferences for lecture support materials would be replicated over a number of years, and it is the intention to repeat the class survey procedures in subsequent years and compare findings. How durable the interest generated in natural resource economics by the teaching strategy is remains to be explored. This would be reflected in choices of further subjects at undergraduate and postgraduate level, and choices of fields for higher degree study, and an investigation of trends there also appears desirable.

REFERENCES


Pearse, P.H. (1990), Introduction to Forestry Economics, University of British Columbia Press, Vancouver.
