Table of Contents
Introduction ........................................................................................................................................4
NREM Faculty ....................................................................................................................................5
Graduate Program Committee ........................................................................................................5
Core Faculty ......................................................................................................................................5
Cooperating Graduate Faculty .........................................................................................................6
Affiliate Graduate Faculty ...............................................................................................................6
Specialization Areas ........................................................................................................................7
Admission and Deficiencies ............................................................................................................7
Continuing Students for PhD Program ..........................................................................................8
Advising for Beginning Students ...................................................................................................8
Degree Offerings and Specific Requirements ..................................................................................8
MS Degree ........................................................................................................................................9
Requirements of MS Degree ..........................................................................................................9
MS Degree Checklists ...................................................................................................................13
PhD Degree ......................................................................................................................................17
Requirements of PhD Degree ........................................................................................................17
PhD Degree Checklist ....................................................................................................................19
Permanent Advisor and Thesis/Dissertation Committee .................................................................21
Guidelines for MS Thesis Committee ............................................................................................21
Guidelines for PhD Dissertation Committee ..................................................................................22
Financial Support ..........................................................................................................................22
Departmental Funding ....................................................................................................................22
Research Assistanship ....................................................................................................................22
Graduate Student Organization Grant ...........................................................................................22
Other Financial Aid ........................................................................................................................23
Resource Management Certificate ...............................................................................................23
Courses ............................................................................................................................................24
NREM Courses..................................................................................................................24

Other departments for relevant courses...........................................................................26

Suggested Graduate Level Research Methods Courses (statistics).................................26

Style and Policy Manual for Theses and Dissertations.....................................................31

Graduate Division Requirements.......................................................................................31

Departmental Information.................................................................................................31

Student Organization........................................................................................................32

Graduate School Forms.....................................................................................................32
Introduction

This document is meant to help guide you in your academic journey in NREM. It complements the academic program description in the UHM catalog, and facilitates the advising of NREM’s incoming and continuing graduate students in the NREM graduate program. NREM offers the following graduate degrees and certificates: M.S. (Plans A, B, and C), and Ph.D. degrees in Natural Resources and Environmental Management, and a University-wide Graduate Resource Management Certificate. Several NREM faculty also participate in a campus-wide graduate degree specialization in Ecology, Evolution and Conservation Biology (EECB: http://www.hawaii.edu/eecb/) to which incoming or continuing students may apply.

The NREM graduate program brings together natural and social scientists to offer an integrative and inter-disciplinary program that uses a system approach to understand and manage tropical and sub-tropical terrestrial and aquatic ecosystems. Emphasis is placed on island settings and their relevance to managing land and seascapes. Studies in NREM incorporate the various components and scales (spatial and temporal) that determine ecosystem structure and function, and that bear upon the social and economic welfare of residents in diverse communities and environmental settings. Curricula and courses emphasize the application of physical, biological, and social sciences to the sustainable management and conservation of natural, environmental, and economic resources. The program also provides a science-based foundation to assess the processes that control the structure and function of terrestrial and aquatic ecosystems, and the human behaviors and policies that impact those processes.

Students are expected to acquire quantitative reasoning, critical thinking, and other advanced skills that enable them to solve contemporary resource use and environmental problems and to assist in sound policy development and implementation. NREM graduates are skilled in addressing natural resources and environmental policy and management issues of the competing needs of diverse clientele and communities. Students are trained in the application of quantitative models to optimize the use and management of natural resources.

Natural resource and environmental management issues are attracting considerable national and global attention, as well as growing donor interest, especially in the Asia/Pacific and tropical and subtropical regions. Graduate training, therefore, features collaboration with national and international institutions to foster programs that provide students with opportunities to learn about the ways in which people from other countries and cultures manage their natural resources and interact with their environments. NREM has a diverse mix of domestic and international graduate students.

Graduating students are expected to serve as leaders and professionals in natural resources and environmental management and policy, academic teaching and research, and applied research and extension in educational and governmental institutions, international, national and state
technical assistance and policy agencies, agricultural and forestry industries, consulting firms, and private nonprofit and non-governmental organizations.

To underscore its integrative and global nature, the NREM Graduate Program features strong collaboration with other academic departments within and outside of the College of Tropical Agriculture and Human Resources (CTAHR), as well as selected collaborating institutions in and outside of Hawai‘i such as transitional economies in eastern Europe and the Middle East. In addition, Cooperating and Affiliate Graduate Faculty in NREM complement and supplement the Department’s expertise.

NREM Faculty

Graduate Program Committee
The graduate program committee is comprised of:

Program chair:

Dr. John Yanagida  
Office: Sherman 220  
Phone: (808) 956-2809, Fax: (808) 956-6539  
E-mail: jyanagid@hawaii.edu  
Website http://www.ctahr.hawaii.edu/nrem/staff/portfolio/yanagida.pdf

Members:

• Dr. PingSun Leung  
  Office: Gilmore 111  
  Phone: (808) 956-8562, Fax: (808) 956-6539  
  E-mail: psleung@hawaii.edu  
  Website: http://www.ctahr.hawaii.edu/LeungP/

• Dr. Creighton Litton  
  Office: Sherman 240  
  Phone: (808) 956-6004, Fax: (808) 956-6539  
  E-mail: litton@hawaii.edu  
  Website: http://www.ctahr.hawaii.edu/LittonC

Core Faculty

*R. L. Bowen, PhD (Associate Chair)—Natural resource policy, economics, sustainable agriculture  
*G. Bruland, PhD—Soil and water conservation, coastal resource management  
*C. Chan-Halbrendt, PhD (Chair)—International agricultural development and environmental economics  
*C. Ching, PhD—Policy and production economics  
*L. J. Cox, PhD—Community economic development
*S. E. Crow, PhD—Soil ecology and biogeochemistry
*C. I. Evensen, PhD—Natural resource management, environmental quality
*A. Fares, PhD—Watershed hydrology
*C. A. Ferguson, PhD—Natural resource and environmental policy
*J. B. Friday, PhD—Tropical forestry/agroforestry extension
*P. V. Garrod, PhD—Marketing and production economics
*C. Gopalakrishnan, PhD—Natural resource and environmental economics and policy
*T. W. Idol, PhD—Tropical forestry/agroforestry
  J. J. K. Leary, PhD—Invasive species control
*C. Lepczyk, PhD—Ecosystem management, wildlife ecology, landscape ecology
*P. S. Leung, PhD—Aquaculture and fisheries economics, systems modeling
*C. Litton, PhD—Terrestrial ecosystem ecology, biogeochemistry
*T. Miura, PhD—Geospatial analysis, remote sensing
  S. Y. Nagano, MS—4-H youth program, county extension
*J. F. Yanagida, PhD—Production economics, price analysis, international trade

