

# Natural Resources Management Program Self Study 2010–2015

*Natural Resources Management Program*

*Biology Department*

*Grand Valley State University*

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## SECTION I: EXECUTIVE SUMMARY

The Natural Resources Management (NRM) Program at Grand Valley State University has continued to make substantial progress toward achievement of program, faculty, student, and student learning goals during the 2010–2015 assessment period. Specifically, the NRM Program has maintained a state-of-the-art NRM curriculum. Results from alumni surveys and a peer-benchmarking process revealed that GVSU's NRM Program was competitive among NRM programs and unique for its place within a liberal arts institution.

The NRM Program Faculty are actively seeking resources and opportunities to enhance professional development in the areas of teaching, scholarship, and service. Faculty members participate in teaching-related workshops, seek grant money for research related to the scholarship of teaching, attend professional conferences, conduct grant-funded research, participate in seminars and workshops, earn professional certifications, and engage in service activities within the department, university, and community. Program faculty members continue to develop professionally as educators, scholars, and citizen-scientists. For future assessments, our protocol will be to maintain or improve current levels of professional development in the areas of teaching, scholarship, and service.

The NRM Program has effectively prepared students to enter careers in a broad range of natural resources management fields. Many NRM Program students plan to enter NRM-related careers, and those who persist in pursuing this goal succeed in doing so. Alumni surveys indicated that 70% of NRM graduates are employed in NRM-related fields or are pursuing advanced NRM-related degrees within 5 years of graduation. The NRM Program faculty members encourage students to enter NRM-related careers and advanced studies. Program faculty will continue to provide the skills and encouragement for successful NRM-related careers and advanced education.

Students in the NRM Program are making good progress in learning the unifying and scientific principles and major professional concepts in natural resources management. Without question, students have demonstrated proficiencies in taking diverse and interdisciplinary approaches to addressing natural resources-related issues. NRM students are also supporting their professional development by enrolling in relevant science elective courses, specifically in upper-level biology and geography.

With implementation of the new program change, effective Fall 2015, it is imperative that NRM program faculty carefully and strategically assess program goals and student learning outcomes. Several objectives and assessment metrics were revised in the new strategic plan to address shortcomings. Specifically, NRM faculty revised assessment metrics to quantitatively evaluate the impact of the courses on student proficiencies in competency areas. Establishment of an external advisory council to review the NRM curriculum and provide recommendations for the program will help us ensure that we are assessing the right metrics for evaluating the quality, rigor, and impact of our program on student learning and the NRM profession.

## SECTION II: NATURAL RESOURCES MANAGEMENT PROGRAM

### *Mission*

The Natural Resources Management Program integrates scientific skills, an interdisciplinary systems approach, as well as hands-on laboratory and field experiences with excellent classroom teaching to prepare students to be critical thinkers, engaged citizens, and creative and competent professionals in natural resources management.

### *Vision*

The Natural Resources Management Program aspires to provide a distinguished degree program.

We recognize that a current, challenging curriculum, highlighted by intensive field and laboratory courses, and which encourages our students to work outside of their comfort zones is a vital component of a quality program. We require a core of science courses from biology, chemistry, geology, mathematics, and statistics. On this foundation we offer interdisciplinary courses in Natural Resources Management designed to integrate systems concepts with practical applications.

We recognize that critical components of a superior program include an interdisciplinary systems approach to natural resources management, and development of a working knowledge of the tools and scientific principles available to understand and address complex natural resources management issues. We aspire to infuse our curriculum with current examples of the application of a science-based ecosystems approach to natural resources management issues.

We recognize that student involvement in practical hands-on natural resources management experience is a critical component of our program and we aspire to encourage and motivate all of our undergraduates to participate in natural resources management experiences such as internships, jobs, or research, and volunteer service.

We recognize that a diverse faculty engaged in their areas of expertise and responsive to the needs of our students, colleagues, and community is necessary for our program. We aspire to support our faculty such that they may perform this role effectively and efficiently.

We aspire to have our graduates active in a field of their choice using the expertise developed in the Natural Resources Management Program. Some may be employed, others may be in graduate or professional programs where they will continue to build their expertise, and yet others may choose an alternative career but still spend a portion of their lives promoting the conservation of natural resources.

