The University Senate of Michigan Technological University

Proposal 44-15

(Voting Units: Full Senate)

"Proposal for a new Bachelor's of Science Degree in Natural Resources Management"

School of Forest Resources and Environmental Science

Contacts: Dr Joseph K. Bump, Chair, SFRES Curriculum Committee
Dr. Terry L. Sharik, Dean and Professor
Dr. Andrew J. Storer, Associate Dean and Professor

Latest revision – March 27, 2015

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I. General description and characteristics of program

A. Mission: To develop students with the skills and training to solve 21st-century natural resource challenges, and manage ecosystems and renewable resources sustainably. The broad purpose of the Bachelor of Science degree in *Natural Resources Management* (*NRM* hereafter) is to equip students with the knowledge, expertise, ethics, and perspective necessary to address complex environmental problems that relate to renewable natural resources.

B. Goals: Environmental problems are fundamentally natural resource and ecosystem management problems. Finding solutions and providing leadership on environmental issues requires a broad based foundation in natural resources science and ecosystem management. The School of Forest Resources and Environmental Science (SFRES) at Michigan Technological University (Michigan Tech) has broad expertise and offers three specialized degrees in natural resource fields (*Forestry*, *Wildlife Ecology and Management*, and *Applied Ecology and Environmental Sciences*). **The goal of this new major is to provide broad-based training and comprehensive understanding of the interdependence of ecological and sociopolitical systems in the context of natural resource and ecosystem management.**

C. **Objectives:** This proposal will implement an undergraduate Bachelor of Science degree program in *NRM* that 1) attracts students with diverse interests in environmental issues, natural resource science, sustainability, biomaterials, and ecosystem management; 2) provides a broad-based curriculum that will allow students to gain the knowledge and develop the skills necessary to design solutions for 21st-century environmental problems; 3) receives accreditation from Society of American Foresters as a Natural Resource and Ecosystem Management undergraduate degree program.

II. Rationale

A. National trends in natural resources: Nationally, enrollment in Bachelor of Science majors in the area of natural resources and environmental or ecosystem management are eclipsing more specialized programs (Figures 1 & 2). For example, the Society of American Foresters, which accredits our School's Forestry degree, developed accreditation standards for *NRM* majors for the first time in 2014. The proposed program aims to capitalize on this trend and anticipate future student interests and occupational trends. The job market for *NRM* is broader than our more specialized programs and this degree program provides a sound undergraduate education for students who wish to enter other areas of the job market or graduate school.

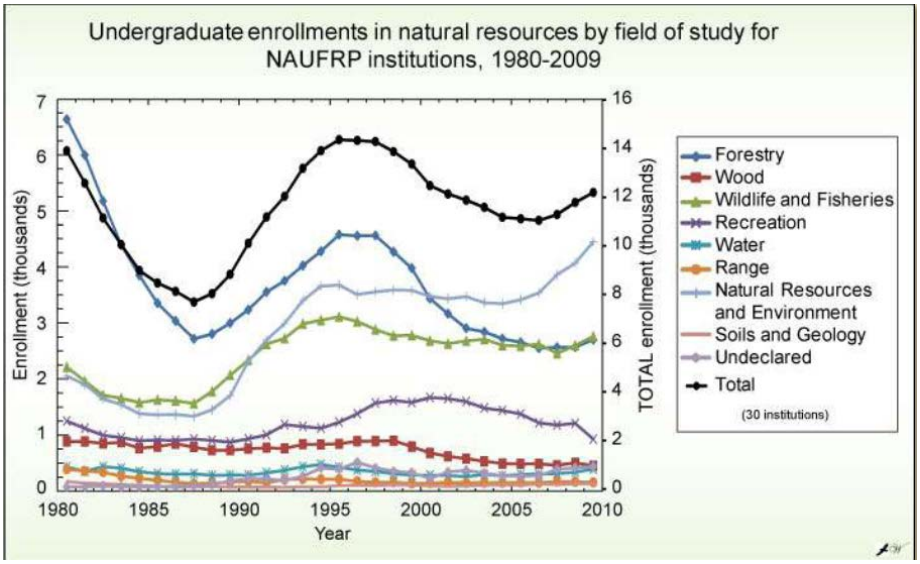


Figure 1. Undergraduate enrollment in Natural Resources by field of study for institutions in the National Association of University Forest Resource Programs (NAUFRP), 1980-2009.