Cooperating Graduate Faculty

*K. Burnett, PhD (UHERO)—Invasive species assessment and management
*J. DeFrank, PhD (TPSS)—Herbicide management
*A. El-Kadi, PhD (G&G/CEE)—Groundwater hydrology
*T. Giambelluca, PhD (GEOG)—Climatology, hydrology
*M. Habte, PhD (TPSS)—Soil ecology, microbiology
*N. V. Hue, PhD (TPSS)—Organic cycling
*Q. Li, PhD (MBBE)—Environmental chemistry
*T. Radovich, PhD (TPSS)—Organic and Sustainable farming
*C. Ray, PhD (CEE)—Ground water hydrology and chemistry
*G. Uehara, PhD (TPSS)—Systems simulation in agriculture
*H. Valenzuela, PhD (TPSS)—Vegetation physiology and management

*Graduate Faculty

Affiliate Graduate Faculty

K. Chaston PhD (NOAA)—Coral and coastal management
J. Fox, PhD (East-West Center)—Social forestry
Christian Giardina PhD (IPIF- USDA-FS) Forestry Ecology
J.B. Kauffman, PhD (USDA Forest Service)—Disturbance ecology
Y. Li, PhD (UH Hilo)—Forest ecosystem management
R. Mackenzie, PhD (USDA Forest Service)—Aquatic ecology
M. Pan PhD (NOAA Fisheries)—Fishery economics
Specialization Areas

NREM is an interdisciplinary department that offers integrative graduate curricula necessary for quality decision-making and solution-oriented natural resource and environmental management. As a foundation for graduate training, all NREM students are expected to acquire a common base of knowledge embodied in a set of core courses. Beyond that, students are expected to develop knowledge and skills within a chosen specialization area. This helps to ensure that students have the real-world skills needed to perform specific tasks, analyze resource management and policy issues, carry out original and meaningful research, and effectively perform outreach educational activities.

Examples of specialization areas include, but are not limited to:

- Aquaculture economics and management
- Coastal watershed management
- Contaminant hydrology
- Contaminant sources and transport in watersheds
- Ecological and environmental economics
- Economics of sustainable resource utilization
- Fishery economics and management
- Forest economics
- Forest ecosystem management
- Integrated resource management
- Irrigation and water management
- Land and water use policy assessment
- Land degradation processes and models
- Land resource inventory and interpretation
- Land, soil and water conservation reclamation and remediation
- Landscape ecology
- Natural resource and environmental non-market valuation
- Restoration ecology
- Remote sensing and geospatial analysis
- Sustainable community economic development
- Sustainable land and resource management
- Tropical forestry and agroforestry
- Water quality
- Watershed hydrology

The student’s advisor and thesis/dissertation committee will assist in choosing appropriate coursework and research or other activities to develop a specialization area. Students are expected to achieve this by the completion of their first year in the department.

Admission and Deficiencies

Regular, probationary, and conditional status is determined based on student’s academic performance at the time of application. If you are admitted as regular status, you may start your formal graduate program immediately. If you are admitted as probationary or conditional status, you have specific criteria that must be fulfilled such as a B.S. or MS degree, course deficiencies, GRE (expected minimum GRE score of 1,100), or other documents. These criteria are specified in your letter of acceptance, and should be discussed immediately with your advisor. It is
expected that a student will move from probationary and/or conditional status to regular status by the end of their first year by completing Form I. Applicants for the MS degree are required to have a BS or equivalent degree and applicants for the PhD degree are required to have an MS or equivalent degree.

The minimum required TOEFL score (for foreign applicants only) is: (a) MS student: 550, 213, or 80 for paper-based, computer-based, or internet-based examinations, respectively; and (b) PhD student: 600, 250, or 100 for paper-based, computer-based, or internet-based examinations, respectively. The TOEFL requirement applies to all foreign students, except those who are native speakers of English from Australia, Great Britain, Canada, New Zealand or Singapore. In addition, students who have received a bachelor's degree or an advanced degree from an accredited/recognized college within the last five years in the United States, United Kingdom, Canada, New Zealand, Singapore or Australia are exempt from the TOEFL requirement. Students with weak TOEFL scores if admitted are required to enroll in remedial ELI (English Language Institute http://www.hawaii.edu/eli/index.html) courses.

NREM requires prior completed coursework that is equivalent to or higher than NREM 310, NREM 220 (or ECON 130), NREM 203, CHEM 151+L, and BIOL 171+L (See UHM Course Descriptions at http://www.catalog.hawaii.edu/courses/description-index.htm). Students who do not have coursework in one or more of these areas may be accepted into the program, but will be required to make up course deficiencies within their first 1-2 semesters on campus.

Continuing Students for PhD Program
Requirements for students who complete the MS degree Plan A and would like to pursue the PhD degree.

1. GPA of 3.5 or higher
2. Evidence of research capability: a published article in a peer reviewed journal
3. Consultation with MS advisor regarding ability to conduct research.
4. Three letters of recommendation (one from MS advisor)

Advising for Beginning Students
Admitted students will check in with NREM staff (Lois Agena), her/his Advisor, or the Graduate Chair as soon as possible. An advisor has been identified for every student based on the student’s interest, with the consent of the advisor. The primary responsibilities of the advisor during your first semester on campus are to verify entrance and background deficiencies, prescribe remedial courses as early as possible in the student’s program, and provide guidance in course selection. All of these items should be completed by the end of the student’s first year. Submit Form I to Graduate Chair upon fulfilling all deficiencies. If you have no deficiencies, Form I should be submitted at the beginning of your first semester on campus.

Degree Offerings and Specific Requirements
A “NREM graduate course” is defined as a NREM course at the 500-level or above. A maximum of six credits of upper-division undergraduate coursework (i.e., 400-level) can be used towards
the “other than NREM graduate courses” degree requirement. For additional course applicability criteria refer the graduate division at [http://www.hawaii.edu/graduate/policies/html/courses.htm](http://www.hawaii.edu/graduate/policies/html/courses.htm).

