Proposal for a Master of Environmental Management

Department of Natural Resources & Environmental Management
College of Tropical Agriculture & Human Resources
University of Hawai‘i at Mānoa

College: College of Tropical Agriculture & Human Resources
Planning Committee: Peter Garrod, Researcher, Catherine Chan-Halbrendt, Chair
Natural Resources and Environmental Management
Program Category: New
Department: Natural Resources and Environmental Management
Level of Program: Graduate
Degree Proposed: Master of Environmental Management
Proposed Implementation: Academic Year 2016-17
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Executive Summary

Essentially, this is a proposal to rename part of an existing degree, the plan B or non-thesis Master of Science in Natural Resources and Environmental Management, to a Master of Environmental Management. This simple name change will have two significant impacts. The first and most significant is that it will make our graduates more competitive, by providing them with a degree title that clearly describes their preparation as a professional in environmental management and is similar to those awarded by other institutions providing professional masters of environmental management degrees. For the same reason it will also facilitate future recruitment.

No new resources are requested and no impact on current course loads is anticipated. However, because this will create a new degree title (Master of Environmental Management) while leaving the existing degree title (Master of Science in Natural Resources and Environmental Management) in place for students writing a thesis, this is also a proposal for a new degree.

Overview
The Department of Natural Resources and Environmental Management (NREM) offers BS, MS and PhD degrees with current enrollments of 71, 42, and 21 students respectively (Fall 2015). The Master’s program has two tracks, Academic and Professional. The Academic or Plan A track requires a thesis and the Professional or Plan B track, requires more course work plus an externship/practicum. The first master’s degree was awarded in 2004, since then, 132 Master’s degrees have been awarded; of which 64 were academic (thesis) and 68 were professional degrees.

This proposal to change the degree title for the non-thesis or Plan B track from a Master of Science in Natural Resources and Environmental Management to a Master of Environmental Management (MEM) is consistent with the national Professional Science Masters movement. If approved, the department will offer two master’s degrees, the professional Masters in Environmental Management, and the academic Master of Science in Natural Resources and Environmental Management (thesis only).

The Master of Environmental Management or MEM degree is currently being offered by Yale, Duke, Portland State, Salisbury University, University of New South Wales, Webster University, University of Queensland, the Freie University (Berlin), and others. Very similar professional master’s degrees are being offered at many Mainland institutions, including Sustainability & Environmental Management (Harvard, St. Edward’s University), Environmental Studies (University of Pennsylvania ), Environmental Science and Management (UCSB), Environmental Policy and Management (Denver University, American Public University) and Environmental Science and Management (University of Rhode Island).

If this change is approved, NREM will then offer a BS, MS, and PhD in Natural Resources and Environmental Management and a Master of Environmental Management, and the MS degree will no longer have the non-thesis (Plan B) option. Most of our Plan B students (and future MEM students) are expected to be self-funded.

1 "The Professional Science Master's (PSM) is an innovative, new graduate degree designed to allow students to pursue advanced training in science or mathematics, while simultaneously developing workplace skills highly valued by employers. PSM programs consist of two years of academic training in an emerging or interdisciplinary area, along with a professional
Proposal

Background

NREM is a relatively new department, formed by merging the Department of Agricultural and Resource Economics with part of the Agronomy and Soil Science Department. Enrollment has been steadily increasing since the Department was created, reaching a high of 146. Current enrollment (Fall 15) is 134\(^2\).

The number of graduate students graduating per year has also increased, reaching 18 for academic year 2013-14. In recent years about 2/3 of the M.S. degrees were awarded to students receiving a professional master’s degree.

Students graduating with a master’s degree have found jobs in Universities, government agencies, the private sector, and non-profits. Anecdotally, graduates with professional science masters have been

\(^2\)The decline appears to be due to a temporary decline in undergraduate enrollment. Initial data for the upcoming semester indicate the undergraduate enrollment will revert to its previous levels.
quite successful in finding jobs directly related to their training, often with the organization where they interned. Some have also progressed to doctoral programs.

1. **Program Objectives and State Need:**

The educational objectives are well summarized by the NREM Graduate Student Learning Outcomes:

- Students demonstrate knowledge of social and ecological principles and the interdisciplinary aspects of natural resource and environmental management issues;
- Students can analyze and address natural resource and environmental management problems by using appropriate methods from social and/or natural science disciplines;
- Students can communicate effectively, both orally and in writing, to diverse audiences including professionals, resource managers, local communities and policy makers;
- Students can conduct a capstone project of professional quality to acquire practical experience by applying social and ecological principles, and
- Students can function as professionals in their specialization area by demonstrating responsible and ethical conduct, effective collaboration, informed decision making, and life-long learning.

**Expected Enrollment and Graduation Rate:** Based on recent enrollments in the Plan-B option of the MS in NREM, we expect to enroll 10 to 15 students per year, resulting in a standing enrollment of 25 to 35 students and a graduation rate of 9 to 14 students per year.

**State Need:** Since the 1960’s, there has been increasing interest in both the public and private sectors in environmental management and this has been augmented by the recent increased interest in sustainability. This has resulted in a continuing demand for professionals with training in environmental management. NREM M.S. graduates have consistently found jobs in public agencies (Local, State, National, and global), and in the private sector in Hawai’i and overseas.