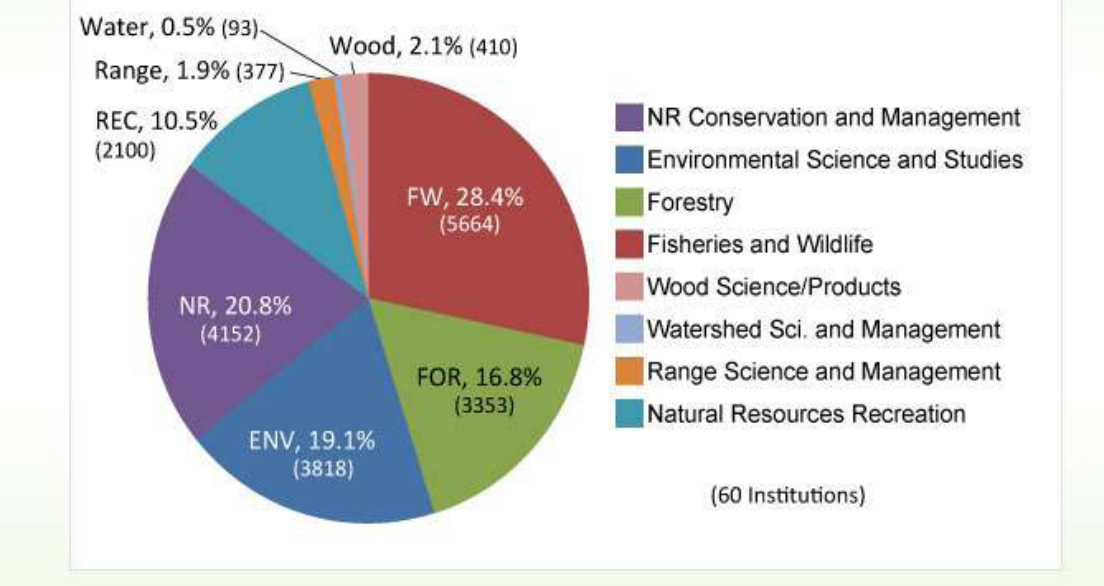


Figure 2. Proportion of undergraduate enrollment in Natural Resources in the National Association of University Forest Resource Programs (NAUFRP) in 2010.

B. Students: An increase in the number of students coming to Michigan Tech is expected with the implementation of this program, as it will appeal to a broader range of interests in natural resources and environmental science. Presently, the School of Forest Resources and Environmental Science has ~150 undergraduate students, divided among the *Forestry, Wildlife Ecology & Management*, and *Applied Ecology & Environmental Sciences* majors. Michigan Tech has a reputation, fostered by students and alumni alike, for having high standards for graduation. The quality of the School's incoming freshman compares very well with the at-large average for Michigan Tech. Students entering Michigan Tech average 27.0 on the ACT; those entering the School of Forest Resources and Environmental Science average 27.1. This standard will be maintained or enhanced with the addition of this degree program.

Approximately one third of the School of Forest Resources and Environmental Science undergraduates enter as transfer students. These students include internal transfers as well as students who transfer from community colleges and other programs outside Michigan Tech. We anticipate that the *NRM* major will attract transfer students from outside Michigan Tech as well as freshman students. This program will strengthen the bond between Michigan Tech and community colleges in the Upper Great Lakes Region.

The School of Forest Resources and Environmental Science offers financial aid to students which totals around 65K annually. In addition, many students have the opportunity to gain work experience working in faculty labs and on field-based projects supported by external grants and contracts.

C. Regional need: This program will uniquely satisfy a strong regional need. This need reflects the resource-based economy of the region. The universities in the Upper Great Lakes region lack a *NRM* program comparable to that proposed here. The program will

provide students with a broad educational experience, emphasize the development of skills and knowledge in natural resource science, but also address the sociological, political, and economic facets of natural resources and ecosystem management. This broad-based, multidisciplinary preparation will provide students with a background for employment potential in the diverse field of natural resources management. This field is anticipated to increase in the future due to high levels of interest in sustainable resource management, a growing biomaterials economy, and threats to resources posed by development, exotic species and global change.

D. Diversity: The Native American community is one of the target audiences, and recent trends in Native American enrollment in *NRM* degree programs demonstrate strong potential for development (Figure 3). In addition, recruitment of students that do not belong to any specific target audience is projected to be very successful. The Lake Superior basin, with its important natural and economic resources, including state and national parks, is an ideal training ground for natural resources managers.

E. Career flexibility: A Bachelor of Science Degree in *NRM* will prepare students for a wide variety of career options. Students may find employment as resource managers in the private sector, state and federal agencies, and non-governmental organizations. The *NRM* program will prepare students who want to develop more specialized skills at the graduate level through research or coursework based degrees. Other students will pursue this degree program due to their interests, and use it as a more broadly defined qualification as they enter the job market or graduate, law or business school.

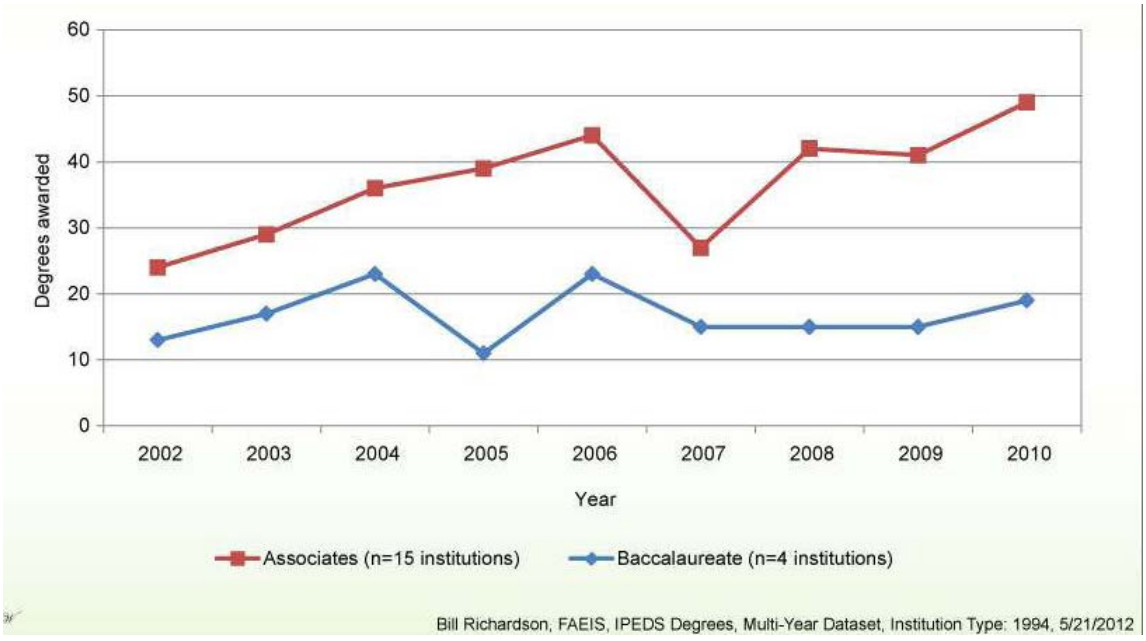


Figure 3. Associate and Baccalaureate degrees awarded in natural resource fields at tribal institutions in 2002-2010. 32 institutions reporting, FAEIS 2011.