NREM offers both MS and PhD degrees:

**MS Degree**

NREM offers three options for MS degrees

*Plan A*

Plan A is a thesis-driven, research degree and a student will only be accepted into this plan if a faculty sponsor has agreed to advise the student.

*Plan B*

Plan B is a course driven, professional degree that also requires an integrating capstone experience.

*Plan C*

Plan C is only for students with exceptional prior work experience which requires a minimum of two semesters of full time resident study at UHM and a final written and oral comprehensive examination.

Once admitted, MS students must select a specialization (Plan A) or concentration (Plan B) area with the approval of their advisor. To meet the integrative, interdisciplinary intent of the NREM program, a set of graduate level courses (the Primary MS Core) will be required of every student, regardless of his/her selected Plan option or specialization area.

**Requirements of MS Degree**

*Plan A*

In addition to the Primary MS Core, a set of electives are required for a total of 30 credits. Electives provide background in research methods and depth in the student’s area of specialization. The remaining credit requirements will be met with thesis credits (NREM 700) for conducting the research project. Once the thesis topic is finalize, a proposal for research must be approved by the committee. An oral defense of proposal in front of the committee members is also required for their final approval of the thesis topic. A public defense of thesis is also required and an announcement with thesis abstract, defense date, and location must be sent to the graduate program chair and graduate secretary **at least two weeks before the final defense.**
Primary MS Core (9 Cr)

- NREM 600 Evaluation of Natural Resources Management (3)
- NREM 601 Economic Analysis of Natural Resource Management (3)
- NREM 605 Research Skills (2)
- NREM 701 Research Seminar in NREM (1)

Electives (15 Cr)

- Course in graduate research methods (3)
- NREM graduate courses (6)
- Other graduate courses for specialization from within or outside of NREM (6); a maximum of 6 credits of upper-division undergraduate course credits (400-level) allowed.

Thesis Option (6 Cr)

- NREM 700 Thesis (6)

Plan B

Plan B is a course-driven professional degree that requires a total of 36 credits. Students are required to declare a concentration from one of four possible concentration areas. Courses include the Primary MS Core (9 credits), research methods (3 credits), a minimum of 9 elective credits from the chosen concentration area, a minimum of 3 elective credits from each of the other three concentration areas, and a 6 credit capstone experience. Of the 18 elective credits required at least 12 credits must be NREM courses; and no more than 6 credits from courses at the 400 level.

Primary MS Core (9 credits)

- NREM 600 Evaluation of Natural Resources Management (3)
- NREM 601 Economic Analysis of Natural Resource Management (3)
- NREM 605 Research Skills (2)
- NREM 701 Research Seminar in NREM (1)

Research Methods (3 credits)

- Course in graduate research methods (3)
Plan B Concentration Areas (total 18 credits)

Plan B students will select a concentration area from the 4 listed below. They are required to take a minimum of 9 credits from their concentration area and 3 credits from each of the other areas. The following list is not comprehensive, and substitutions will be considered at any time via a petition by a faculty advisor to the graduate committee.

Geospatial Analysis & Modeling

- GEOG 470 Remote Sensing
- NREM 477 GIS for Resource Managers
- NREM 627 Applied Microeconomic Analysis
- NREM 664 Small Watershed Modeling
- NREM 677 Advance Remote Sensing
- NREM/ECON/TPSS 429 Spreadsheet Modeling for Business and Economic Analysis

Natural Resources Economics and Environmental Planning

- NREM 420 Community and Natural Resource Management
- NREM 458 Project Evaluation and Resource Management
- NREM 637 Resource Economics
- NREM 671 International Agricultural Systems
- GEOG 621 Coastal Management and Planning
- GEOG 622 Environmental Impact Assessment
- PLAN 640 Land Use Policies and Programs

Land & Water Resource Management

- NREM 461 Soil and Water Conservation
- NREM 463 Irrigation and Water Management
- NREM 467 Natural Resource Conservation Planning
- NREM 612 Prediction and Controlling Degradation in Human-Dominated Terrestrial Ecosystems
• NREM 660 Hydrologic Processes in Soils
• NREM 662 Watershed Hydrology
• NREM 665 Coastal and Wetland Ecology and Management

Applied Terrestrial Ecology
• NREM 450 Wildlife Ecology & Management
• NREM 480 Applied Forest Ecology
• NREM 680 Ecosystem Ecology
• NREM 682 Restoration Ecology
• NREM 684 Landscape Ecology
• NREM 686 Forest Nutrition and Biogeochemistry

Plan B Capstone Experience (6 credits)
A capstone experience is required for all Plan B students (NREM 695 – M.S. Plan B Capstone). All capstone experiences require approval from the faculty advisor, the NREM 695 course instructor, and the Plan B Capstone Panel. The Capstone Experience requirement may be fulfilled in a number of ways, based on each individual student’s interests. In as much, it will vary from student to student, but typical capstone experiences will involve: (i) an internship/coop/special field experience; (ii) an investigation of a special topic; and/or (iii) development of a project, directed readings/study, or a research project. Each student is expected to take the primary role in identifying and organizing their capstone experience. In meeting this requirement, it will be important for students to demonstrate that they are getting an “integrative” experience in natural resources and environmental management. Each student will be required to give a public oral presentation and provide a written document on their capstone experience, both of which will be evaluated by a rotating, three member panel comprised of the NREM 695 instructor, the student’s advisor and an additional NREM graduate faculty member.

Plan C
Plan C is for students with exceptional prior work experience. Requirements include residence for two semesters of full-time study, a minimum of 18 graduate credit hours, and a final examination (written and oral). This option is only available to students who are mid-career professionals, having at least 5 years of relevant work experience in natural resources and environmental management.

Primary MS Core (9 credits)
• NREM 600 Evaluation of Natural Resources Management (3)
• NREM 601 Economic Analysis of Natural Resource Management (3)
• NREM 605 Research Skills (2)
• NREM 701 Research Seminar in NREM (1)

Electives (9 Cr)

NREM graduate courses (9 credits, with no more than 3 credits of NREM 699)

**MS Degree Checklists**

Use the following checklists, along with your advisor and the graduate committee, to help guide you through your graduate degree.
NREM Graduate Program  
MS Plan A Degree Checklist

Name: ______________________  Advisor: ______________________

1. Check for deficiencies and submit Form I for deficiency removal within the 1st year.

2. The MS Plan A Program requires 30 total credits, 9 of which are the Primary MS Core courses, 15 are elective courses, and 6 are thesis credits.