The State projects an 8 percent increase in the demand for planners and 11 percent increase in the demand for biologists. MEM graduates will have the professional skills necessary to meet the demands of both. On any given day, there typically at least a half a dozen or more postings on the County, State, and Federal sites that would be appropriate for NREM graduates. There are also jobs available in the private sector, ranging from EIS (Environmental Impact Statement) work to management positions in private firms. A recent UHERO report estimated that there will be 49 new jobs per year in Hawai’i’s natural resource management sector.

Of the seven students who graduated with a non-thesis masters (the professional masters) this past spring (May 2015), five already have jobs consistent with their degree, one is continuing on for his Ph.D., and only one is still in the process of applying for a position (see page 10 for more information). This is truly an outstanding outcome.

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4 Recent Trends in Hawai’i’s Green Economy, K, Burnett and C. Wada, UHERO, Jan 2016.
2. Appropriateness of Objectives

The past and potential future impact of population growth, climate change, invasive species, past and future military activities, expanding infrastructure, and many other changes on Hawai‘i’s environment and agriculture sector have created a demand for trained professionals in environmental management, both in the private and public sectors.

Food security and sustainability are becoming increasingly more important locally, nationally, and internationally, creating a demand for professionals trained in both the natural and social science aspects of environmental management.

The proposed program is entirely consistent with the Department’s mission, “To be the premier resource for creating new knowledge and innovative solutions for agricultural, natural resource, and environmental management issues for the tropics.”

3. Program Organization

The MEM program described below is same as the existing Plan B MS program in NREM.

Admission: Applicants must have a B.A./B.S. with the qualifications necessary to gain admission to the UH Mānoa Graduate Studies (including TOEFL or IELTS scores for international applicants) as well as (i) undergraduate coursework documenting adequate preparation in the natural, social, and quantitative sciences; (ii) a minimum GRE score of 302-308 combined Verbal and Quantitative Reasoning; (iii) a well-written objective statement on why they want to pursue a MEM degree; and (iv) recommendation letters.

Advising: All MEM students will have a faculty advisor who is a member of the graduate faculty. See Attachment 1.

Academic Program: The MEM is a course-driven professional degree and requires a total of 36 credits. Students are required to declare a concentration from one of four possible concentration areas (see below). 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
- a maximum of 6 credits of upper-division undergraduate course credits (400-level) are allowed.

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5 The Department’s mission and vision statements are currently being revised.
Primary 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)

- A course in graduate research methods (3)

MEM Concentration Areas (total 18 credits)
MEM students will select a concentration area from the 4 listed below. Each student is required to take a minimum of 9 credits from their selected 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 by petitioning the NREM Graduate Committee via the student’s faculty advisor.

a. Environmental Policy & Economics (18 courses, 9 NREM) Focus is on the relationship between public policy, economics, and the environment as well as the design and implementation of appropriate policy.
   - GEOG 413 Resource Management
   - NREM 420 Community and Natural Resource Management
   - NREM/ECON/TPSS 429 Spreadsheet Modeling for Business and Economic Analysis
   - NREM 611 Resource and Environmental Policy
   - PLAN 620 Environmental Policies and Programs
   - GEOG 621 Coastal Management and Planning
   - GEOG 622 Environmental Impact Assessment
   - PLAN 625 Environmental Planning
   - NREM 627 Applied Microeconomic Analysis
   - PLAN 628 Urban Environmental Problems
   - NREM 637 Resource Economics
   - GEOG/PLAN 637 Environment and Development
   - PLAN 640 Land Use Policies and Programs
   - NREM 658 Advanced Environmental Benefit-Cost Analysis
   - NREM 671 International Agricultural Systems
   - PLAN 671 Disaster Management: Understanding the Nature of Hazards
   - NREM 691 Valuing Nature
   - NREM 691 Collaborative Natural Resource Management

b. Land & Water Resource Management (14 courses, 7 NREM) Focuses on the relationship between land and water policy and management and the environment.
   - ZOOL 410 Corals and Coral Reefs
   - GEOG 423 Human Dimensions of the Coastal Ocean
   - BOT/ZOOL 450 Natural History of Hawaiian Islands
   - HWST 457 ʻĀina Mauliola: Hawaiian Ecosystems
   - NREM 461 Soil and Water Conservation
   - NREM 463 Irrigation and Water Management
   - NREM 467 Natural Resource Conservation Planning
   - LWEV 588 Legal Aspects of Water Resources and Control
- NREM 612 Predicting & Controlling Degradation in Human-Dominated Ecosystems
- GEOG 618 Human Environment Systems
- HWST 650 Hawaiian Geography and Resource Management
- NREM 660 Hydrologic Processes in Soils
- NREM 662 Watershed Hydrology
- NREM 665 Coastal and Wetland Ecology and Management

c. **Applied Terrestrial Ecology (12 courses, 7 NREM)** Focuses on the interaction of ecology with environmental management.
   - BOT 444 Ethnoecology and Conservation
   - NREM 450 Wildlife Ecology & Management
   - NREM 480 Applied Forest Ecology
   - TPSS 481 Weed Science
   - TPSS 604 Advanced Soil Microbiology
   - BOT 651 Invasion Biology
   - BOT 661 Hawaiian Vascular Plants
   - NREM 680 Ecosystem Ecology
   - NREM 682 Restoration Ecology
   - NREM 685 Landscape Ecology
   - NREM/BOT/ZOOL 690 Conservation Biology
   - NREM 691 Forest Nutrition and Biogeochemistry

d. **Geospatial Analysis & Modeling (8 courses, 3 NREM)** Provides training in geospatial analysis and modeling in the context of effective and efficiently managing the environment.
   - GEOG 470 Remote Sensing
   - GEOG 472 Field Mapping
   - NREM 477 GIS for Resource Managers
   - NREM 664 Small Watershed Modeling
   - NREM 677 Remote Sensing of the Environment
   - TPSS/GEOG 680 Geospatial Analysis of Natural Resource Data
   - PLAN 673 Information Systems for Disaster Management and Humanitarian Assistance
   - ZOOL 750 Topics in Conservation Biology