F. University and School mission: The proposed program is consistent with the mission of Michigan Tech, especially in the areas of engagement to advance sustainable economic prosperity, ethical conduct and responsible use of resources. The proposed program addresses goal 2 in the strategic plan "A distinctive and rigorous action-based learning experience grounded in science, engineering, technology, sustainability, business, and an understanding of the social and cultural contexts of our contemporary world". It also contributes to Goal 1.2 as we work to increase diversity through this type of program offering. The mission of SFRES is to *foster excellence in forestry and ecological science.* The proposed program in *NRM* will contribute to this mission by training undergraduates to be environmentally responsible Natural Resource Management professionals in a broad and growing field.

III. Related Programs

A. Within the School of Forest Resources and Environmental Science: The current majors in *Forestry*, *Wildlife Ecology and Management*, and *Applied Ecology and Environmental Sciences* within SFRES offer students more specialized approaches to focused areas in natural resources. The new *NRM* major will focus on the broad spectrum of technical and vocational aspects of natural resources and ecosystem management that are common across natural resource fields and environmental management occupations. Interest in *NRM* is both long-standing and widespread, and is growing throughout the Upper Great Lakes Region and across the country.

B. Supporting Programs at Michigan Tech Many academic units at Michigan Tech offer coursework relevant to students pursuing the B.S. in *NRM.* The following academic units provide required or elective classes for students pursuing this degree, and have each been consulted in relation to the curriculum design: Departments of Biological Sciences, Social Sciences, Humanities, Mathematical Sciences, Geological Engineering and Sciences, and the School of Business and Economics.

C. At other institutions: There is no other Bachelor of Science program in *NRM* in the Upper Peninsula, although, in other states, many forestry programs or school's of natural resources offer similar programs that are very successful. Only one other institution nationally, SUNY ESF, has an accredited B.S. in natural resources and environmental management. The School of Natural Resources and Environment at The University of Michigan has a Resource Ecology Program at the graduate level and Michigan State University offers undergraduate degrees in Fisheries and Wildlife Management, and Environmental Studies and Applications. Hence, a *NRM* degree program at Michigan Tech is expected to offer a unique experience to high school students interested in careers that focus on environmental science and natural resource fields.

IV. Project how many students can be enrolled based on current faculty numbers or requested faculty lines.

We project an annual enrollment of 10-20 new students per year in this program with existing faculty numbers.

V. Scheduling plans (Extension, Evening, Regular).

Regular.

VI. Curriculum Design

To obtain a B.S. degree in *NRM,* students will be required to take a minimum of 69 credits in courses fundamental to natural resources management (offered by the School of Forestry and Environmental Science, Department of Biological Sciences, and Department of Mathematics), of which 9 credits are natural resource electives. In addition, 8 credits of social dimensions (5 required and 3 from an elective list), and 9 credits of economics, business, management, or marketing electives are required (Table 1). **SFRES faculty voted unanimously in support of this curriculum design.**

This program would be distinct from our other programs in that:

- It has a social/human dimensions sequence of 8 credits (5 credits more than our existing majors), with a minimum of 6 of these credits taught by faculty with primary appointments in the Department of Social Sciences.
- It has an economics/business sequence of 9 credits, with all 9 credits taught by faculty with primary appointments in the School of Business and Economics.
- It has a unique capstone class (3 credits); Biogeochemistry (3 credits), Natural Resources Ethics & the Environment (2 credits), and Natural Resource Conservation seminar (2 credits) required.

VII. New course descriptions.

Two new courses are needed for this program, *Biogeochemistry* and *Capstone Experience for in Natural Resources Management* (New Course Add Forms are in Appendix B). These courses will be taught by existing faculty members as part of their regular teaching load.

VIII. Model schedule demonstrating completion time.
Please see Figure 4.

IX. Existing Resources, Equipment, and Space

A. Faculty. All of the faculty in the School of Forest Resources and Environmental Science hold the Ph.D. degree, and many are considered national and international experts. They share a commitment to quality teaching and to providing an excellent learning environment. Active in their professions, the faculty share their expertise and keep current through research and by participating in conferences, presenting seminars, and publishing in professional journals: There are ~35 research and tenure-track faculty and administrators in the School who contribute to our undergraduate teaching mission. Full curricula vitae are available at http://www.mtu.edu/forest/about/faculty-staff/

B. **Physical Facilities:** The School of Forest Resources & Environmental Science occupies space in a number of buildings located on the campus of Michigan Technological University and in the surrounding local area. These include the UJ Noblet Forest Resource and Environmental Science building, the Ford Center and Forest, and the Isle Royale Sands Research facility. This space is adequate to meet the needs of this program.

C. Library Resources: The proposed degree is based on courses currently offered for Applied Ecology and Environmental Sciences, Wildlife Ecology and Management, Forestry, and Biological Sciences majors. The basic library resources are already in place supporting these programs, including journals, electronic databases, government documents and access to interlibrary loan services

As the program matures, specific deficiencies in the Library holdings may become apparent. A reevaluation of library resources, with the potential of adding new resources should be included in the program assessment when it reaches its enrollment capacity.