<table>
<thead>
<tr>
<th>NREM core courses</th>
<th>Semester Taken:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NREM 600</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 601</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 605</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 701</td>
<td>Semester: _______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective courses</th>
<th>Semester: _______</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course in graduate research methods (3)</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number________; Credits___</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM graduate courses (6)</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number________; Credits___</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number________; Credits___</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Other graduate courses for specialization (6)</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number________; Credits___</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number________; Credits___</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Thesis credits (6 Cr)</td>
<td>Semester: Fall   Spring</td>
</tr>
</tbody>
</table>

Form the thesis committee (by the end of 1st year) Date __________
Thesis proposal seminar Date __________
Submit Form II Date __________
Oral defense* Date __________
Submit Form III (After successful defense) Date __________
Submit Form IV (Final approval of thesis) Date __________
Application for Graduation Submitted Date __________ (Check graduate division timeline)

Note: Normally, only credits earned with required letter grades may be applied toward a graduate degree, with the following exceptions:

- Credits earned for courses offering only the Cr/NC option
- 699 credits earned with the Cr designation (up to six credits)

*Copy of thesis abstract, defense date, and location must be sent to the graduate program chair and graduate secretary at least two weeks before the final defense.
NREM Graduate Program

MS Plan B Degree Checklist

Name: ___________________  Advisor: ___________________  Concentration: ___________________

1. Check for deficiency and submit Form I for deficiency removal within the 1st year.

2. The MS Plan B Program requires 36 total credits. Courses include the Primary MS Core (9 credits), research methods (3 credits), a minimum of 9 credits from the chosen concentration area, a minimum of 3 credits from each of the other concentration areas, and a 6 credit capstone experience.

<table>
<thead>
<tr>
<th>NREM core courses</th>
<th>Semester Taken:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NREM 600</td>
<td>Semester: ______</td>
</tr>
<tr>
<td>NREM 601</td>
<td>Semester: ______</td>
</tr>
<tr>
<td>NREM 605</td>
<td>Semester: ______</td>
</tr>
<tr>
<td>NREM 701</td>
<td>Semester: ______</td>
</tr>
</tbody>
</table>

Research Methods
Course in graduate research methods (3)
Course Number_________; Credits___  Semester: ______

Courses in your concentration area (9)
Course Number_________; Credits___  Semester: ______
Course Number_________; Credits___  Semester: ______
Course Number_________; Credits___  Semester: ______

Courses in other concentration areas (9)
Course Number_________; Credits___  Semester: ______
Course Number_________; Credits___  Semester: ______
Course Number_________; Credits___  Semester: ______

Capstone Experience (6 Cr)
Semester:     Fall_____ Spring_____

Submit Form II  Date__________
Submit Form III  Date__________
Capstone Experience  Date__________
Application for Graduation Submitted  Date__________

Note: Normally, only credits earned with required letter grades may be applied toward a graduate degree, with the following exceptions:

- Credits earned for courses offering only the Cr/NC option
- 699 credits earned with the Cr designation (up to nine credits)
NREM Graduate Program  
MS Plan C Degree Checklist  

Name: ___________________  Advisor: ___________________

1. Check for deficiency and submit **Form I** for deficiency removal within the 1st year.

2. Requirements include residence for two semesters of full-time study, a minimum of 18 graduate credit hours, and a final examination (written and oral)

<table>
<thead>
<tr>
<th>NREM core courses (9)</th>
<th>Semester Taken:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NREM 600</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 601</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 605</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>NREM 701</td>
<td>Semester: _______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective (9)</th>
<th>Semester Taken:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Number ______  ; Credits _____</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number ______  ; Credits _____</td>
<td>Semester: _______</td>
</tr>
<tr>
<td>Course Number ______  ; Credits _____</td>
<td>Semester: _______</td>
</tr>
</tbody>
</table>

Submit **Form II**  
Date __________

Final Examination (written and oral)  
Date __________

Submit **Form III**  
Date __________

Application for Graduation Submitted  
Date __________
PhD Degree

The PhD degree in NREM is awarded only to students with outstanding scholarly achievement. Applicants for the PhD program are expected to have an MS degree. However, PhD standing may be provisionally granted to applicants with a BS degree if they have a strong academic record (i.e., Honors), research experience (i.e., prior scientific publication(s)) and high GRE scores. These applicants may still be required to obtain an MS degree in NREM before formal admission to PhD candidacy. Those with academic records that do not match NREM core requirements will be expected to incorporate these into their PhD program. In addition, to meet the integrative, multi-disciplinary intent of this program, a set of graduate level courses (Primary PhD Core) will be required of every student regardless of his/her selected specialization area. In addition, a set of electives will also be required. These electives are meant to provide background in research methods and depth in the student’s specialization area. The remaining degree requirements will be met by dissertation credits (NREM 800). All PhD students must pass a written and oral Comprehensive Examination (described below) before being advanced to candidacy. The student’s dissertation committee is responsible for designing and administering the Comprehensive Examination.

Requirements of PhD Degree

Primary PhD Core (7 Cr)

- NREM 611 Resource and Environmental Policy (3)
- NREM 612 Predicting and Controlling Degradation in Human-Dominated Terrestrial Ecosystems (3)
- NREM 701 Research Seminar in NREM (1)

Electives (24 Cr)

- Graduate research methods (6)
- NREM graduate courses (9)
- Other graduate courses for specialization from within or outside of NREM (9); a maximum of 6 credits of upper-division undergraduate course credits (400-level) allowed.
  - from within or outside of NREM (9)

Dissertation (1 Cr)

- NREM 800 Dissertation (1)

PhD Comprehensive Examination Policy
The final outcome of the comprehensive examination is the acceptance of the student to the Doctor of Philosophy candidacy in NREM. Based on this examination, the student’s committee will determine if the student: (i) is ready, (ii) needs to take more courses to remediate deficiencies in her/his training, or (iii) that the student is not fit for the doctoral degree program. In the process of administering the examination, the committee will test the rigor of the student’s training as: (i) a scientist in general (that the student can follow the scientific method and procedure to address a research problem and also has the analytical skills to conduct research), (ii) a scientist in NREM (has in-depth knowledge of what makes her/him unique compared to other graduates of UH that might have similar interests; in other words, a NREM student focusing on hydrology should not only be trained to deal with a hydrology problem but also should be able to address the natural resources and environmental management implications of that problem as compared to a hydrology graduate from Civil and Environmental Engineering or Geology and Geophysics or Geography), and (iii) a scientist in her/his specialty area (for example, a NREM PhD student with a specialty in hydrology should have more in-depth expertise in hydrology than other NREM PhD students working in other specialty areas e.g., Forestry, Ecological Management or Resource Economics).