**MEM Capstone Experience (6 credits):** A capstone experience is required for all MEM students. The capstone experience consists of:
- NREM 695 (1 cr.) Capstone Preparation, to be taken when the student is preparing their proposal;
- NREM 696 (3 cr.) Capstone Experience; and
- NREM 699 (2 cr.) Directed Research (with faculty advisor); to be taken when the student has completed their capstone experience and is writing up their final document.

All capstone experiences require approval from the MEM Capstone Panel, which consists of the faculty advisor, the NREM 695 course instructor, and an at-large Panel member.
The Capstone Experience requirement may be fulfilled in a number of ways, based on each individual student’s interests. Therefore it will vary from student to student, but typical capstone experiences include:
Each student is expected to take the primary role in identifying and organizing their capstone experience. Each student is required to provide and publically defend a written proposal. Upon completion of the capstone, a written report and a public defense will be evaluated by the MEM Capstone Panel.

A list of Faculty is attached (Attachment 1).

4. Student Demand. Who will enroll?

Each year we receive 50 or more completed applications for our graduate MS program, plus many more inquires. Of these we accept about 50%. Applications are received from students in Hawai‘i, on the mainland, and overseas. These are individuals interested in pursuing careers in resource management. Interests range from agricultural development, soil, water, pest, and forest management, to geospatial resource analysis.

The interest of potential students in a professional NREM master’s degree reflects both their interest in resource management and sustainability and the fact that there are jobs available for professionally trained individuals in this area. Support for this hypothesis can be found in the attached support letters as well in the employment history of past graduates.

However, it is not expected that changing the name will cause enrollment patterns will change very much. We expect a modest increase of about 10-20%. So far, about 60% of the graduates have been female, about 80% have been US citizens, and slightly fewer than 10% held a UH bachelor’s degree (which were more or less equally divided between Mānoa and Hilo). Based on last year’s enrollment in the MS program about 50 percent of the enrolled students are Hawai‘i residents.

As is true for many interdisciplinary programs, students come from a variety of academic disciplines. Past students had academic backgrounds ranging from social sciences to natural sciences, and also included students from professional schools such as business and education.

However, we are hoping that the name change, besides making our graduates more competitive in the market place, will also attract additional students interested in professional careers to our program.

5. What resources are required for implementation?

No new or additional resources are required. This proposal is designed to be budget neutral, i.e., to be implemented with existing resources. The renamed program will utilize the same resources as the current MS non-thesis program. NREM currently has offices in Sherman Labs and offers twenty-eight graduate courses. The renamed degree will utilize existing faculty and courses. A list of faculty is attached (Attachment 1) as well as a list of the current course offerings (Attachment 5).

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6 Past and current Plan B students (the professional science masters) had or have internships in the public, private, and non-profit sectors. For a significant number of the past graduates, the internship has led directly to a professional placement in the same organization.
In terms of resources that are used only by the professional masters, there are three courses, including one directed reading/research class, dedicated to the professional masters. Also, each student has a faculty advisor (some faculty are advising more than one student). This is a total of 4 units of scheduled classes, equivalent to 1/6 of an instructional FTE.

Library Resources: UH is fortunate to have an excellent research library on campus. A quick online search of the Hamilton Library database for the main areas covered in the professional master’s program revealed that there are extensive holdings. These include book titles as well as journal articles.

<table>
<thead>
<tr>
<th>Search Entry</th>
<th># of holdings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Policy</td>
<td>563,486</td>
</tr>
<tr>
<td>Environmental Economics</td>
<td>157,377</td>
</tr>
<tr>
<td>Land Resource Management</td>
<td>60,298</td>
</tr>
<tr>
<td>Water Resource Management</td>
<td>60,364</td>
</tr>
<tr>
<td>Applied Ecology</td>
<td>91,394</td>
</tr>
<tr>
<td>Geospatial Analysis</td>
<td>13,116</td>
</tr>
</tbody>
</table>

A brief review of the Journal holding revealed that the Library has all the relevant major journals. A partial list of the relevant journals currently in the Library is attached (Attachment 5).

6. Costs

To calculate the cost of a new degree, the best way is to estimate the amount of new resources, including faculty time, required to provide the new degree. This is the marginal cost of the additional degree. In this case, inasmuch as the degree is currently being offered, marginal cost should be approximated by the amount of resources that would be saved if the degree was not offered. As described above, this is 1/6 of an instructional FTE. With a standing enrollment of 25 plus students, this would make the program appear to be extremely efficient.

An alternative way would be to examine revenue generation. Last year (Fall 14 and Spring 15) there were 932 students who enrolled in and completed an NREM class. Of these 80 were enrolled in graduate courses. If instructional faculty FTE were prorated accordingly, slightly less than .5 FTE would be attributed to the graduate program, or less than .25 FTE to the professional master’s program.