## *Values*

The Natural Resources Management Program values an academic environment that features:

- A broad, challenging and current curriculum featuring intensive field and laboratory courses along with excellent classroom instruction;
- Opportunities for undergraduates to obtain hands-on experiences through internships, employment, research, and volunteer service;
- An engaged, diverse, and responsive faculty, dedicated to excellent teaching, scholarship, and professional service;
- A curriculum that fosters an understanding of the methods, tools and skills necessary for natural resources management; and
- Producing graduates who recognize the value of professional and community service.

### **SECTION III: PROCESS**

The process implemented to complete this self-study began with a revision of the NRM Strategic Plan in 2009 for the 2010–2015 assessment period. Throughout the assessment period, the NRM Program faculty met several times each semester to discuss current issues, direction of the program, assessment metrics, and curriculum. Beginning in the winter of 2014, NRM Program faculty began discussions regarding a program change that was to be effective fall 2015. We underwent rigorous curriculum mapping activities, developed an alumni survey, compiled results, agreed on a revised curriculum, and revised our strategic plan.

Each year, the NRM faculty compiled and summarized data pertaining to performance metrics for evaluating student learning goals, which were entered into WEAVE Online by the unit head. Also, NRM faculty provided data for other program and faculty goals by completing reports in Digital Measures and making them accessible to faculty in the Biology Department. Reports were generated annually and discussed among the NRM faculty. NRM program, faculty, and student goals were developed and aligned with those for the Biology Department. All NRM faculty contributed to assessment at all-levels and provided constructive feedback pertaining to the self-study.

## SECTION IV: PROGRESS

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### PROGRAM GOALS

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**Program Goal #1: To maintain a state of the art natural resources management curriculum.**

*Objective A: To ensure that adequate facilities and staff support exist to support the student body and curriculum.*

#### Assessment Measures

- i. Comparison of curriculum to that of peer institutions.
- ii. Assess senior exit surveys and alumni surveys to evaluate students' and graduates' perceptions of professional preparedness.

#### Assessment Results

- i. The NRM Program faculty identified 3 peer and 4 aspirant institutions that offer a broad-based degree in Natural Resources Management (NRM) or a comparable degree (Table 1). None of the institutions identified as peers by Grand Valley State University offer a degree in Natural Resources Management. Most of the institutions offering a broad-based degree in natural resources management are large, research-oriented institutions. The number of required credits in NRM program at GVSU is comparable to those required by other institutions. Two of the institutions do not require a summer field experience or internship as part of their degree requirements. The percent of credits representing various skill sets (i.e., foundational sciences, ecological principles, technical, social context, communication, and analytical) required for an NRM degree at GVSU is comparable to those required at peer institutions (Figure 1). However, our greatest strength is providing students with a strong background in foundational sciences and communication. The percent of credits devoted to technical skills (e.g., lab and field work) and social context (e.g., economics, policy, administration, ethics) was at the lower end of the range for those offered at other institutions (Figure 1).
- ii. One question on senior exit surveys assessed student perceptions of professional preparedness. The exit surveys were administered via Blackboard to students enrolled in capstone courses. Specifically, the questions asks: "*How well-prepared to you feel for achieving success in [a job, professional school, or graduate school]?*" The criterion for adequate professional preparedness was 75% or more of the responses rating their preparedness as average, very good, or excellent. All respondents perceived their preparedness as average or better (Figure 2).

An alumni survey was administered during the fall of 2013. We received responses from 146 alumni. Approximately half the respondents graduated between 2009–2013, and 92% of the respondents graduated between 2002–2013.

Three questions in the survey assessed alumni perceptions of professional preparedness. Participants were asked to 1) Indicate their level of agreement whether the NRM program helped improve 14 professional skill categories related to communication, analysis, technical, foundational sciences, social context, and management; 2) Indicate their level of agreement whether the NRM program helped prepare them for professional careers; 3) Indicate the level of agreement whether 14 specific types of courses helped prepare them for professional careers.

Survey results indicated that the NRM program largely helped prepare students for their professional careers by improving skills in all areas (Figure 3). For instance, on a scale between 1–5 (1 = strongly disagree and 5 = strongly agree), 7 of 14 skills were ranked greater than 4.0 on average. All 14 skills were ranked greater than 3.5 on average. Greater than 65% of respondents agreed or strongly agreed that the program enhanced skills in all categories except those related to economic and / or policy analysis, where 57% of respondents agreed or strongly agreed that the program enhanced their skills. It was evident that our strengths were in student preparation in field and /or lab measurements and ecology/natural history skills (Figure 3). Nearly 80% of alumni agreed or strongly agreed that the NRM program overall helped prepare them for their professional career.