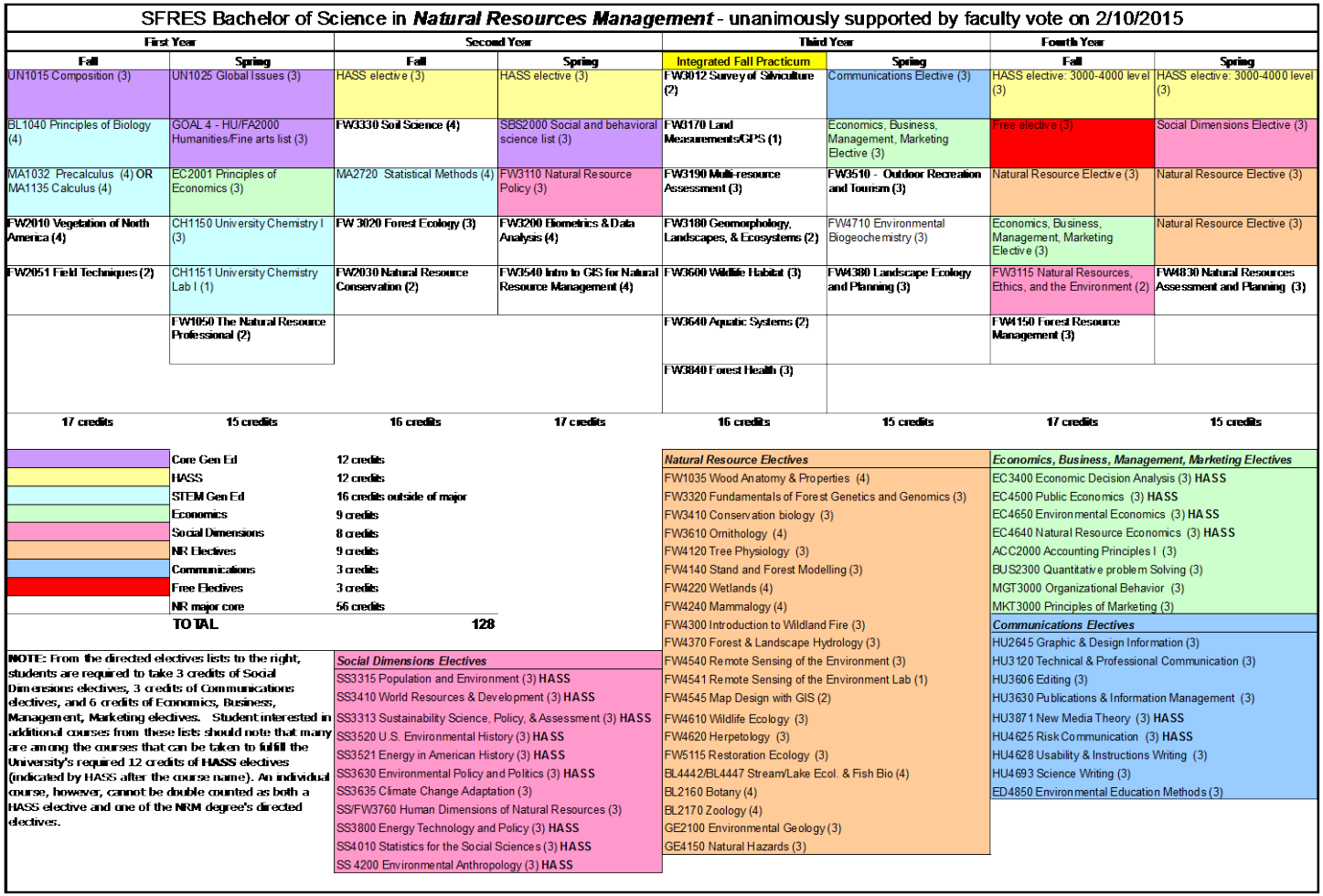
Table 1: Curriculum design for proposed B.S. in Natural Resources Management

Major Requirements

Course	Title	Credits
FW2010	Vegetation of North America	4
FW2051	Field Techniques	2
FW1050	The Natural Resources Professional	2
EC2001	Principles of Economics	3
FW2030	Natural Resources Conservation	2
FW3330	Soil Science	4
FW3020	Forest Ecology	3
FW3200	Biometrics & Data Analysis	4
FW3540	Introduction to GIS for Natural Resource Management	4
FW3110	Natural Resource Policy	3
FW3012	Survey of Silviculture	2
FW3170	Land Measurements/GPS	1
FW3190	Multi-resources Assessment	3
FW3180	Geomorphology, Landscapes, & Ecosystems	2
FW3600	Wildlife Habitat	3
FW3640	Aquatic Systems	2
FW3840	Forest Health	3
FW3510	Introduction to Outdoor Recreation and Tourism Systems	3
FW4710	Environmental Biogeochemistry	3
FW4380	Landscape Ecology and Planning	3
FW3115	Natural Resources, Ethics, and the Environment	2
FW4150	Forest Resource Management	3
FW4830	Natural Resources Assessment and Planning	3
	Directed Electives (Social Dimensions 3, Business related 6, Communications 3, Natural Resource 9)	21
	Gen Ed Core	12
	Gen Ed LG-HASS	12
	Gen Ed STEM	16
	Free Electives	3
	Total	128

A total of 128 credits will be needed to graduate in this degree program with students receiving a Bachelor of Science in four years (Figure 4 – course sequence).