The accompanying spreadsheet is designed to approximate average cost. This is a useful measure when examining budget issues. There are currently 5.2 instructional FTE in the Department. The faculty with instructional FTE are the instructors in the NREM undergraduate, masters, and doctoral programs. Undergraduate courses account for seventy-five percent of the course offering, this leaves 1.3 FTE for the graduate courses. Based on current enrolment it is projected that less than half the graduate students will be in the professional master’s program. The other half will be thesis masters and doctoral students. However, all the graduate courses are used by all the graduate students.

In completing the attached spreadsheet, it was assumed that, on average, 0.65 instructional FTE will be used in the professional master’s program. It also includes a modest increase in enrollment. We also
assumed that the professional masters’ students would be taking, on average, 9 units a semester, which is the necessary course load to graduate in 2 years. Note that per the cost template the program appears to generate enough tuition to support the program. Like most programs where the faculty are heavily engaged in research, a lot of research time is jointly used for instruction.

Overall, this proposal is cost neutral. Tuition revenues will continue to be a function of the number of revenue-generating students. Revenues should increase if the estimated demand projections for the professional master’s degree are correct.

7. How effectiveness will be demonstrated?

There are several ways to assess the effectiveness of a professional program. The bottom line, however, is the rate at which graduates find relevant employment and if this results in a successful career.

Spring 2015 MS Plan B “Professional Masters” Employment

<table>
<thead>
<tr>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Fish and Wildlife Service</td>
</tr>
<tr>
<td>Currently applying for jobs</td>
</tr>
<tr>
<td>Secretariat of the Pacific Community, Geoscience for Development Program</td>
</tr>
<tr>
<td>Kupu - also a PhD candidate in NREM</td>
</tr>
<tr>
<td>Same as previous employment</td>
</tr>
<tr>
<td>O’ahu Army Natural Resource Program</td>
</tr>
<tr>
<td>B &amp; L Seafood</td>
</tr>
</tbody>
</table>

Of the seven students who graduated this past spring, five already have jobs, one is in the Ph.D. program, and only one is still looking. This is an outstanding employment statistic. NREM is currently initiating a program to track its graduates. Social media will assist us greatly in keeping in touch with our graduates.

Another measure is the public and private demand for students as interns. In as much as net costs are important, the program should continue to enroll sufficient numbers of students.

In addition, each year NREM evaluates whether or not the Campus, College, and NREM Institutional and Student Learning Outcomes (SLOs) (NREM’s SLOs are listed on page 3) are met. Before the start of the Fall semester, the graduate committee (a standing faculty committee) reviews the syllabi for all the graduate courses to determine to what extent each class satisfies some or all of the SLOs. However, this is only part of the assessment process. The key to the professional master’s is the capstone experience. Each student is required to submit a capstone paper and to make an oral public presentation describing their project. Both the paper and the presentation are reviewed by the capstone committee composed of three faculty members, including their advisor, the instructor of their capstone course, and an at-large faculty member. To be judged satisfactory, not only must the paper and the presentation meet professional standards, the student must also be able to demonstrate that they were utilizing “NREM Skills” as defined in the SLO’s in a real world problem.
situation. Examples of recent (2014-15 academic year) capstone presentations by students in the professional master’s program follow:

<table>
<thead>
<tr>
<th>Capstone Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping Invasive Pine Trees with High Resolution Remote Sensing</td>
</tr>
<tr>
<td>Using Conceptual Ecosystem Modeling to Support the West Hawaii Integrated Ecosystem Assessment</td>
</tr>
<tr>
<td>Urban Forest Landscape Management Plan</td>
</tr>
<tr>
<td>Kōke‘e Post Fire Restoration Management Plan</td>
</tr>
<tr>
<td>Evaluation of an Integrated Hawaii-based Curriculum in Waipahu High School’s Natural Resource Pathway</td>
</tr>
<tr>
<td>Towards a Greener Campus – Planting Guidelines for Sustainable Landscaping at UH-Mānoa</td>
</tr>
<tr>
<td>Agricultural tourism in Hawaii: What Do Farmers Need in Order to Participate?</td>
</tr>
<tr>
<td>Valuing the Aesthetics of a Primary Koa Forest in Hawaii</td>
</tr>
<tr>
<td>DOFAW’s Forest Stewardship Program Advisor</td>
</tr>
<tr>
<td>Optimization of baseline soil carbon stock assessment across the Hawaiian Islands</td>
</tr>
<tr>
<td>Documenting the Genuine Progress Indicator in Hawaii</td>
</tr>
<tr>
<td>Inventory and assessment of native uplands on the Benton Lake National Wildlife Refuge</td>
</tr>
<tr>
<td>Enhancing and Promoting Hawai‘i’s Trails and Public Health</td>
</tr>
<tr>
<td>Consumer Preference for Banana Chip Product Attributes in Cagayan de Oro, Mindanao, Philippines</td>
</tr>
<tr>
<td>Evaluating the efficacy of large-scale rat control grids in Hawaii</td>
</tr>
<tr>
<td>Internship at the Secretariat of the Pacific Community, Applied Geoscience and Technical Division (SOPAC)</td>
</tr>
<tr>
<td>Drafting an Intellectual Property Rights Statement and Data Sharing Agreement for the Maui Nui Makai Network</td>
</tr>
<tr>
<td>Waipahu High School Natural Resources Pathway Program</td>
</tr>
</tbody>
</table>

To give an indication of the quality of the students in the non-thesis masters’ program and how well they are prepared for a professional career in resource management, a copy of the report sent to the Hau‘oli Mau Loa foundations detailing the accomplishments of the first cohort of NREM plan B students they sponsored is attached (Attachment 5).