Different types of courses benefitted NRM graduates in preparation for their professional careers (Figure 4). Specifically, greater than 80% of alumni agreed or strongly agreed that NRM 250 (*Resource Measurements and Maps*), NRM 281 (*Principles of Soil Science*), BIO 460 (*Terrestrial Ecosystem Ecology*), Capstone, NRM Electives, and Biology coursework helped prepare them for their professional positions. Those types of courses had an average score greater than 4.2 (on a scale between 1–5). NRM 395 (GIS Applications in Natural Resources) also was perceived as preparing students well for their careers (score = 4.3). NRM 140 (*The Climatic Factor*), Chemistry coursework, and Economics coursework were rated lower in terms of helping prepare students for their careers, with scores between 3.0–3.5). Alumni scored all other courses greater than 3.5. Three courses had relatively high (greater than 25%) proportions of respondents indicating N/A, which suggested that they did not take those specific courses during their undergraduate program. Those courses included NRM 140, NRM 395, and Economics (Figure 4).

## Discussion

The NRM Program at GVSU underwent a program change effective fall 2015, which reduced the total number of credits required for the degree. This credit reduction eliminated 12 credits of science electives/cognate courses. Before the program change, a degree in NRM required 80 credits, which was comparable to the University of Wisconsin – Stevens Point and was greater than Oregon State University, two peer institutions (Table 1). A 68-credit requirement for an NRM degree remains greater than the required number of credits for a comparable degree at the University of Minnesota, Crookston

and the University of Montana; however, it is 6–32 credits fewer than those required at five of seven peer institutions (Table 1). A direct consequence of the credit reduction was a decrease in the proportion of total credits focusing on development of technical skills to students (Figure 1). Many of those credits involving technical skills came from science electives, especially those from biology courses. Alumni indicated that biology courses were very beneficial in helping them prepare for professional careers (see Figure 4). A positive consequence of the program change was an increase in the percent of credits offering skills related to social context (i.e., with the addition of requiring ECO 345 [*Environmental and Resource Economics*]). The percent of credits in social context, however is at the lower end of the range compared to other institutions. The percent of credits representing skills taught in ecological principles, communication, and analyses were comparable to those required at peer institutions. Students who graduate from GVSU with an NRM degree have better skills in foundational sciences and communication than graduates from other institutions. This outcome likely results from their liberal arts education.

Most of the peer and aspirant institutions require a summer field camp or internship experience. While a summer field experience or internship is not required by the GVSU NRM program, faculty encourage students to gain that experiential education through S<sup>3</sup> projects, internships, volunteer experience, or independent research projects. A future assessment metric will evaluate student participation in such high-impact experiences.

Seniors in capstone courses felt adequately prepared for success in NRM-related professional positions. One hundred percent of respondents rated their preparation as average or better. Response rate, however, was relatively low (n = 46 responses out of more than 120 students). In the future, exit surveys will be administered in the classroom as opposed to Blackboard, where it is difficult to ensure complete participation.

Responses from the alumni survey indicated that the large majority (80%) of alumni agreed or strongly agreed that the NRM program prepared them well for their careers, and 70% of alumni were employed in NRM-related positions. Alumni indicated that the NRM program was particularly strong in helping students develop technical skills (i.e., field and lab measurements, and technical equipment use), knowledge of ecology/natural history, effective written communication, spatial analysis skills, and collaboration and /or interpersonal skills (Figure 3). These results provide further evidence that the NRM Program must continue to maintain or improve these strengths, and all future program changes must provide such skills.

Table 1. Comparison of GVSU requirements for a Natural Resources Degree to those at peer and aspirant institutions.

