ACADEMIC REQUEST FORM (LEVEL I AND II) (7/17)

Please attach/submit additional documents as needed to fully complete each section of the form. Deadlines and instructions can be found on the Office of the Provost's curriculum website.

Proposals for a NEW degree or center require notification in advance of this proposal. See the Office of the Provost's curriculum website for information.

I. DEPARTMENT / PROGRAM

Water-Energy-Food Nexus Graduate Certificate

II. SUMMARY OF CHANGE REQUESTED (360 WORDS MAXIMUM)

What
A new graduate certificate focused on the water-energy-food nexus

Why
To capitalize on courses and workshops already being offered and provide students with credentials for completing graduate training focused on water, energy, and food

Resources
No new resources are required or requested. This certificate is supported by a National Science Foundation National Research Traineeship award to the UM BRIDGES program.

Relationship to similar MUS programs
Although there are programs within MUS with strengths in food, energy, or water, there are no MUS programs focused on the nexus of water, energy, and food systems.

III. ENDORSEMENTS AND APPROVALS

Requestor: Laurie Yung
(406) 270-7335  laurie.yung@umontana.edu

Program Directors: Laurie Yung
                        Andrew Wilcox
Geosciences Chair: James Staub
Dean: Tom Deluca
Dean: Chris Comer
Graduate School Dean (If Graduate Level)

Signature Date 9-11-17
Signature Date 9-13-17
Signature Date 9-13-17
Signature Date 9/14/17
Signature Date 9/14/17
Signature Date 9-14-17
IV. TYPE OF PROPOSAL

Any additional required forms are listed after each type of proposal and must accompany this form. Proposals for a new degree or center require notification in advance of this proposal. See the Office of the Provost's curriculum website for information and instructions.

Level I Proposals:

- 1a. Placing a program into moratorium (Program Termination Form)
- 1b. Withdrawing a program from moratorium
- 2. Adding, retilting, terminating or revising a campus certificate of 29 credits or fewer
- 3. Adding a BAS/AA/AS Area of Study
- 4. Offering an existing program via distance or online delivery
- 5. Retitling an existing postsecondary educational program
- 6. Terminating an existing postsecondary educational program (Program Termination Form)
- 7. Consolidating existing postsecondary educational programs (BOR Curriculum Proposal Form)
- 8. Adding a new minor where there is a major or concentration (option) in a major (BOR Curriculum Proposal Form)
- 9. Revising a program substantially (e.g. changing program focus) (BOR Curriculum Proposal Form)
- 10. Adding a temporary Certificate or AAS Degree Program Approval limited to 2 years

Level II Proposals:

- 11. Establishing a new postsecondary educational program (Curriculum Proposal and Reviewed Intent to Plan Form)
- 12. Exceeding the 120 credit maximum for baccalaureate degrees (Exception to policy 301.11)
- 13. Forming a college, division, school, department, institute, bureau, center, station, laboratory or similar unit (Curriculum Proposal or Center/Institute Proposal and Approved Intent to Plan Form)
- 14. Eliminating or consolidating an academic, administrative, or research unit.
- 15. Retitling an academic, administrative, or research unit.

V. CIP CODE (CLASSIFICATION OF INSTRUCTIONAL PROGRAMS)

The BOR requires a CIP Code (Classification of Instructional Programs) for tracking and reporting of degrees. Use the CIP Code website to identify the most applicable code.

CIP Code: __ 3.9999 __________

VI. METHOD OF DELIVERY

Will more than 50% of the proposed program be delivered via online or distance methods?

- Yes [x] No

Provide a brief description of the method of instructional delivery (i.e. percentage of face-to-face, hybrid, distance/online education).
100% face-to-face

VII. CATALOG LANGUAGE

Attach the current or proposed catalog language with any changes clearly identified.

Water-Energy-Food Graduate Certificate
Geosciences and the College of Forestry and Conservation

This graduate certificate is part of the UM BRIDGES program and focuses on the nexus of water, energy, and food systems. UM BRIDGES trains graduate students in STEM disciplines to conduct cutting-edge research on complex food, energy, and water problems and prepares these students to succeed in a range of science and science-related jobs through an innovative, interdisciplinary program.

For more information on UM BRIDGES please visit: [http://www.umt.edu/bridges/](http://www.umt.edu/bridges/)

**Requirements (13.0 credits total)**

**Core Courses**
*Students are required to take all 7.0 credits*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO/NRSM 540</td>
<td>The Food-Energy-Water Nexus</td>
<td>3.0</td>
<td>Fall only</td>
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<tr>
<td>GEO/NRSM 541</td>
<td>Food-Energy-Water Seminar I</td>
<td>1.0</td>
<td>Fall only</td>
</tr>
<tr>
<td>GEO/NRSM 541</td>
<td>Food-Energy-Water Seminar II</td>
<td>1.0</td>
<td>Spring only</td>
</tr>
<tr>
<td>GEO/NRSM 542</td>
<td>Food-Energy-Water Field Lab</td>
<td>2.0</td>
<td>Spring only</td>
</tr>
</tbody>
</table>