**Conclusion**

This proposal for a new degree just makes sense. There are no additional costs, but the simple change in the name of the degree will make students earning this degree more competitive. The title is consistent with national trends in awarding professional science master’s degrees and is the same as or similar to degrees awarded at other U.S. and international universities. The end result will be that UH graduates will be even more competitive in the expanding field of resource management.
Attachment 1 – Faculty

K. Carlson, PhD – Agro ecosystems and human dimensions
C. Chan-Halbrendt, PhD —International agricultural development and environmental 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
J. B. Friday, PhD—Tropical forestry/agroforestry extension
P. V. Garrod, PhD—Marketing and production economics
T. W. Idol, PhD—Tropical forestry/agroforestry
J. J. K. Leary, PhD—Invasive species control
P. S. Leung, PhD—Aquaculture and fisheries economics, systems modeling
C. Litton, PhD—Terrestrial ecosystem ecology, biogeochemistry
T. Miura, PhD—Geospatial analysis, remote sensing
F. Inman-Narahari, PhD—Hardwood tree improvement and forest regeneration
K. L. Oleson, PhD —Ecosystem service valuation, environmental ethics, policy analysis
R. Ryals, PhD – Agricultural Ecosystem Ecology
Y. Tsang, PhD – Tropical Soils and Watershed Hydrology
M. Vaughan, PhD – Eco-cultural Restoration
J. F. Yanagida, PhD—Production economics, price analysis, international trade

Cooperating NREM 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
H. Valenzuela, PhD (TPSS)—Vegetation physiology and management

Affiliate NREM Graduate Faculty
G. Bruland, PhD (Principia College)—Soil and water conservation
K. Chaston (NOAA)—Coral and coastal management
D. Drigot (US Army Corp of Engineers)—Natural resource management
J. Fox, PhD (East-West Center)—Social forestry
C. Giardina, PhD (IPIF - USDA-FS)—Forest Ecology
S. A. Gray, PhD - Social-Ecological Modeling, Collaborative Resource Management
S. Hess (USGS-BRD)—Wildlife ecology and management
Y. Li, PhD (UH Hilo)—Forest ecosystem management
R. Mackenzie, PhD (USDA Forest Service)—Aquatic ecology
D. Meason, PhD (Scion, New Zealand)—Forest ecosystem analysis and modeling
M. Pan, PhD (NOAA Fisheries)—Fishery economics
S. Pooley, PhD (NMFS)—Marine resource economics
M. Robotham, PhD (USDA)—Conservation technology
C. Smith (USDA)—Soil genesis, survey and classification
M. Walker, PhD (Univ. of Nevada, Reno)—Water quality, microbiology
Attachment 2 – Journals in Hamilton Library

Advances in Space Research
Africa News Service
Agricultural Development & Equipments
Agriculture Ecosystems And Environment
American Behavioral Scientist
American Journal Of Agricultural Economics
Applied Geography
Australasian Journal of Environmental Management
Aviation Week & Space Technology
Benzinga.com
Biodiversity and Conservation
Biological Conservation
BioScience
Bulletin of Surveying and Mapping
Canadian Journal of Civil Engineering
Canadian Journal of Forest Research
Cartography and Geographic Information Science
Climatic Change
Computers & Geosciences(93)
Computers and Electronics in Agriculture
Computers and Geosciences(136)
Computers, Environment and Urban Systems
Computerworld
Conservation Biology
Ecological Applications
Ecological Economics
Ecological Management & Restoration
Ecological Modelling
Ecology
Ecology and Society
Ecology Law Quarterly
Economics Week
Ecosystems
Energy Policy
Engineering of Surveying and Mapping
ENP Newswire
Environment, Development and Sustainability
Environmental & Resource Economics
Environmental and Planning Law Journal
Environmental Earth Sciences
Environmental Economics And Policy Studies
Environmental Entomology
Environmental Management
Environmental Monitoring and Assessment
Environmental Pollution
Environmental Science & Technology
European Journal of Operational Research
Federal Computer Week
Forest Ecology And Management
Forest Policy and Economics
Geography and Environmental Planning
Geoinformatica
GeoJournal
Geomorphology
Geomorphology(58)
Geophysical Research Letters
Geophysical Research Letters
Global Change Biology
Government Computer News
GPS World
Human Ecology
IEEE Transactions on Intelligent Transportation Systems
IEEE Transactions on Power Delivery
International Forestry Review
International Journal of Environmental Studies
International Journal of Health Geographics
International Journal of Production Economics
Internet Wire
JAWRA Journal of the American Water Resources Association
Journal For European Environmental & Planning Law
Journal of Applied Ecology
Journal of Arid Environments
Journal of Biogeography
Journal of Coastal Research
Journal of Construction Engineering and Management
Journal of environmental economics and management
Journal of Environmental Economics and Policy
Journal of environmental management
Journal of Environmental Planning and Management
Journal of Forestry
Journal of Geodesy
Journal of Geophysical Research
Journal of Hydrology
Journal of Surveying Engineering
Journal of Sustainable Forestry
Journal of the American Planning Association
Journal of the American Water Resources Association
Journal of the Science of Food and Agriculture
Journal of Transportation Engineering
Journal of vegetation science
Journal of Wildlife Management
Journal of Zhengzhou Institute of Surveying and Mapping
Land Use Policy
Landscape and Urban Planning
Landscape Ecology
Marketwire Canada
Mena Report
Mondaq Business Briefing
Natural Resources Forum
Nature
Nature Biotechnology
New Phytologist
Oecologia
Planning UK
Plant and Soil
PR Newswire
Precision Agriculture
Proceedings Of The National Academy Of Sciences Of The United States Of America
Radio Science
Rangeland Ecology & Management
Science
Science of Surveying and Mapping
Science of the Total Environment
Sensors
Society & Natural Resources
Soil Biology And Biochemistry
Tectonophysics
Transactions in GIS
Trends in Ecology and Evolution
Water Resources Management
World development
Attachment 3 - Current Graduate Courses Offered by NREM

NREM 500 Master’s Plan B/C Studies (V) Enrollment for degree completion. Repeatable up to 3 credits. Pre: master’s Plan B or C candidate and consent.