Institution	Program and Major	Required Credits for Major	Required field experience or internship	Approximate percent of required credits					
				Foundational sciences	Ecological principles	Technical	Social context	Communication	Analytical
GVSU	College of Liberal Arts and Sciences	Pre-2014: 80 credits	No	21	17	37	7	6	12
	Biology Department BS in Natural Resources Management	2015: 68 credits		23	13	31	9	11	13
<b>Peer institutions</b>									
University of Wisconsin-Stevens Point	College of Natural Resources Human Dimensions of Natural Resources BS in Resource Management Emphasis in General Resource Mgt	75-87 credits  depending on emphasis electives	Yes	27	11	24	28	3	6
University of Minnesota, Crookston	Natural Resources Department BS in Natural Resources Emphasis in Natural Resources Mgt	42-79 credits	No	13	11	47	3	15	10
Oregon State University	College of Forestry BS in Natural Resources 17 Specialty options	74 credits	No	16	17	22	24	3	16
<b>Aspirant Institutions</b>									
University of Montana	College of Forestry and Conservation BS in Resource Conservation 10 specialty tracks	90 credits	Yes	10	9	54	11	7	10

Table 1. (Continued).

Institution	Program and Major	Required Credits for Major	Required field experience or internship	Approximate percent of required credits					
				Foundational sciences	Ecological principles	Technical	Social context	Communication	Analytical
State University of NY, College of Environmental Science and Forestry	Department of Forest and Natural Resources Management BS in Natural Resources Management*	100 credits	Yes	6	18	42	19	5	10
Colorado State University	Warner College of Natural Resources Department of Forest and Rangeland Stewardship BS in Natural Resources Management	97 credits	Yes	16	10	42	9	12	9
North Carolina State University	College of Natural Resources Department of Forestry and Environmental Resources BS in Natural Resources - Ecosystem Assessment BS in Natural Resources - Policy and Administration	87 credits	Yes	22	7	42	11	8	10

\*Degree program accredited through the Society of American Foresters.