Based on this understanding, the comprehensive examination questions can cover: (i) her/his specialty (i.e., hydrology, forest ecology and management), (ii) general topics related to NREM (i.e., core courses, background knowledge), (iii) knowledge of general research methods (i.e., statistics, analysis methods, etc.), and (iv) proposed dissertation research.

**Requirements:**

1. Take Written and then Oral Comprehensive Examinations on proposed dissertation research, courses, and specialty area when most coursework (~80%) and the research proposal have been completed.
2. Required public Seminar on Research Proposal (publically advertised at least two weeks in advance).
3. Required public Seminar on Dissertation Defense (publically advertised at least two weeks in advance).

**Guidelines:**

**Written Exam:**

- Student should begin scheduling and preparing for the examination at least 3 months in advance.
- Questions will be contributed by each committee member.
Questions from each Committee member should be related to course work and/or reading materials provided by the Committee member and from the proposed dissertation research. The student will send a list of courses that s/he has taken at UHM, and elsewhere to Committee members. All committee members should already have a copy of the research proposal. The student will also consult with each member individually for instructions as to areas to prepare for the exam.

No more than 24 contiguous hours to complete each committee member’s examination question(s), to be administered on same or separate days over a period not to exceed two calendar weeks.

Open or closed book, at each committee member’s discretion.

Committee members will have at least one week to review the answers and provide a grade of Pass, Low Pass, or Fail. Committee members will meet with the student to provide feedback from the examination.

Passing the written exam requires NO more than one failing grade from the committee. That is, if two or more members issue a failing grade on their questions, the written exam is considered a FAIL.

In the event of a failed written exam, the student will have one more opportunity to take another written exam within six months and with the same examining committee.

If the student passes the written exam, s/he will then proceed to the oral exam as described below.

Oral Exam:

The oral examination will be on the research proposal and on the written examination.

The primary deciding factor here is whether the student has sufficient course background and knowledge to be able to conduct the proposed research activities and whether the research activities are doable and of sufficient academic rigor.

In the event of a failed oral exam, the student will have one more opportunity to take another oral exam within six months with the same examining committee.

PhD Degree Checklist
Use the following checklist, along with your advisor and the graduate committee, to help guide you through your graduate degree.
NREM Graduate Program: PhD Degree Checklist

Name: ______________________  Advisor: ______________________

1. Check for deficiency and submit Form I for deficiency removal within the 1st year.
2. The PhD Program requires 32 total credits, 7 of which are the Primary PhD Core courses, and 24 are elective courses. For course policies see http://www.hawaii.edu/graduate/policies/html/courses.htm

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<thead>
<tr>
<th>NREM core courses</th>
<th>Semester Taken:</th>
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<tbody>
<tr>
<td>NREM 611</td>
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<th>Elective courses</th>
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Form the thesis committee (by the end of 1st year) Date________ (by end of 1st year)
Dissertation proposal seminar* Date________ (after forming committee)
Comprehensive exam Date________ (after finishing with 80% of course requirements)
Submit Form II Date________ (after successful proposal defense and comprehensive exam)
Oral defense* Date________
Submit Form III Date________ (After successful dissertation defense)
Submit Form IV Date________ (Final approval of dissertation)
Application for Graduation Submitted Date________

Note: Normally, only credits earned with required letter grades may be applied toward a graduate degree, with the following exceptions: (i) credits earned for courses offering only the Cr/NC option and (ii) 699 credits earned with the Cr designation.

*A copy of the dissertation abstract and seminar/oral defense date and location should be sent to the graduate program chair and graduate secretary at least two weeks before the proposal seminar or oral defense.
Other NREM Graduate Program Policies

1. A “NREM graduate course” is defined as a NREM course at the 500-level or above. A maximum of 6 credits at the 400-level may be taken to meet the “other than NREM graduate courses” degree requirement.

2. For those students who have an undergraduate and/or MS degree(s) in NREM and are continuing on for a PhD in NREM, the following rules apply:
   - Any courses (credits) used to fulfill a BS/MS degree requirement cannot be used toward a PhD degree requirement.
   - If NREM 611/612 (PhD primary core requirements) has been taken during the MS degree, that student must take other appropriate graduate level courses as a substitute to these courses. The student will consult with their advisor and committee members regarding what is considered to be an appropriate substitute course(s).
   - NREM 701 must be taken again to fulfill the core course requirements.

3. **Graduate Committee Members:** In addition to graduate committee requirements, graduate student must submit a petition (a memo and a CV of the proposed committee member) to the NREM Graduate Committee for approval to add a non UH-Manoa graduate faculty member to their graduate committee.

4. Note: a course used to meet a deficiency cannot be used to satisfy any other course requirement.

Permanent Advisor and Thesis/Dissertation Committee

Within two regular semesters of starting the NREM graduate program, all students should have established an effective working relationship with her/his permanent advisor. MS students should form their thesis committee by the end of their first year. PhD students should form their dissertation committees by the end of their first year and complete their comprehensive examinations by the end of the second year. PhD advisor must be NREM graduate faculty or cooperating graduate faculty. Submit Form II to Graduate Chair upon approval of research proposal by the committee (PhD students must have also passed their comprehensive examination at this juncture).

The advisor will guide the student’s program and assist with the development of a thesis/dissertation research topic and proposal, schedule and administer the Comprehensive (for PhD students only) and Defense examinations, and oversee the completion of the degree requirements. The latter two tasks will be assisted by the Committee as necessary. Refer to the section above, “PhD Comprehensive Examination,” for details.