Figure 4. Course Sequence for B.S. in Natural Resources Management



SFRES Bachelor of Science in ***Natural Resources Management*** - unanimously supported by faculty vote on 2/10/2015

First Year		Second Year		Third Year		Fourth Year	
Fall	**Spring**	**Fall**	**Spring**	**Integrated Fall Practicum**	**Spring**	**Fall**	**Spring**
UN1015 Composition (3)	UN1025 Global Issues (3)	HASS elective (3)	HASS elective (3)	**FW3012 Survey of Silviculture (2)**	Communications Elective (3)	HASS elective: 3000-4000 level (3)	HASS elective: 3000-4000 level (3)
BL1040 Principles of Biology (4)	GOAL 4 - HU/FA2000 Humanities/Fine arts list (3)	**FW3330 Soil Science (4)**	SBS2000 Social and behavioral science list (3)	**FW3170 Land Measurements/GPS (1)**	Economics, Business, Management, Marketing Elective (3)	Free elective (3)	Social Dimensions Elective (3)
MA1032 Precalculus (4) **OR** MA1135 Calculus (4)	EC2001 Principles of Economics (3)	MA2720 Statistical Methods (4)	FW3110 Natural Resource Policy (3)	**FW3190 Multi-resource Assessment (3)**	**FW3510 - Outdoor Recreation and Tourism (3)**	Natural Resource Elective (3)	Natural Resource Elective (3)
FW2010 Vegetation of North America (4)	CH1150 University Chemistry I (3)	**FW 3020 Forest Ecology (3)**	**FW3200 Biometrics & Data Analysis (4)**	**FW3180 Geomorphology, Landscapes, & Ecosystems (2)**	FW4710 Environmental Biogeochemistry (3)	Economics, Business, Management, Marketing Elective (3)	Natural Resource Elective (3)
FW2051 Field Techniques (2)	CH1151 University Chemistry Lab I (1)	**FW2030 Natural Resource Conservation (2)**	**FW3540 Intro to GIS for Natural Resource Management (4)**	**FW3600 Wildlife Habitat (3)**	**FW4380 Landscape Ecology and Planning (3)**	FW3115 Natural Resources, Ethics, and the Environment (2)	**FW4830 Natural Resources Assessment and Planning (3)**
	FW1050 The Natural Resource Professional (2)			**FW3640 Aquatic Systems (2)**		**FW4150 Forest Resource Management (3)**	
				FW3840 Forest Health (3)			
17 credits	**15 credits**	**16 credits**	**17 credits**	**16 credits**	**15 credits**	**17 credits**	**15 credits**

	Core Gen Ed	12 credits
	HASS	12 credits
	STEM Gen Ed	16 credits outside of major
	Economics	9 credits
	Social Dimensions	8 credits
	NR Electives	9 credits
	Communications	3 credits
	Free Electives	3 credits
	NR major core	56 credits
	TOTAL	**128**

NOTE: From the directed electives lists to the right, students are required to take 3 credits of Social Dimensions electives, 3 credits of Communications electives, and 6 credits of Economics, Business, Management, Marketing electives. Student interested in additional courses from these lists should note that many are among the courses that can be taken to fulfill the University's required 12 credits of **HASS** electives (indicated by HASS after the course name). An individual course, however, cannot be double counted as both a HASS elective and one of the NRM degree's directed electives.

Social Dimensions Electives
SS3315 Population and Environment (3) **HASS**
SS3410 World Resources & Development (3) **HASS**
SS3313 Sustainability Science, Policy, & Assessment (3) **HASS**
SS3520 U.S. Environmental History (3) **HASS**
SS3521 Energy in American History (3) **HASS**
SS3630 Environmental Policy and Politics (3) **HASS**
SS3635 Climate Change Adaptation (3)
SS/FW3760 Human Dimensions of Natural Resources (3)
SS3800 Energy Technology and Policy (3) **HASS**
SS4010 Statistics for the Social Sciences (3) **HASS**
SS 4200 Environmental Anthropology (3) **HASS**

Natural Resource Electives
FW1035 Wood Anatomy & Properties (4)
FW3320 Fundamentals of Forest Genetics and Genomics (3)
FW3410 Conservation biology (3)
FW3610 Ornithology (4)
FW4120 Tree Physiology (3)
FW4140 Stand and Forest Modelling (3)
FW4220 Wetlands (4)
FW4240 Mammalogy (4)
FW4300 Introduction to Wildland Fire (3)
FW4370 Forest & Landscape Hydrology (3)
FW4540 Remote Sensing of the Environment (3)
FW4541 Remote Sensing of the Environment Lab (1)
FW4545 Map Design with GIS (2)
FW4610 Wildlife Ecology (3)
FW4620 Herpetology (3)
FW5115 Restoration Ecology (3)
BL4442/BL4447 Stream/Lake Ecol. & Fish Bio (4)
BL2160 Botany (4)
BL2170 Zoology (4)
GE2100 Environmental Geology (3)
GE4150 Natural Hazards (3)

Economics, Business, Management, Marketing Electives
EC3400 Economic Decision Analysis (3) **HASS**
EC4500 Public Economics (3) **HASS**
EC4650 Environmental Economics (3) **HASS**
EC4640 Natural Resource Economics (3) **HASS**
ACC2000 Accounting Principles I (3)
BUS2300 Quantitative problem Solving (3)
MGT3000 Organizational Behavior (3)
MKT3000 Principles of Marketing (3)

Communications Electives
HU2645 Graphic & Design Information (3)
HU3120 Technical & Professional Communication (3)
HU3606 Editing (3)
HU3630 Publications & Information Management (3)
HU3871 New Media Theory (3) **HASS**
HU4625 Risk Communication (3) **HASS**
HU4628 Usability & Instructions Writing (3)
HU4693 Science Writing (3)
ED4850 Environmental Education Methods (3)

D. Computer Facilities

The existing computer facilities are adequate to support this program. This includes computer teaching labs in SFRES and around campus, software and network access. GIS and Remote Sensing software utilized for teaching includes: ERDAS, Arc/Info, and ArcView. The major portion of undergraduate instruction in geographic information systems is conducted in a computer teaching laboratory that exists for this purpose.

