18. Justification

2. Why is this course being requested or modified?

Natural Resources and Environmental Management is a holistic, interdisciplinary systems approach to understanding and managing tropical, especially island, terrestrial ecosystems. It involves gathering, developing, synthesizing, integrating, exchanging, and disseminating scientific knowledge, experience, and management technologies that are technically sound, economically feasible, socially acceptable, and ecologically compatible for the efficient use of renewable natural and environmental resources in Hawaii and selected areas of the tropics.

The continuing diversification of Hawaii’s agriculture and forestry requires sound information on the land resource base and environmental quality in an integrated manner. Geographic information systems (GIS, a map-based database management system of natural resources and land use) have been proven not only highly effective for the systematic inventory of such information, but also for determining productivity potential, economic potential, optimal land use and management, and suitability for agricultural or forestry diversification in a holistic manner. Recent advances in and continuing improvements of computer technology have made GIS in routine use and thus become “must-to-have” skills in the natural resources and environmental management fields.

3. How will the content be organized?

The proposed course emphasizes on students’ learning of the practical skills of GIS and consists of lecture (100 hours per week, 2 credits) and lab (150 hours per week, 1 credit) parts. The lecture part is designed to introduce to students the basic concepts, principles, technical terms, and practical knowledge. The lab part is designed for students to practice and be acquainted with the practical skills of these tools. Each lab exercise covers the same materials taught in the same week’s lectures and is made from the past and current real natural resource and environmental management problems/issues in Hawaii. Three weeks of the course are allocated to introduce the basics of other geospatial analysis tools, including remote sensing (image processing technologies for mapping land use and land use change, e.g., aerial photography and satellite imagery) and global positioning system (GPS, a unit to “geo-locate” any objects on earth). The discussion of remote sensing and GPS will be limited to the very basic level. The intention is to introduce the basic concepts and existence of these technologies as both remote sensing and GPS are also routinely used to derive many GIS data layers. A draft syllabus of the course is attached in the end.

4. What other courses at UHM closely parallel the proposed course and in what way will the latter make a distinct contribution?

NREM currently requires a GIS course offered in Geography Department (GEOG 488) as a core course to fulfill this need. Although the course itself is excellent, its main focus is different from the skills demanded in the natural resources and environmental
management fields and thus NREM students find it difficult to learn to apply GIS to resource and environmental management. GEOG 488, which thoroughly discusses GIS theories and geographic information science, is rather complementary to the proposed, application-oriented GIS course.

5. Where or how does the proposed course fit into the current and future curriculum?

Teaching a new undergraduate course on applications of GIS to natural resource management and environmental quality assessment has been the highest priority in Department of Natural Resources and Environmental Management (NREM) and this proposed NREM 477 course has been accepted as a NREM undergraduate core course by the NREM undergraduate program committee. The development of such a course and skilled graduates from the university have been strongly and urgently demanded by both state and federal agencies, including Hawaii’s Department of Land and Natural Resources and USDA Natural Resource Conservation Service.

The proposed course, NREM 477, is by nature to comprehend resource/environmental management using computer tools. Thus, the course will be built upon the prerequisites in three fields: 1) quantitative skills, 2) map interpretation, and 3) natural resources and environmental management and policy.

<table>
<thead>
<tr>
<th>Introductory or Intermediate Quantitative Skills</th>
<th>Map Interpretation Skills</th>
<th>Natural Resources and Environmental Management or Policy</th>
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<tbody>
<tr>
<td>MATH 140, NREM 310, or MATH 373</td>
<td>GEOG 370, GEOG 375, or GEOG 387</td>
<td>NREM 301</td>
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</tbody>
</table>

The proposed course will replace one of the current NREM upper division requirement courses for quantitative analysis, GEOG 488. As described earlier in this document, NREM 477 and GEOG 488 will be complementary with the former being application-oriented and the latter being theory- and geographic information science-oriented. Interested students could take NREM 477 and proceed on GEOG 488 or vice versa. The instructors of NREM 477 (Dr. Tomoaki Miura, NREM) and GEOG 488 (Dr. Matthew McGranaghan, Department of Geography) are in communication for this purpose (see the attached letter from Dr. McGranaghan).
6. Why is the number of credits and level justified? Explain the prerequisites and the absence thereof.