**Workshops**
One computational/quantitative skills workshop (Numeracy or Data Mining – offered rotating years)
Two communications workshops (both workshops offered every year)

**Electives**
*Students are required take 6.0 electives*
*Up to 6.0 credits from Elective List A can count toward certificate requirements. Only 3.0 credits from Elective List B can count toward certificate requirements.*

**Elective List A: Courses focused on water, energy, food, and related topics**
BIOB 480 Conservation Genetics
BIOB 506 Ecology
BIOE 416 Alpine Ecology
BIOE 438 Stream Ecology
BIOE 440 Conservation Ecology
BIOE 451 Landscape Ecology
BIOE 491 Aquatic Microbial Ecology
BIOE 453 Lake Ecology
BIOE 458 Forest and Grassland Ecology
BIOE 491 Drone Remote Sensing of Freshwater Ecosystems
BIOS 532 Ecosystem Ecology
NRSM 449 Climate Change Ethics and Policy
NRSM 460 Rangeland Management
NRSM 462 Rangeland Ecology
NRSM 465 Restoration Ecology
NRSM 575 Environment and Development
NRSM 513 Natural Resource Conflict Resolution
NRSM 515 Environmental Negotiation and Mediation
NRSM 532 Forest Ecosystem Analysis
NRSM 570 Political Ecology
NRSM 571 International Conservation and Development
NRSM 579 Collaborative Conservation
NRSM 595 International Water Governance
NRSM 622 Advanced Natural Resource Policy
PTRM 574 Human Dimensions of Natural Resources
PTRM 595 Conflict and Collaboration
WILD 410 Wildlife Policy and Biopolitics
WILD 568 Topics in Aquatic Ecology

Elective List B: Courses focused on skills relevant to the nexus
CSCI 444 Data Visualization
CSCI 558 Intro to Bioinformatics
CSCI 564 Applications Mining Big Data
CSCI 577 Simulation Modeling
CSCI 595 Big Data Science
ECNS 560 Advanced Econometrics
ENST 555 Research Methods for Social Change
FORS 503 Predictive Distribution Modeling
FORS 505 Sampling Methods
FORS 538 Ecological Statistics
FORS 551 Digital Image Processing
GPHY 465 Planning Principles and Processes
GPHY 466 Environmental Planning
GPHY 468 Community & Regional Analysis
GPHY 481 Advanced Cartographic Design
GPHY 482 Spatial Analysis and GIS
GPHY 487 Remote Sensing and Raster GIS
GPHY 486 Transport, Planning, and GIS
GPHY 564 Planning Design
GPHY 580 Seminar in GIS and Cartography
GPHY 587 Digital Image Analysis & Modeling
GPHY 588 Vector GIS
JRNL 505 Journalism and Environment
JRNL 570 Covering Environmental and Resource Issues
NRSM 500 Conservation Social Science Research Methods
PSCI 501 Public Administration
PSCI 504 Organizational Theory
STAT 451, 452, 457, 545, 548, or 549
WBIO 562 Wildlife Habitat Modeling
VIII. JUSTIFICATION

Provide enough information that someone without specialized knowledge can make an informed decision.

The proposed WEF Certificate will:

- Enable graduate students from a range of disciplines to gain expertise related to the water-energy-food nexus
- Provide relevant skills-based training opportunities in computational, numeracy, and communication skills
- Train students to be innovative, interdisciplinary thinkers prepared for a range of career paths
- Synergize faculty expertise and course content from different units on campus
- Cement UM as a leader in water-energy-food graduate education
- Help recruit graduate students interested in the water-energy-food nexus to UM

Additional information:

The proposed WEF certificate will be jointly housed in the College of Forestry and Conservation and in the Department of Geosciences. The core courses and workshops listed above are part of the UM BRIDGES program. New course proposals are being submitted for all of the core courses. The certificate will be coordinated/governed by the UM BRIDGES leadership team and faculty Steering Committee.

Why this certificate is needed now:

This curriculum is in place and fully funded. The first cohort of 16 graduate students began the training program in fall 2017. The certificate is needed now in order to fully credential these students and to cement UM as a leader in graduate training in the water-energy-food nexus, thereby helping to recruit more students to this program.

IX. SUBMISSION

1. Submit a hard copy of this form with all required signatures to the Office of the Provost.

2. Submit an electronic copy of this Word document, along with all other required BOR forms (in Word) to jasminezink.laine@msu.umt.edu

- After approval by the Provost, the proposal will be submitted to the Faculty Senate Office.
- After approval by the appropriate Curriculum Committee (ASCRC or Graduate Council), the full Faculty Senate must approve the proposal.
- Upon Faculty Senate approval, the Office of the Provost will submit the proposal to OCHE for the next possible OCHE/BOR meeting.
  - Note that BOR and internal UM deadlines require submission quite in advance of the BOR meeting.
- The Office of the Provost will notify the proposer once the change has been approved by OCHE/BOR.