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 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 658 Advanced Environmental Benefit Cost Analysis (3) Advanced environmental benefit-cost analysis will require that proficiency be demonstrated on fundamentals and address topics related to sustainability, including income equality, non-market goods, risk, cost of public funds, and the social discount rate.

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 marshes, mangroves, sea grass beds, and coral reefs. Emphasis on the hydrology, biogeochemistry, 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 consent. Recommended: either GEOG 470 or GG 460 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 (3) 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)

NREM 685 Landscape Ecology (3) Focuses on the history, theories, and contemporary views of landscapes; including scale, land cover, land use, landscape metrics, disturbance regimes, land management, landscape change, the relationship of landscapes to species, and modeling. Pre: graduate students, or consent. (Alt. years)

NREM 690 Conservation Biology (3) Theories and concepts of ecology, evolution and genetics for conservation of biological diversity. Topics will include restoration ecology, management planning, laws and policies, biological invasions. Pre: BIOL 375 and either ZOOL 480 or BOT 462; and either ZOOL 410, 439, 620, 623, BOT 453, 454, 456, or 492. (Cross-listed as BOT 690 and ZOOL 690)
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 695 Master's Plan B Capstone Preparation (1) Preparation for NREM Master's Plan B capstone experience. NREM majors only. A-F only. Pre: 600 (or concurrent), 601, 605 (or concurrent), a graduate methods course, and at least 12 graduate elective credits. (Fall only)

NREM 696 Master's Plan B Capstone Experience (3) Capstone experience for NREM Master's Plan B students. NREM majors only. A-F only. Pre: 695 or concurrent.

NREM 699 Directed Research (V) Repeatable unlimited times. Pre: graduate standing.

NREM 700 Thesis Research (V) Repeatable unlimited times.

NREM 701 Research Seminar (1) Presentation and discussion of student research proposals, theses and dissertations, and research presentations by NREM faculty, students, and invited speakers. A-F only. Pre: consent.

NREM 800 Dissertation Research (V) Repeatable.
Attachment 4 - Hauʻoli Mau Loa Fellowships (FALL 2012 - SPRING 2014)

The selectees for the 2012 Hauʻoli Mau Loa Fellowships in the Department of Natural Resources and Environmental Management (NREM) at the University of Hawaiʻi at Mānoa (UHM) successfully graduated in May 2014 with M.S. Plan B degrees in Natural Resources and Environmental Management (professional, course-driven M.S. degrees) focused in the Applied Terrestrial Ecology concentration area. Each student is currently employed as follows:

**Student #1**: After graduating from the NREM M.S. program at UH Manoa, Student #1 has been working as an aquaponics consultant for educational programs on Oʻahu to extend public awareness and understanding of concepts of sustainable agricultural in Hawaiʻi. Student #1 has also been working as a hatchery assistant at a disease-free tilapia hatchery and will soon begin training start-up farmers in techniques of aquaponic farming through a two-year training program. Additionally, in partnership with the Koʻolau Mountains Watershed Partnership, Student #1 has been propagating native plants for a restoration project at the Pali Lookout, aiming at raising public awareness of issues threatening native Hawaiian ecosystems and current efforts to restore them.

**Student #2** is currently working on the Oʻahu Early Detection Program (OED), a partnership between the Oʻahu Invasive Species Committee and the Bishop Museum’s Herbarium Pacificum. The goal of the OED program is to make efficient use of limited natural resource management agency funds by connecting scientific, herbarium-based data to invasive plant management in Hawaiʻi. This is done primarily by providing up-to-date distribution and weed threat information from herbarium records on invasive or potentially invasive species of concern to agencies, which then allows agencies to make informed decisions and keep weed management goals realistic. The work involves site surveys of plant introductions, plant identification, and communication with other land management agencies. The work also includes the opportunity to participate in the development of policies and plans for site-led weed management, as well as biosecurity issues statewide.

**Student #3** is currently employed with the Mauna Kea Watershed Alliance as a contractor to conduct botanical surveys for Kamehameha Schools Land Assets Division. Student #3 will start a full-time position with Mauna Kea Watershed Alliance on October 1, 2014 to assist with a variety of current projects: native ecosystem restoration (out-planting, weed control, fencing), youth education and public outreach, and botanical surveys.
Attachment 5

Letters of Support
February 13, 2015

Office of the Vice Chancellor for Academic Affairs
University of Hawaii at Manoa
2500 Campus Road
Hawaii Hall 209
Honolulu, HI 9622

Dear Sir or Madam:

It has been brought to our attention that the Department of Natural Resources and Environmental Management (NREM) at the University of Hawaii at Manoa is proposing to change the degree title for the non-thesis, or Plan B, degree from a Master of Science (M.S.) in Natural Resources and Environmental Management to a Master of Environmental Management (M.E.M.). The Division of Forestry and Wildlife supports the proposed graduate degree name change.