The proposed course, NREM 477, is a 3 credits, combined lecture-laboratory course:

- Lecture part: 100 minutes of contact per week = 2 credit hours
- Laboratory part: 150 minutes of contact per week = 1 credit hour
- Total: 3 credit hours

As the course is an upper division course, the followings are prerequisites to NREM 477:

- MATH 140 or NREM 310 or MATH 373 or upper division statistics course(s),
- GEOG 370 or GEOG 375 or GEOG 387 or other mapping-related course(s), and
- NREM 301 or upper division natural resources/environmental management course(s).

7. How will the course assist students to achieve the critical skills and competencies expected of CTAHR graduates?

<table>
<thead>
<tr>
<th>SKILL CATEGORIES</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Written Communications</td>
<td>The lab report requirements help students develop skills to write in a logical manner as problem solving in GIS requires logical thinking that needs to be reflected in the lab report writing.</td>
</tr>
<tr>
<td>Analytical/Problem Solving Skills</td>
<td>Lab exercises will make students develop analytical/problem solving skills. The instructor will demonstrate the skills in lectures and assist students in solving problems during lab hours.</td>
</tr>
<tr>
<td>Personal Characteristics</td>
<td>Learning GIS is very time-consuming and requires patience. Although the course curriculum does not explicitly address these skills, students will be encouraged and instructed by the instructor to think on a step-by-step basis and manage time effectively.</td>
</tr>
<tr>
<td>Human Relations Skills</td>
<td>Students will be encouraged to work in a group to discuss and develop problem solving skills through lab exercises. The instructor will facilitate this process during lab hours.</td>
</tr>
<tr>
<td>Computer Skills</td>
<td>GIS is an advanced software based on so-called, geographic information science and computer science. The whole course is dedicated for students to develop skills in properly operating GIS. The lecture part will</td>
</tr>
</tbody>
</table>
8. How will students be evaluated?

Students’ learning accomplishments will be evaluated by one mid-term (25%), one final exam (25%), and lab reports (50%). The mid-term and final exams will be used to evaluate students’ understanding of the subject matters, including analytical/problem solving skills, the basic concepts, and technical terms. A large weight is given to lab reports as it is a practical skills-oriented course. A lab report is required for each lab exercise to document students’ activities, i.e., problem & solution identifications followed by proper software operations to realize the identified solution in the GIS framework.

9. What are the minimum qualifications for teaching this course? Is a qualified instructor now available?

The minimum qualifications for teaching this course are:

- Ph.D. in natural resource management, environmental science, soil and water science, ecology, or equivalent degree;
- Research experiences involving the extensive use of geospatial data;
- Familiarity with science computing.

A qualified new faculty member for the Natural Resource Inventory and Interpretation position, Dr. Tomoaki Miura, is available to teach the course.

10. How will the course be financed, assuming no further cutbacks?

NREM Department is equipped with a networked computer lab. A larger lab space is needed to offer lab exercises for the course. Three computers in the lab need to be replaced simply because of their outdated architecture on which the proposed GIS software (ArcGIS) would not run properly.

The annual maintenance fee for a single ArcGIS license is $250. The course requires 10 licenses ($2,500). In order to partially cover the fee, we propose to charge an extra fee of $50 per student who registers for the course. The rest of the fees will be covered by the NREM department.

11. Has the course been offered before? Is there a demand for it?

The expected course enrollment is 20 students. An experimental version of the course was offered in Spring 2004 (NREM 491/691 GIS and Remote Sensing for Resource Managers), in which enrollment was 23 students. The course was advertised only within NREM Department for the experimental version. Upon official course approval of
NREM 477, we will advertise the course on a campus wide basis. This should attract additional students body from other departments as well as other colleges.

12. Is the course cross-listed with another department?

No.