Guidelines for MS Thesis Committee

A MS thesis committee must be headed by an NREM graduate faculty or cooperating graduate faculty member, and must consist of at least three professionals. The majority of committee members must be from the NREM graduate faculty, cooperating graduate faculty, or affiliate graduate faculty. Approval of a committee member outside the University of Hawaii must be approved first by the NREM graduate committee and then by the UHM Graduate Division. A fourth and/or fifth member may be added to the committee when deemed appropriate/necessary to provide required expertise, but the majority of committee members must still be from the
NREM graduate faculty, cooperating graduate faculty or affiliate graduate faculty. Consult with your major advisor about your research interest and potential thesis committee members. Committee members are responsible for providing feedback on proposed research, guidance on appropriate coursework and reviewing thesis drafts in a timely manner. A list of potential members who can be part of thesis committee can be found at [http://www.hawaii.edu/graduate/wa/selectmember.php](http://www.hawaii.edu/graduate/wa/selectmember.php)

**Guidelines for PhD Dissertation Committee**

PhD dissertation committee consists of a minimum of five professionals, all of whom must hold a PhD degree and the majority of whom must be graduate faculty, cooperating graduate faculty, or affiliate faculty members in NREM. One external committee member must be a graduate faculty member from a different department at the University of Hawai‘i. Your dissertation committee will be responsible for designing and proctoring the comprehensive exam, providing guidance on appropriate coursework, providing feedback on proposed research, and reviewing dissertation drafts in a timely manner. The dissertation committee chair shall have primary responsibility for the supervision of the student's work, setting deadlines, and guiding the student's progress. A list of graduate faculty qualified to serve on doctoral committee can be found at [http://www.hawaii.edu/graduate/wa/selectmember.php](http://www.hawaii.edu/graduate/wa/selectmember.php)

**Financial Support**

**Departmental Funding**

NREM department offers teaching assistantships (TAs) for up to 1 year and tuition waivers to a limited number of current and incoming graduate students on a competitive basis. An announcement will be made at the beginning of every semester and students interested in applying for these forms of financial assistance are encouraged to check with the graduate chair or department secretary about the deadlines and procedure for application.

**Research Assistantship**

NREM also offers research assistantships (RAs) to its current and incoming students through ongoing research projects. In general, an RA supports the research activities of a faculty who is the principal investigator (PI) of a funded project. The project PI is responsible for advertising and interviewing potential candidates.

**Graduate Student Organization Grant**

The graduate student organization (GSO) at the University of Hawai‘i at Mānoa, represents the academic interests of graduate students attending the university and endeavors to facilitate research initiatives from graduate students through its grants and awards program. The GSO
provides awards to graduate students for conducting research and attending conferences worldwide. Check with your NREM GSO representative about these programs and inform him/her before applying for funding. Interested students can also refer to the GSO website at http://gso.hawaii.edu/html/index.php for more information about application processes and eligibility criteria.

Other Financial Aid

Graduate Division Achievement Scholarship http://www.hawaii.edu/graduate/financial/html/awards.htm

East West Center Scholarships/Fellowships http://www.eastwestcenter.org/scholarships-fellowships/

Other funding opportunities http://manoa.hawaii.edu/grad/announce/

Resource Management Certificate

NREM is a partner in offering the multidisciplinary campus-wide Graduate Resource Management Certificate. The Graduate Resource Management Certificate is a cooperative program primarily involving the College of Social Sciences (Urban and Regional Planning, Anthropology, Economics, and Geography), the College of Tropical Agriculture and Human Resources (NREM), and the East-West Center (Program on Environment, Program on Resources: Energy and Minerals). Because of its diverse topical components, multidisciplinary faculty, and practical application throughout Asia and the Pacific, the program is ideal for students who are pursuing graduate studies in traditional disciplines and also seeking expertise in environmental resource management. To earn this certificate, students are expected to complete 15 credit hours, at least 9 of which are at the graduate level. For more information, contact the Department of Urban and Regional Planning (808-956-7381).
Courses

NREM courses

NREM 600 Evaluation of Natural Resource Management (3) Critical evaluation of natural resource management approaches. Emphasis on the physical, chemical, and biological aspects within an environmental context. Pre: graduate standing or advanced undergraduate standing, and consent.

NREM 601 Economic Analysis of Natural Resource Management (3) Lecture/discussion providing an economic framework for assessing natural resource management projects and environmental policies. Use of case studies to demonstrate applications of the framework in selected subject areas. Spring only. Pre: one ECON course.

NREM 605 Research Skills (2) Assists the student in developing skills necessary to write a research grant and design a research proposal. NREM majors only. A-F only. Fall only.

NREM 611 Resource and Environmental Policy (3) Exploration of institutional and policy dimensions of natural resource development, management, allocation, markets and pricing, focusing on their environmental impacts. Emphasis on policy analysis using case studies and empirical findings. Original paper required. A-F only. Pre: ECON 300 or ECON 301, or consent. Fall only.

NREM 612 Predicting and Controlling Degradation in Human-Dominated Terrestrial Ecosystems (3) Historic, present, and projected trends in understanding and managing human-dominated terrestrial ecosystems; predicting, measuring and mitigating degradation especially in terrestrial ecosystems with a focus on small volcanic islands in tropical settings. A-F only. Pre: 301 and 304 (or equivalent) and 600. Recommended 461, or consent. Fall only.

NREM 627 Applied Microeconomic Analysis (3) Economic applications to the agricultural and nonagricultural industries are emphasized. Econometric techniques are used to estimate demand, supply, production and cost functions which are analyzed in terms of economic theory and market information. A-F only. Pre: AREC 626 and ECON 627, or consent.

NREM 631 Sustainable Agriculture Seminar (2) Critical evaluation of existing and alternative cropping systems from a long-term perspective. Value conflicts and resolution. Pre: graduate standing or advanced undergraduate standing, and consent.