Our agency and partner organizations have a need for graduate-level professionals with the skill sets that this professional graduate degree offers. With the interdisciplinary skills in the natural and social sciences that these graduates gain in this professional graduate program, they will have the background and training to fill much-needed positions throughout the state. We frequently advertise for a variety of natural resource management positions in the fields of forestry, wildlife management, and GIS and often have difficulty in finding qualified applicants. We hope this program can continue to provide natural resource management agencies in Hawaii with locally educated professionals.

Sincerely,

Lisa J. Hadway
Administrator
To: Office of the Vice Chancellor for Academic Affairs, University of Hawaii at Manoa

This letter is regarding your request for my thoughts on a possible name change for the non-thesis, or Plan B, Master’s program in the Department of Natural Resources and Environmental Management (NREM) at the University of Hawaii at Manoa from a “Master of Science (M.S.) in Natural Resources and Environmental Management” to a “Master of Environmental Management (M.E.M)”. This change is certainly reasonable as it more accurately captures the nature of the program – a program that I have interacted with on multiple occasions and find to be one of the gems at the University of Hawaii. The change is in line with a national trend at top ranked universities to offer an MEM option to students seeking professional degrees in the natural resources. I see all positives and am in support of the proposed graduate degree name change. The USDA Forest Service, other conservation and natural resources management oriented organizations in Hawaii, and organizations across the tropics benefit enormously from the graduate-level professionals that leave NREM programs. They acquire the skill sets that this professional graduate degree offers, providing them with the background and training to fill much-needed positions in Hawaii and the region. Thank you for this opportunity to weigh in on this possible change.

Sincerely

Christian P. Giardina
Research Ecologist
Pacific Southwest Research Station

02/13/2015
To whom it may concern:

Kupu is a 501c3 nonprofit organization that provides meaningful environmental experiences for youth between the ages of 16 to 24. Over the past several years Kupu has partnered with UH Manoa’s Natural Resource and Environmental Management Department to provide college credit for youth participating in Kupu’s Summer Hawaii Youth Conservation Corps Gateway and Frontiers program. Some of Kupu’s program participants continue into the NREM Department after completing the Kupu internship.

Kupu is supportive of The Department of Natural Resources and Environmental Management offering a Master of Environmental Management (MEM) for students that are completing a non-thesis or Plan B track. This name change is consistent with the national Professional Science Masters movement.

The Master of Environmental Management or MEM degree is currently being offered by Yale, Duke, Portland State, Salisbury University, University of New South Wales, Webster University, University of Queensland, the Freie University (Berlin), and others. Very similar professional master’s degrees are being offered at many Mainland institutions, including Sustainability & Environmental Management (Harvard, St. Edward’s University), Environmental Studies (University of Pennsylvania), Environmental Science and Management (UCSB), Environmental Policy and Management (Denver University, American Public University) and Environmental Science and Management (University of Rhode Island).

This simple name change will have two significant impacts. The first and most significant is that it will make our graduates more competitive, providing students with a degree title that describes their preparation and that is similar to those awarded by other institutions providing this professional degree.

Mahalo again for your time!

Matthew Bauer
Chief Operating Officer- Kupu
February 11, 2015

Dr. Reed Dassenbrock  
Office of the Vice Chancellor for Academic Affairs  
University of Hawai‘i, at Mānoa  
2500 Campus Road  
Hawai‘i Hall 209  
Honolulu, HI 96822

Dear Dr. Dassenbrock,

I have learned that the Department of Natural Resources and Environmental Management (NREM) at the University of Hawai‘i at Mānoa is proposing to change the degree title for the non-thesis, or Plan B, degree from a Master of Science (M.S.) in Natural Resources and Environmental Management to a Master of Environmental Management (M.E.M). I am writing to tell you that we support the proposed graduate degree name change.

Hau‘oli Mau Loa Foundation has been working with NREM for the past several years by providing funding to support graduate assistantships for students from Hawai‘i who are interested in pursuing this degree so that they can obtain important conservation jobs across our state. This degree prepares them for such jobs and ensures they are well qualified when they apply. Through research we have done, both with UHERO and independently, we have found there are approximately 3,200 conservation jobs in our state and many of these require or prefer candidates who have a graduate degree. Thus far, we have found that the graduates of the NREM, Plan B M.S. are well qualified and able to secure good jobs in Hawai‘i. It is both the interdisciplinary skills in the natural and social sciences and the practical experiences they gain from their practicum that seem to prepare them well for employment.

We hope that you will support the proposed name change as proposed by NREM. Should you have any questions, please contact me.

Sincerely,

Janis A. Reischmann  
Executive Director

701 BISHOP STREET  
HONOLULU, HAWAII 96813  
T 808.545.4212
Attachment 6 – Costs and Revenues

Narrative for Academic Cost and Revenue Template

Headcount Enrollment and Annual SSH: Based on the number of students currently enrolled in the Plan B option of the MS in Natural Resources & Environmental Management degree.

Faculty FTE and Instructional Costs. There are three courses, including one directed reading/research course, dedicated to the professional master’s degree. Each student has a faculty advisor (some faculty members advise more than one student). We’ve estimated these faculty resources to total 4 units of scheduled classes, or the equivalent of 1/6 of an instructional faculty FTE. Total salaries (Section K) were calculated accordingly, using the average of faculty salaries in the Department.