X. Program Administration, Policies, Regulations and Rules.

Responsibility for administration of the program will reside with the Dean of the School of Forest Resources and Environmental Science, who reports to the Executive Vice-President and Provost for Academic Affairs.

XI. Accreditation requirements.

A goal in developing this new degree is to meet The Society of American Foresters accreditation standards for *NRM* programs. The proposal and specifically the curriculum were developed with these standards in mind. These requirements are available at http://www.safnet.org/education/AccHdbk_Dec2014.pdf

XII. Planned implementation date.

Fall 2015

XIV. Program costs, years 1, 2, and 3.

No new resources are requested at this time. Classes to be offered under this proposal are either already offered and can accommodate the students in this program, or are being proposed as part of regular faculty workloads.

Please see Appendix B, Financial Documentation.

Approvals:

Faculty of SFRES – Feb 10, 2015 (unanimous)

Provost's Office

University Senate

Provost and University President

Board of Control

MichiganTech

— Course Add Proposal —

PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at http://www.mtu.edu/registrar/faculty-staff/course-proposal/

1) Course Information

Is this a **half-semester course proposal?** ☐ Yes ■ No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details: http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm

Course Prefix/Number *(i.e. MEEM 2110)*: FW xxxx

Course Title *(abbreviated; used on transcript - Up to **30** characters including spaces)*

Natural Resourc. Assess. & Plan.

Alternative Title for Catalog *(Up to **100** characters including spaces)*

Natural Resources Assessment & Planning

2) Credits

Number of credits assigned to this course 3

OR

Range of credits if **variable** ☐ to ☐ *(Number of credits to be taken in a given semester)*

3) Schedule

Contact Hours per Week *(Lec & Rec: 1 credit =1 contact hour; Lab: 1 credit =1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab)*

☐	2	1
Lecture	Recitation	Lab

OR

Research Course? ☐ Yes ☐ No

OR

Special Topics Course? ☐ Yes ☐ No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

■ No

☐ Yes, for a maximum of _____ credits. *(Must be a multiple of the course credits, i.e. Research or Special Topics)*

☐ Yes, for an unlimited number of credits. *(i.e. Music, Varsity sports, etc.)*

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY**? *(grade of S or E)* ☐ Yes ☒ No

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6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? ☐ Yes ☒ No

If yes, what is the other subject and course number? _____

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? ☐ Yes ☒ No

If yes, what is the subject and course number of the dropped course? _____

---

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses MUST be offered during the same term):

Required corequisite course(s):

_____

_____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course.
Select appropriate box and use parentheses where needed.

Required prerequisite course(s):

1_____

☐ And ☐ Or 2_____

☐ And ☐ Or 3_____

☐ And ☐ Or 4_____

☐ And ☐ Or 5_____

☐ And ☐ Or 6_____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s):

_____

_____

_____

8) Catalog Course Description

The traditional catalog style description for a course should be **40 words or less**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Provides a capstone experience by integrating techniques from the natural resources core courses. Covers resource assessment and the development of management plans that describe alternatives for achieving desired management goals and objectives.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

  Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

  ☐ Department OR ☐ Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

☐ **No College/School Restrictions**

Colleges/Schools who MAY NOT enroll (EXCLUDE)

_____

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

_____

☐ **No Major Restrictions**

Majors that MAY NOT enroll (EXCLUDE)

_____

-OR-

Majors that MAY enroll (INCLUDE)

_____

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

☒ **No Class Restrictions**

Class of students who MAY NOT enroll (EXCLUDE)
_____
-OR-
Class of students who MAY enroll (INCLUDE)
_____

10) Semester(s) Offered

☐ Fall ☒ Spring ☐ Summer *(Check all that apply)*

OR ☐ On Demand

If offered in a specific semester, will the course be offered only in alternate years? ☐ Yes ☒ No

If yes, what will be the starting academic year? *(i.e. 2014-15 or 2015-16)*_____

11) General Education

To propose this course for inclusion on the **HASS, HASS Restricted, STEM, or STEM Restricted list,** please complete the appropriate proposal form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

12) Co-Curricular

To propose this course for inclusion on the **Co-Curricular List** please complete a new ***Co-Curricular Proposal*** form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

13) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the Blank Course Fees Form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

14) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s):
Natural Resources Management

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

15) Course Rationale *(Required)*

Natural resource managers require experience synthesizing and applying information regarding impacts on natural resources (i.e., air, water, soil, vegetation, wildlife) of land and water use decisions, management and extraction of resources (wood and other biomaterials, fish, wildlife), recreation, global change, natural disturbance, and energy and mineral exploration. This capstone course creates the opportunity to synthesize, develop, and apply the cumulative knowledge, skills, abilities, and behaviors gained in this major to the sustainable management of natural resources.

16) Faculty Contact

Faculty proposing this course *(please print)*: Name _____

Email _____

DID YOU USE RED INK TO COMPLETE THIS FORM?

IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.