NREM 637 Resource Economics (3) Analysis of problems of development and management of natural resources with emphasis on resources in agriculture and role in economic development. Pre: ECON 608 and ECON 629. (Cross-listed as ECON 637)

NREM 652 Information Research Skills (1) Examines the use of libraries and information technology for scholarly investigation in support of scientific research; provides experience utilizing and critically evaluating a variety of print and electronic sources in basic and applied sciences. Pre: consent. (Cross-listed as ANSC 652, FSHN 652, and TPSS 652)
NREM 660 Hydrologic Processes in Soils (3) (2 Lec, 1 3-hr Lab) Hydrologic properties in soils and the processes involved in water infiltration drainage and solute transport. Emphasis on key parameters required for modeling. Recommended: CEE 424 or consent. Fall only. (Cross-listed as BE 664 and CEE 625)

NREM 662 Watershed Hydrology (3) Application of basic hydrologic processes and management practices occurring on small islands watersheds. Pre: 203 or equivalent and 304 or equivalent; or consent. (Once a year)

NREM 664 Small Watershed Modeling (3) Introduction to process-based modeling of watershed with emphasis on model applications. Deals with the characterization and simulation of small watershed hydrologic and pollutant transport processes. Pre: CEE 424 (or concurrent) or GG 425 (or concurrent) or BS degree from NREM, or consent. Spring only.

NREM 665 Coastal and Wet and Ecology and Management (3) Study of bogs, marshes, mangroves, sea grass beds, and coral reefs. Emphasis on the hydrology, biogeochemistry, physiology, productivity, and community dynamics of these systems. Response to perturbations and management strategies will also be discussed. Pre: advanced undergraduate coursework in hydrology, soils, and ecosystem ecology recommended. (Alt. years)

NREM 671 International Agricultural Systems (2) Analysis of trends and strategies in international agricultural research and development. International agricultural research centers (IARC), Food and Agriculture Organization (FAO), university networks and consortia, and private voluntary organizations (PVOs). Pre: graduate standing or advanced undergraduate standing, and consent.

NREM 677 Remote Sensing of the Environment (3) Fundamentals, techniques, and applications of remote sensing for natural resource assessments and environmental monitoring. Lab consisting of field radiometric exercises, computer modeling of energy-matter interaction, processing, and analysis of remotely sensed imagery. Pre: one physics course (e.g., PHYS 151), one calculus course (e.g. 203), and one statistics course (e.g. 310), or one introductory remote sensing course. (Alt. years)

NREM 680 Ecosystem Ecology (4) (2 Lec, 1 3-hr Lab) Principles of ecosystem ecology with emphasis on tropical forests, human impacts, and global environmental change. Factors controlling ecosystem structure, productivity, nutrient cycling, plant-soil-atmosphere interactions, and energy balance. Field and laboratory methods in ecosystem science. Pre: advanced undergraduate coursework in ecology and soil science; graduate standing; and consent. (Alt. years; Spring)

NREM 682 Restoration Ecology (2) Graduate seminar on foundations of restoration ecology, application of ecological theory to restoration practice. Emphasis on restoration of structure and function in degraded terrestrial ecosystems using case studies from Hawai‘i and around the world. Pre: advanced undergraduate ecology course and graduate standing, or consent. Completion of 680 recommended, but not required. (Alt. years; Fall)

NREM 691 Advanced Topics in Natural Resources and Environmental Management (V) Study and discussion of significant topics and problems at an advanced level. Offered by visiting or existing faculty as a special course. Repeatable one time. Pre: graduate standing or consent.
NREM 699 Directed Research (V) Repeatable. Pre: graduate standing.


Other Departments at UHM with potentially relevant courses

- Botany
- Civil and Environmental Engineering
- Geology and Geophysics
- Geography
- Zoology

Suggested Graduate Level Research Methods Courses (statistics)
Ultimately, the choice of a course to meet the graduate level research methods requirement is between the student, their advisor, and thesis/dissertation committee. Therefore, this list is not comprehensive.

BE 622 Experimental Methods in Cause-Effect Modeling (3) Factorial designs and fractional factorial designs for screening variable and response optimization, Response surface methodology. Experimental designs appropriate to building and testing multi-variable behavior relationships. Sequential experimental designs.

CEE 626 Surface Water Hydrology (3) Deterministic and probabilistic methods include reliability of empirical distributions, multiple regression analysis, extreme value analysis and domain of attraction. Short-memory models for stochastic simulation of streamflows include autoregressive, Markov chain and moving average models. Time series analysis of hydrologic data is discussed. Pre: consent. (Alt. years)

ECON 628 Quantitative Method (3) Probability; density and distribution functions; expectation, variance, and co-variance; central limit theorem; maximum likelihood methods; statistical estimation, testing and inference; bivariate regression. Pre: one of 321, AREC 310 or MATH 241 or consent. (cross-listed as AREC 626)

ECON 629 Econometrics (3) Specification, statistical estimation, inference and forecasting of econometric models. Includes advanced topics for single-equation models, pooled models, qualitative dependent variables, simultaneous systems, distributed lags, and time series. Pre: 628 or consent. (cross-listed as AREC 634)

ECON 686 Strategic Behavior and Experimental Economics (3) Experimental economics: methodology. Experimental game theory. Market experiments. Applications include: topics
in industrial organization, provision of public goods, asset markets, auctions. Repeatable one time. Pre: 606 and 608 or consent.

**ES 480 Qualitative Research Methods (3)** Introduction to qualitative data collection methods; explore methods of analyzing data including grounded theory method, discourse analysis and narrative analysis and those used in ethnic, gender and community studies. A-F only. Pre: one upper division ES or SOCS course or consent.

**MET 631 Statistical Meteorology (3)** Probability; frequency distributions of atmospheric variables; linear models; time series analysis (frequency and time domain); principal component analysis; statistical weather forecasting and verification. Pre: MATH 371 (alt. years)

**PLAN 605 Planning Models (3)** Allocation, decision, derivation, and forecasting models used in the analysis of demographic, economic, land use, and transportation phenomena in urban and regional planning. Repeatable one time. Pre: one of ECON 321, GEOG 380, or SOC 476; or consent.