Comparable Program: The Master of Business Administration degree was used as the comparable program. The MBA is a professional degree housed within a College that also offers a research degree (the PhD).
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</tr>
</tbody>
</table>

*Note: The table above is a simplified representation of the document content.*
Please include an explanation of this template in your narrative.

### A. Headcount Enrollment
- Headcount enrollment of majors each Fall semester. Located at url: [http://www.hawaii.edu/iro/maps.php?category=Enrollment](http://www.hawaii.edu/iro/maps.php?category=Enrollment) Campus data may be used when majors are a subset of enrollment reported in IRO reports.

### B. Annual SSH
- Course Registration Report located at url: [http://www.hawaii.edu/iro/maps.php?title=Course+Registration+Report](http://www.hawaii.edu/iro/maps.php?title=Course+Registration+Report) Add the SSH for the Fall and Spring reports to obtain the annual SSH. This is all SSH taught by the program, including to non-majors. Adjust if majors are subset of SSH reported.

### C. Instructional Cost without Fringe
- Fringe salary cost for all faculty and lecturers teaching in the program. *Formula for column D: =IF(OR(D32<>"",D36<>""),D31+D36,"")

### D. Other Personnel Cost
- Salary cost (part or full time) for personnel supporting the program (APT, clerical lab support, advisor, etc.) This includes personnel providing necessary support for the program who may not be directly employed by the program and may include partial FTEs. Add negotiated collective bargaining increases and 4% per year for inflation thereafter.

### E. Unique Program Cost
- Costs specific to the program for equipment, supplies, insurance, etc. For provisional years, this would be actual cost. For established years, this would be projected costs using amortization for equipment and add 4% per year for inflation thereafter.

### F. Total Direct and Incremental Cost
- **C + D + E** *Formula for column D: =IF(OR(D13<>"",D18<>"",D16<>"",D17<>""),SUM(D13,D16,D17),"")

### G. Fringe (automated calculation)
- Direct salary cost for all faculty and lecturers teaching in the program. *Formula for column D: =IF(D32<>"",D32+D34,"")

### H. Fringe/SSH
- **(K2 + K4) / B** *Formula for column D: =IF(D10<>"",SUM(D33,D35)/D10,"")

### I. Total Revenue
- **G + H** *Formula for column D: =IF(OR(D21<>"",D23<>""),SUM(D21,D23),"")

### J. Net Cost
- **F - I** This is the net incremental cost of the program to the campus. A negative number here represents net revenue (i.e., revenue in excess of cost.) If there is a net cost, please explain how this cost will be funded. *Formula for column D: =IF(AND(D18<>"",D16<>""),D18-D24,"")

### K. Salaries without Fringe
- Fringe for Full Time Faculty and Lecturers who are ≥ .5 FTE based on FTE directly related to the program. Add negotiated collective bargaining increases and 4% per year for inflation thereafter.

### L. Support Cost/SSH
- The campus' non instructional expenditure/ssh + systemwide support – organized research (UHM only) as provided by UH Expenditure Report (http://www.hawaii.edu/iro/maps.php?title=Expenditures+Study) *Formula for column D: =IF(OR(D37<>"",D38<>"",D39<>""),D37+D38-D39,"")

### M. Total Program Cost/SSH
- **K + L** *Formula for column D: =IF(OR(D31<>"",D38<>""),D31+D38,"")

### N. Total Campus Expenditure/SSH
- Taken from UH Expenditures Report. For example, for 2009-2010: UHM = $923-131 (organized research) = $792, UHH = $682, UHWO = $501, HawCC = $408, HonCC = $505, KapCC = $316, KauCC = $703, LeeCC=$300, Maui CC = $396, WinCC=$457

### O. Comparable Program/Division Instructional Cost/SSH
- Taken from UH Expenditures Report (http://www.hawaii.edu/iro/maps.php?title=Expenditures+Study) or campus data, as available. Please note in the space provided, the program used for the comparison.

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**Example for 2010-11 UH Expenditure Report**

- For example, from the 2010-11 UH Expenditure Report ([http://www.hawaii.edu/cgi-bin/iro/maps?esuhfy1011.pdf](http://www.hawaii.edu/cgi-bin/iro/maps?esuhfy1011.pdf)), the support expenditure/ssh per campus is:

<table>
<thead>
<tr>
<th>Campus</th>
<th>Support Expenditure/SSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>UHM</td>
<td>$907.00 + $56 - $128 for organized research = $435</td>
</tr>
<tr>
<td>UHH</td>
<td>$437.00 + $45 = $482</td>
</tr>
<tr>
<td>UHWO</td>
<td>$230.00 + $28 = $258</td>
</tr>
<tr>
<td>Haw CC</td>
<td>$155.00 + $34 = $189</td>
</tr>
<tr>
<td>Hon CC</td>
<td>$234.00 + $44 = $278</td>
</tr>
<tr>
<td>Kap CC</td>
<td>$123.00 + $29 = $152</td>
</tr>
<tr>
<td>Kau CC</td>
<td>$129.00 + $39 = $168</td>
</tr>
<tr>
<td>Lee CC</td>
<td>$125.00 + $27 = $152</td>
</tr>
<tr>
<td>Maui CC</td>
<td>$160.00 + $35 = $195</td>
</tr>
<tr>
<td>Win CC</td>
<td>$264.00 + $40 = $304</td>
</tr>
</tbody>
</table>

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