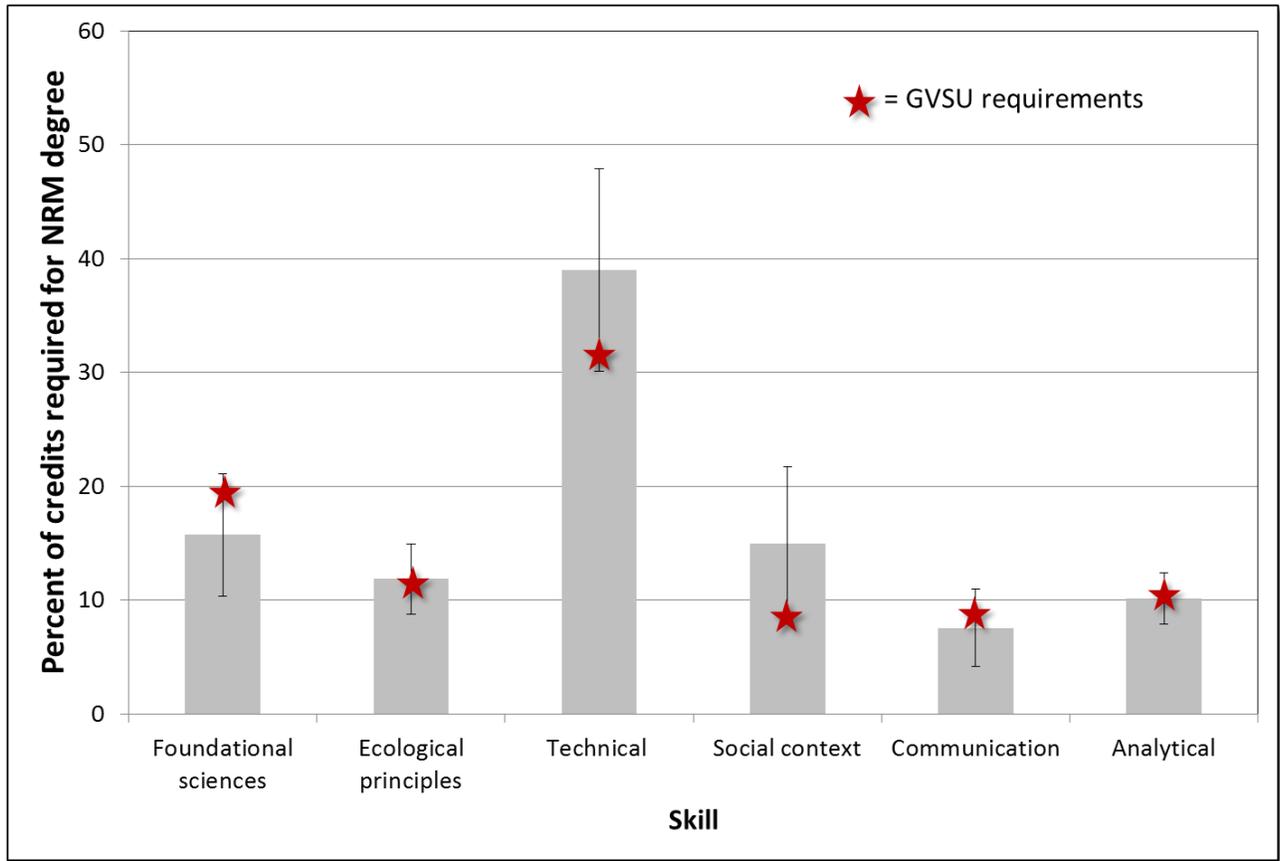


Figure 1. Average percent of credits required for various skills in in Natural Resources Management B.S. degrees from 3 peer and 4 aspirant institutions (bars), and from Grand Valley State University (stars). Error bars represent 2 standard deviations from the mean.

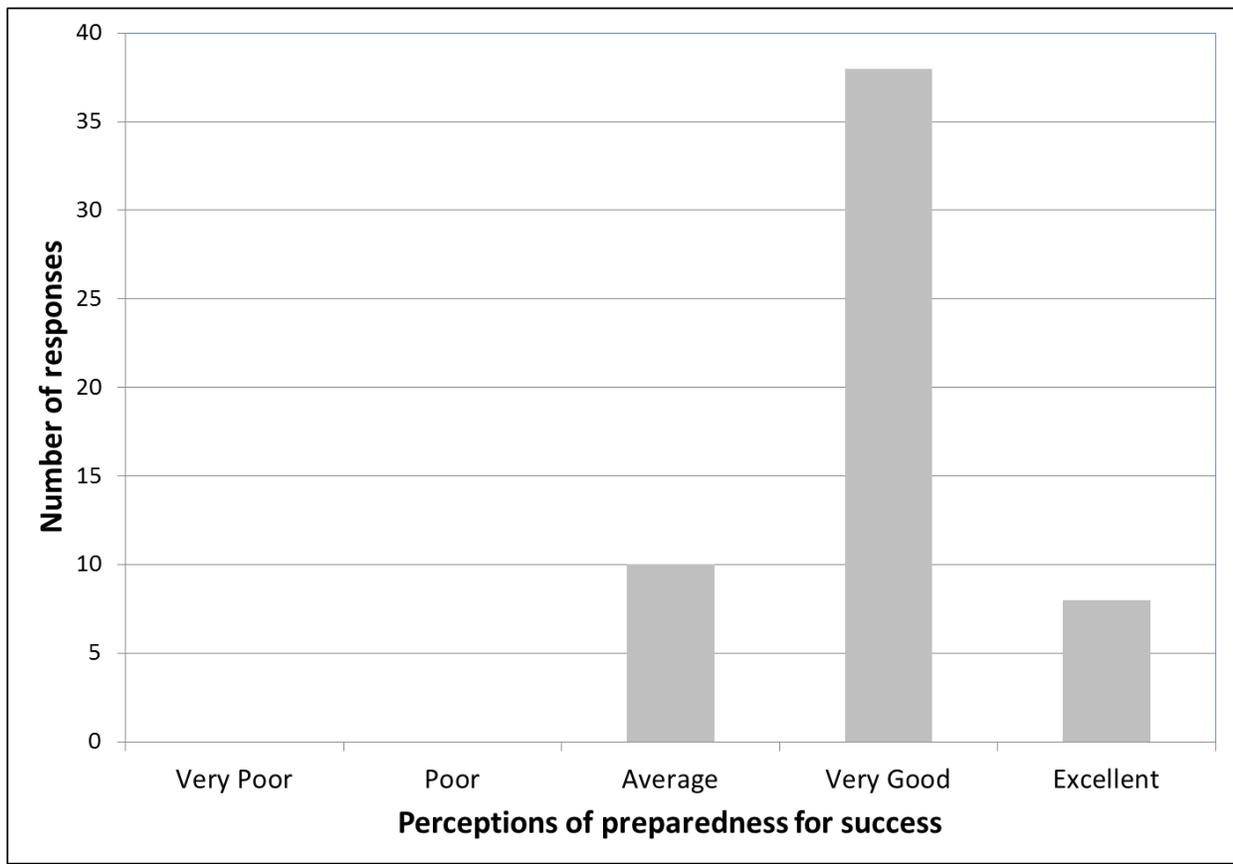


Figure 2. Perceptions of senior preparedness for success in obtaining an NRM-related job, position in a professional school, or graduate position. The specific survey question was: *How well-prepared do you feel for achieving success in [a job, professional school, or graduate school]?* Results are reported from fall 2010 through winter 2015. (n = 45 respondents).