**PPST 691 Methods of Demographic Analysis (3)** Statistical evaluation and analysis of population data; data sources; population growth; composition; standardization of rates; mortality and the life table; nuptiality and fertility distribution, migration, urbanization; projections and stable population theory. Pre: basic statistics or consent. (cross-listed as PH 659)

**SOC 605 Seminar in Advanced Statistics (3)** Multivariate analysis. Analysis of variance; multiple regression procedures; multiple classification analysis, stepwise regression, discriminant functional analysis and path analysis. Pre: 476

**SOC 605L Advanced Statistics Laboratory (1)** Required lab for computer applications for analysis of sociological data. CR/NC only. Pre: 476 or consent. Co-requisite: 605

**SOC 606 Research Methods and Design (3)** Emphasis on theory selection, theory construction and choice of research strategies

**SOC 608 Survey Research Design and Analysis (3)** Survey study designs, survey sampling, questionnaire construction, interviewing, pre-tests, pilot studies, logic of measurement and association, table construction and elaboration models. Pre: consent. (cross-listed as EDEA 608)

**SOC 609 Seminar Qualitative Research (3)** Advanced seminar on conducting fieldwork in natural social settings with emphasis on qualitative techniques, political and ethical considerations, data management and assessment, interpretation and reflexive writing. Repeatable once only. Pre: 478 or consent

**ZOOL 631 Biometry (4)** (3 Lec, 1/2 hr discussion) Basic statistical methods: design of studies; data exploration; probability; distributions; parametric and non parametric one-sample, two sample, multi sample, regression and correlation analysis; frequency tables. Pre: MATH 241 or consent
**ZOOL 632 Advanced Biometry (4)** (3 Lec, 1 2-hr Discussion) Multivariate statistical methods: multiple regression and correlation; multiway anova; general linear models; repeated measures and multivariate anova; loglinear analysis and logistic regression. Pre: 631 and MATH 241, or consent.

Graduate Level Research Methods Courses (field-practical)

**BE 606 Instrumentation and Measurement (3)** Measurement concepts and operating principles applied to the selection and use of instruments important to scientists and engineers dealing with biological systems, including automatic data acquisition and processing. Pre: CHEM 151, MATH 241 and ME 311 or consent

**COM 612 Communication Research Methods (3)** Introduction to the major steps in the research process. Emphasis on the methodological approaches to making choices among alternatives at each step of a research cycle

**GEOG 680 Geospatial Analysis of Natural Resource Data (3)** The application of geostatistics to estimate spatial dependence to improve soil and regional sampling; provide insight into underlying soil, geographic and geologic process, and to provide quantitative scaling up of point measurements to fields, regions and watersheds. State-space modeling also will be included. A to F only. Pre: 488, ZOOL 631, or Times Series Analysis course or consent (cross-listed as TPSS 680)
### Natural Resource and Environmental Management (NREM) Graduate Program

#### Tentative Plan of Courses

<table>
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<th>Student Name: __________________</th>
<th>Degree Sought:</th>
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<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>Credits</th>
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Approved: __________________  __________________
Committee Chair (Advisor)    Date
## NREM Graduate Course Offering Schedule (Tentative)

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Graduate Division Requirements

The margin settings, title page and signature page of the thesis or dissertation must meet Graduate Division requirements. Students who submit pages that do not meet these requirements will be asked to reformat the pages. Consult the Style and Policy Manual for Theses and Dissertations for details at http://www.hawaii.edu/graduate/thesdiss/html/style.htm.

Departmental Information

Conference Room Students may use the department conference room located in Sherman 103 for seminar presentation or for meetings directly related to NREM such as thesis defense. Please be sure to check and reserve the room with the NREM staff. The key for the conference room can be picked up from the office and must be returned when you are done.

Computers Many laboratories and the libraries on campus are equipped with personal computers for conducting research. CTAHR has its own computer lab and printing facility located in AgSci-215. See the link for lab use policies and access http://agsci002.ctahr.hawaii.edu/215Portal/.

Projectors and laptops are available for seminar presentations and NREM projects. Please check the equipment log located in Sherman 101 for reservation dates and times.

Fax Machine You may receive faxes related to NREM through the departmental fax machine. However, no personal faxing will be allowed.

Keys Graduate Assistants will be issued an office key at the time of hire. Please do not loan your key to unauthorized persons. If you lose a key, please notify the NREM staff as soon as possible. You must return all keys when your affiliation with the NREM department ends.

Laboratory and Field Equipment Laboratory and equipment needed for conducting research will be provided for all students by the department through their advisors.

Mailboxes You will be assigned a mailbox located in the department front office in Sherman 101. Check it daily for mail and other correspondence. The office is open from 7:45am – 11:45am and from 1:00pm – 4:45pm. Personal mail such as bank statements should be sent to your home address as the mailboxes are not secured.

Office Supplies Office supplies are not available for student use. However, some supplies are available for Graduate Assistants in relation to their departmental duties. Basic supplies for the offices of Graduate Assistants will be provided by the advisor.

Stationery & Shipping Supplies University of Hawaii stationary is available for Graduate Assistants for correspondence in relation to their official duties and should be approved by their advisors.

- Outgoing packages should be prepared and labeled and brought to the NREM office.
- An account number (obtained from supervisor) must be provided in order for us to schedule a pick-up (for FedEx and UPS).
- An outgoing mailbox is available in the department front office for stamped letters or on-campus mail.
• You may use the departmental address for mail delivery related to NREM. However, you are responsible for pick-up of large and bulky packages.

**Telephone Use** Long distance calls are not permitted on University of Hawaii telephones except for official business with advisor approval.

**University Vehicles** Only University of Hawaii employees (including Graduate Assistants) with a valid Hawaii driver’s license are allowed to drive University vehicles.

To rent a vehicle:

• Obtain a Daily Rental Request Form from NREM office.
• Complete the form and phone in your vehicle reservation to Transportation Services at X68875.
• Return the form to NREM office so that it can be faxed to Transportation Services.
• The original will be returned to your mailbox.
• Your must present the form to Transportation Services in order to obtain the vehicle.

**Xerox Copies** There is a departmental copy machine available in Sherman 101. Personal copies including class materials are 10 cents per page. A color copier is also available for use by Graduate Assistants for work-related projects.

**Desk Assignment** There are limited desk spaces for graduate students in the department. Check with your advisor for desk space in her or his lab. If your advisor cannot accommodate you then the department will try to find a desk space for you in one of our graduate student’s offices. Please contact the Graduate Chair for a desk assignment.

**Student Organizations**

Graduate Student Organization (GSO)  Web: gso.hawaii.edu

Every spring, a NREM GSO representative should be nominated and elected. The GSO representative should carry out the election for the next representatives.

Student Activity and Program Fee Board  Web: www.hawaii.edu/sapfb/

**Graduate School Forms**