MichiganTech

— Course Add Proposal —

PLEASE COMPLETE THIS FORM IN RED

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1) Course Information

Is this a **half-semester course proposal?** ☐ Yes ☒ No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details: http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm

Course Prefix/Number *(i.e. MEEM 2110)*: FW 4710

Course Title *(abbreviated; used on transcript - Up to **30** characters including spaces)*

Environmental Biogeochemistry

Alternative Title for Catalog *(Up to **100** characters including spaces)*

Environmental Biogeochemistry

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2) Credits

Number of credits assigned to this course 3

OR

Range of credits if **variable** ☐ to ☐ *(Number of credits to be taken in a given semester)*

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3) Schedule

Contact Hours per Week *(Lec & Rec: 1 credit =1 contact hour, Lab: 1 credit =1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab)*

☐	☒ 3	☐
Lecture	Recitation	Lab

OR

Research Course? ☐ Yes ☐ No

OR

Special Topics Course? ☐ Yes ☐ No

---

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

☒ No

☐ Yes, for a maximum of _____ credits. *(Must be a multiple of the course credits, i.e. Research or Special Topics)*

☐ Yes, for an unlimited number of credits. *(i.e. Music, Varsity sports, etc.)*

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY**? *(grade of S or E)* ☐ Yes ☒ No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? ☐ Yes ☒ No

If yes, what is the other subject and course number? _____

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? ☐ Yes ☒ No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses MUST be offered during the same term):

Required corequisite course(s):

_____

_____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course.
Select appropriate box and use parentheses where needed.

Required prerequisite course(s):

1 CH 1150

☐ And ☐ Or 2_____

☐ And ☐ Or 3_____

☐ And ☐ Or 4_____

☐ And ☐ Or 5_____

☐ And ☐ Or 6_____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s):

_____

_____

_____

8) Catalog Course Description

The traditional catalog style description for a course should be **40 words or less**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Impacts of decisions regarding landuse, land management, and energy and mineral exploration on natural resources (i.e., air, water, land, and biodiversity) are discussed using the framework of the biogeochemical cycles of the elements.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

  Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

  ☐ Department OR ☐ Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

☐ **No College/School Restrictions**

Colleges/Schools who MAY NOT enroll (EXCLUDE)

_____

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

_____

☐ **No Major Restrictions**

Majors that MAY NOT enroll (EXCLUDE)

_____

-OR-

Majors that MAY enroll (INCLUDE)

_____

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

☒ **No Class Restrictions**

Class of students who MAY NOT enroll (EXCLUDE)
_____
-OR-
Class of students who MAY enroll (INCLUDE)
_____

10) Semester(s) Offered

☐ Fall ☒ Spring ☐ Summer *(Check all that apply)*

OR ☐ On Demand

If offered in a specific semester, will the course be offered only in alternate years? ☐ Yes ☒ No

If yes, what will be the starting academic year? *(i.e. 2014-15 or 2015-16)*_____

11) General Education

To propose this course for inclusion on the **HASS, HASS Restricted, STEM, or STEM Restricted list,** please complete the appropriate proposal form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

12) Co-Curricular

To propose this course for inclusion on the **Co-Curricular List** please complete a new ***Co-Curricular Proposal*** form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

13) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the Blank Course Fees Form available at: http://www.mtu.edu/registrar/faculty-staff/course-proposal/.

14) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s):

Natural Resources Management

***** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.**

15) Course Rationale *(Required)*

Natural resource managers require an understanding of how decisions regarding landuse, land management, and energy and mineral exploration impact natural resources (i.e., air, water, land, and biodiversity). Landuse changes and energy and mineral exploration perturb the biogeochemical cycles of the elements and affect the quality of natural resources. Thus, a fundamental understanding of relationships between biogeochemical cycles of the the elements and the quality of natural resources is required for natural resource managers to make responsible decisions to maintain our natural resources.

16) Faculty Contact

Faculty proposing this course *(please print)*: Name Paul V. Doskey

Email pvdoskey@mtu.edu

DID YOU USE RED INK TO COMPLETE THIS FORM?

IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.

Appendix B: Financial documentation

I. Relation to University Strategic Plan

a. Relation of program to the university's educational and research goals.
The proposed major fits with goal 2 of the strategic plan. “GOAL 2: A distinctive and rigorous action-based learning experience grounded in science, engineering, technology, sustainability, business, and an understanding of the social and cultural contexts of our contemporary world.” Specifically, the proposed major integrates science, sustainability, business and the social and cultural contexts of natural resources and natural resource management.

b. Consistency with the university's resource allocation criteria.
No new resources are being requested at this time

II. Impact on University Enrollment

a. Projected number of students in the program.
We project an annual enrollment of 10-20 new students per year in this program.

b. Source of new students; in particular, will the students be drawn from existing programs, or will they be students who would otherwise not have come to Michigan Tech?
It is possible that some students may come from other majors within the School of Forest Resources and Environmental Science (SFRES), but we project that most enrollment will be of students who are looking for a more broadly based degree program than those currently offered.

c. What is the likely correlation between demand for the new program and existing enrollment patterns at Michigan Tech?
We project that enrollment in SFRES will increase while undergraduate enrollments in many other units is projected to remain in a steady state.

d. What is the current enrollment in the unit?
155 undergraduates, 75 graduate students

III. Impact on Resources Required by Department in Which the Program is housed. This would include, but not be limited to:

a. Faculty lines.
No new faculty lines are requested.

b. Faculty and student labs, including ongoing maintenance.
Adequate classroom and laboratory space is available. The school has recently remodeled a classroom to house over 60 students, which replaces a classroom that housed 32 students.

c. Advising.

The current arrangements for advising will be adequate.

d. Assessment.