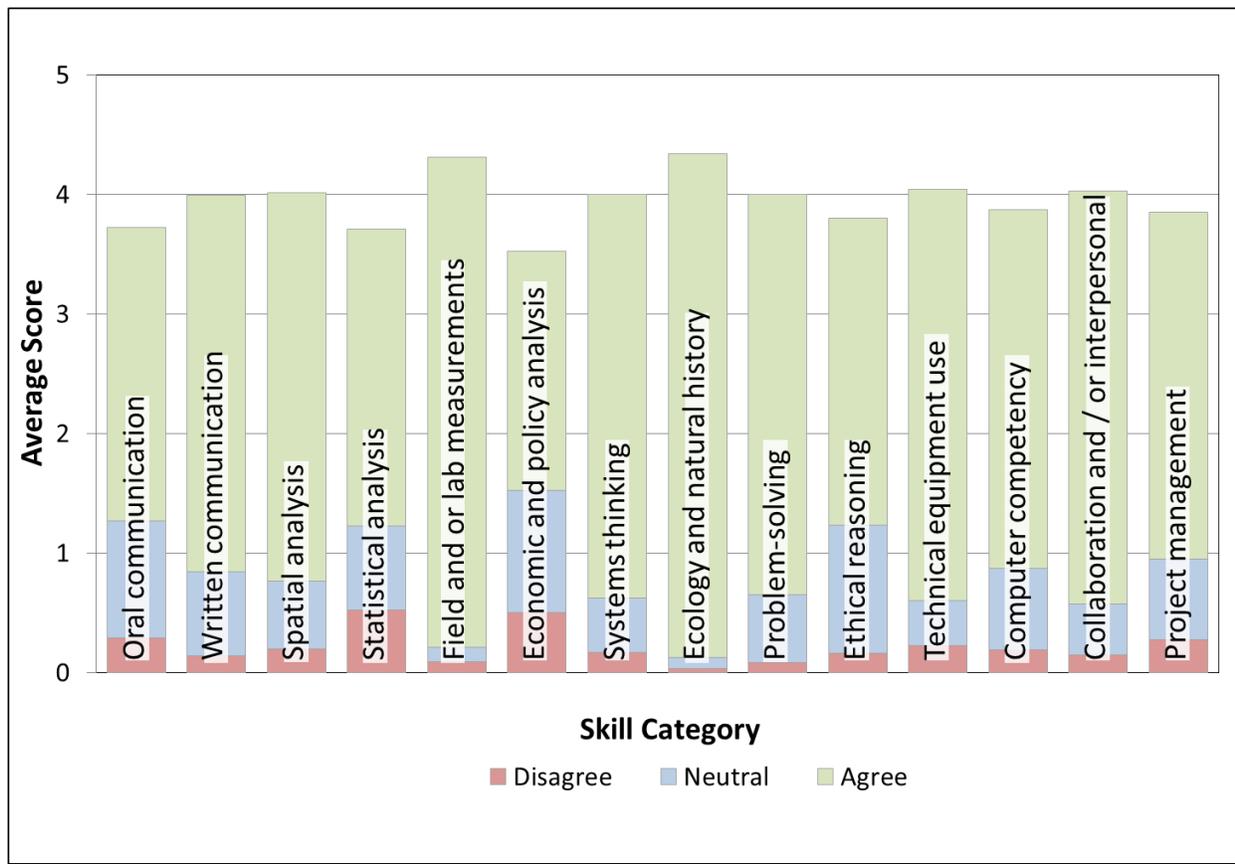
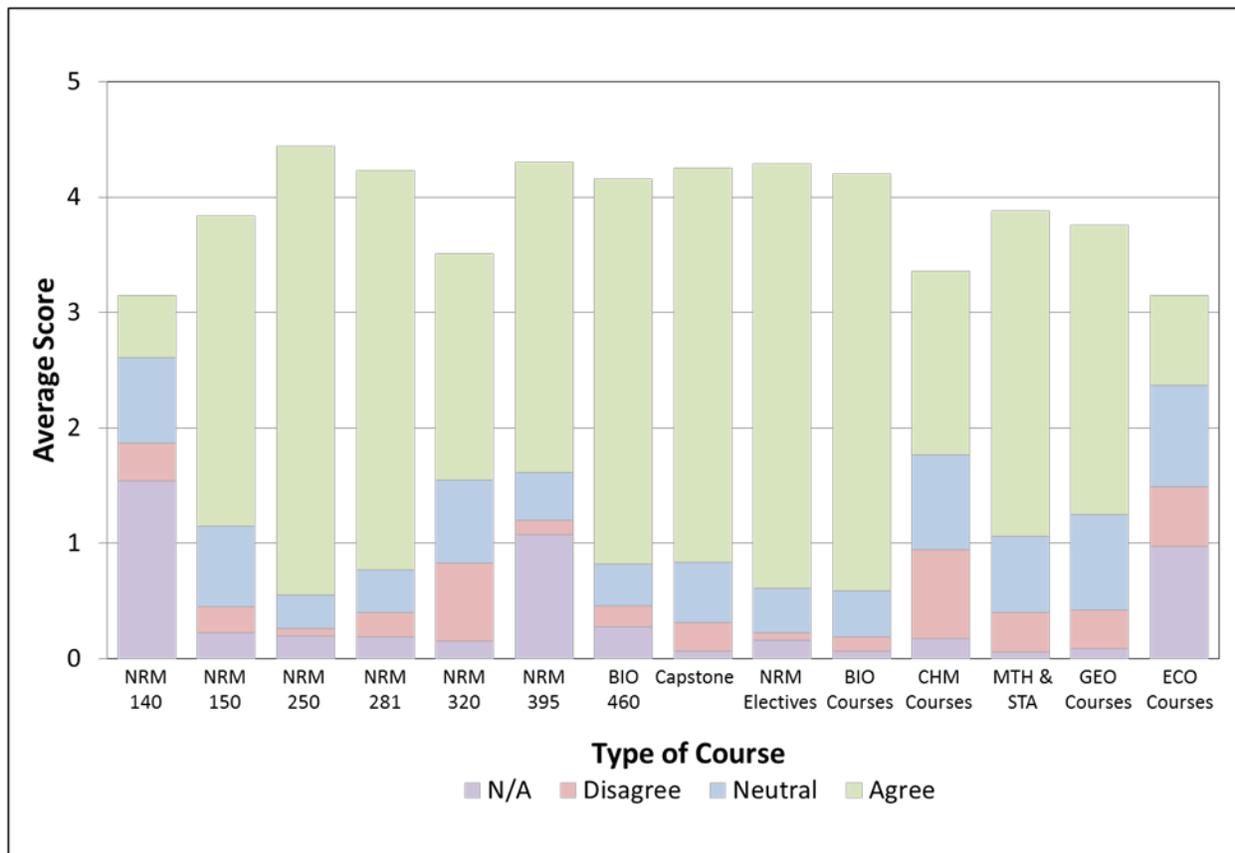