This program will be assessed as part of the ongoing University assessment program. All of the University learning goals will be addressed by one or more classes in the proposed program. Courses that are outside of the general education requirements will address disciplinary knowledge as well as other university learning goals.

IV. Impact on Resources Required By other Units Within the University. This analysis would include, but not necessarily be limited to, the impacts on:

a. Other academic (e.g., Gen Ed) units with regard to faculty, labs and assessment. (NOTE: The current Student to Faculty ratio for the university as a whole is approximately 12:1 per Institutional Analysis.)

Classes in other academic units have been reviewed by those units, and the capacity is available to serve the students in the new major.

b. Information Technology, the Library, central administration and career planning with respect to the impact on the need for computing services, library resources, advising, record keeping, development of employer relations etc.

Existing resources are sufficient to support the new major.

V. Assessment of the ability to obtain the necessary resources assuming requested funds are obtained

a. For high demand fields (e.g., business fields, etc.), will it be possible to fill allocated lines.

No lines are requested at the initiation of this degree program

VI. Past proposals. Has the department initiated any other new degree programs in the last five years? If so:

No undergraduate degree programs have been proposed in the last 5 years. A Master's of Geographic Information Science was recently approved and is now offered.

a. **Describe the extent to which the new program has met the original goals with respect to:**

1. Enrollment,

Enrollment in the new MGIS degree program is low as advertising outside of Michigan Tech has been limited. Students are starting to register for he accelerated version of the degree as they near completion of their undergraduate degree programs. Enrollment in the classes that have been added to the new MGIS have been good – their subject area appeals to a range of graduate students, and they have enhanced the graduate student experience for many.

2. Costs,

To date, the MGIS has met its goals in terms of costs.

3. New faculty,

A lecturer is supported under the new MGIS program.

4. Other resources required for the program

b. How have degree programs added in the past five years affected total

enrollment in the department?

The MGIS is too new to have significantly impacted overall enrollment.

VII. Departmental Budget contribution

a. What is the department's total general fund budget?

2013-2014 $3,658,751

b. How much tuition does the department generate? This information should be provided for both the credit hours taught by the department and the number of credit hours taken by the department's majors.

2013-14 SCH data from compendium – all instructional activity

LOWER	520.0
UPPER	2,829.0
MASTER	644.0
DOCTOR	321.5
TOTAL	4,314.5

If all students are in state, based on 2014-15 tuition rates, undergraduate revenue = 467*(520+2829) = $1,563,983. Graduate revenue = 820.50*(644+321.5) = $792,192

2013-14 SCH data from compendium – tenure/tenure track instructional activity

UNDERGRADUATE	2,402.0
MASTER	521.8
DOCTOR	290.0
TOTAL	3,213.8

For SFRES students taking 32 credits a year (undergraduate) and 19 credits a year (graduate), based on 2014-15 enrollment, total tuition revenue = 155*467*32 (undergraduate) plus 75*820.50*19 (graduate) = $3,485,532.

VIII. How do the benefits from this program compare to other alternatives that are currently under consideration or development. Will approval and allocation of resources to this program preclude the development of other programs?

A major in Natural Resource Management is the top priority for a new undergraduate degree program within the School. Natural Resource degree programs have been performing very well at the national level.

Appendix C **BS in Natural Resources Management: sample degree audit**

Major Requirements

Course	Credits	Course	Credits
FW2010	4	Two of	
FW2051	2	EC3400	
FW1050	2	ED4500	
EC2001	3	EC4650	3
FW2030	2	EC4640	3
FW3330	4	ACC2000	
FW3020	3	BUS2300	
FW3200	4	MGT3000	
FW3540	4	MKT3000	
FW3110	3		
FW3012	2	One of	
FW3170	1	HU2645	
FW3190	3	HU3120	
FW3180	2	HU3606	
FW3600	3	HU3630	
FW3640	2	HU3871	3
FW3840	3	HU4625	
FW3510	3	HU4628	
FW4710	3	HU4693	
FW4380	3	ED4850	
FW3115	2		
FW4150	3	9 credits from (credits)	
FW4830	3	FW1035 (4)	
		FW3320 (3)	
One of		FW3410 (3)	
SS3315		FW3610 (4)	
SS3410		FW4120 (3)	
SS3313		FW4140 (3)	
SS3520		FW4220 (4)	
SS3521		FW4240 (4)	
SS3630	3	FW4300 (3)	
SS3635		FW4370 (3)	9
SS/FW3760		FW4540 (3)	
SS3800		FW4541 (1)	
SS4010		FW4545 (2)	
SS4200		FW4610 (3)	
		FW4620 (3)	
		FW5115 (3)	
		BL4442/BL4447 (4)	
		BL2160 (4)	
		BL2170 (4)	
		GE2100 (3)	
		GE4150 (3)	

STEM requirement (16 credits)

BL1040	4
MA1032 Or MA1135	4
CH1150 and CH1151	4
MA2720	4

Free Electives	3

General education requirements (Credits 24)

Course number	
UN1015	3
UN1025	3
HUFA	3
FA2330, 2520, 2720, 2820, HU2130, 2501, 2538, 2700, 2720,2820, 2910	
SBS	3
EC2001, PSY2000, SS2100, 2200, 2400, 2500, 2501, 2502, 2503, 2504, 2505, 2600, 2700	

HASS Distribution Course: 12 total credits required

No more than 3 credits from the HASS Creative Endeavors List	3
Six (6) credits must be at the 3000 or 4000 level	3
	3
No more than 3 credits from the HASS Supplemental List	3

*A 3000-level or higher modern language course may be used in place of UN1025, Global Issues.

TOTAL	**128**