Figure 3. Average score on a scale of 1–5 (1 = Strongly Disagree and 5 = Strongly Agree) from alumni survey question assessing perceptions of the level of preparedness the Natural Resources Management Degree provided in various skill categories. The specific survey question was: *Indicate your level of agreement with the following statement about the NRM program: “The NRM program helped improve my...”*. The survey was administered during fall 2013 (n = 146 respondents).



NRM 140	The Climatic Factor	BIO 460	Terrestrial Ecosystem Ecology
NRM 150	Introduction to Natural Resources	BIO	Biology courses
NRM 250	Resource Measurements & Maps	MTH	Math courses
NRM 281	Principles of Soil Science	STA	Statistics courses (STA 215)
NRM 320	Introduction to Resource Systems	GEO	Geology courses (GEO111)
NRM 395	GIS Applications in Natural Resources	ECO	Economics (ECO 211)

Figure 4. Average score on a scale of 1–5 (1 = Strongly Disagree and 5 = Strongly Agree) from alumni survey question assessing perceptions of how well different types of courses in the NRM program prepared them for professional careers. The specific survey question was: *Indicate your level of agreement with the following statement: “This course helped prepare me for my professional career”*. The survey was administered during fall 2013 (n = 146 respondents).

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**Program Goal #2: The Natural Resources Management Program will assist the General Education Subcommittee in assessing General Education student learning outcomes.**

*Objective A: The Natural Resources Management Program will identify member(s) to serve on General Education Peer Groups for the purpose of assessing student learning outcomes.*

*Objective B: The Natural Resources Management Program will assist the General Education Subcommittee in collecting assessment data from students in General Education courses.*

*Objective C: The Natural Resources Management Program will review and respond to the General Education Subcommittee about suggestions for improvements, if any are identified by the Peer Group or the General Education Subcommittee.*

### Assessment Measures

- i. Identify faculty to assess student learning outcomes for General Education Courses.

### Assessment Results

- i. We have complied with the General Education assessment for NRM 140 (*The Climatic Factor*) and NRM 451 (*Natural Resources Policy*).

### Discussion

The NRM Program is participating satisfactorily in the General Education Program's assessment activities.

### Conclusion and Future Directions

The NRM Program has met the goal of maintaining a state-of-the-art NRM curriculum. Results from exit surveys and alumni surveys support this conclusion. It is important for the NRM program to continue to carefully assess our ability to maintain a state-of-the-art curriculum. A new objective for the NRM program is to establish an external advisory council consisting of NRM professionals to review the NRM curriculum to ensure that our program is reflecting current needs in NRM fields (Appendix 1). Additionally, we intend to apply for accreditation of the NRM program through the Society of American Foresters (SAF). The accreditation of natural resources programs through SAF is new, and currently one of our peer institutions, the State University of New York College of Environmental Science and Forestry, has accreditation of their BS degree in Natural Resources. Currently, GVSU has the only NRM program in Michigan, however Michigan Tech is moving toward proposing an NRM degree program and seeking accreditation, which may compete with our program. Therefore, we cannot afford to be complacent. At minimum, continuing senior and alumni surveys, and establishing an external advisory council to provide curriculum recommendations for our program will help us maintain our state-of-the-art program.

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## FACULTY / STAFF GOALS

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### Faculty Goal # 1: To enhance faculty professional development.

*Objective A: To seek resources to promote teaching effectiveness.*

#### Assessment Measures

- i. Assess Annual Faculty Activity Reports to evaluate accomplishments.
- ii. An internal faculty survey was developed to ask faculty whether they have adequate resources to promote teaching effectiveness, research/scholarship, professional interactions/collaborations, as well as community engagement. The survey also enquired about resources they have to promote professional development and what additional resources would enhance professional development.

#### Assessment Results

- i. Between 2010–2015, nine of ten NRM faculty members participated in a total of 58 teaching-related activities (Figure 5). These activities included participating in workshops or conferences designed to enhance teaching effectiveness, understand student learning, or incorporate new technology in the classroom. All NRM faculty members have participated in teaching-related activities. The median number of activities was 4.5 per faculty member.

Within the same timeframe, three NRM faculty members sought \$838,511 in funding for teaching enhancement or scholarship. The source of the funding included Pew Teaching Grants (\$4111), a Fulbright Scholar Grant for International Teaching (\$84,400) awarded for sabbatical activities, and the National Science Foundation to pursue teaching-related research (\$750,000).

- ii. During winter 2016, we developed a survey for the NRM faculty (tenure-track, visitor, affiliate) to assess the perceived adequacy of resources to promote teaching effectiveness. Two questions directly addressed satisfaction with the availability and quality of teaching-related resources. Most faculty were largely satisfied with the availability of resources related to all areas, but teaching resources appeared to have the highest level of satisfaction (Figure 6). Specifically, classrooms, teaching labs, library resources, and institutional teaching support (i.e., Faculty Teaching and Learning Center) are more than satisfactory to meet teaching needs. On a question asking, “If you could choose one category to allocate additional resources, which would most enhance your work at GVSU?” one respondent (10%) selected teaching.

## Discussion

It is evident that the NRM faculty are actively seeking resources to promote teaching effectiveness. The NRM faculty value teaching and are devoting time, effort, and resources to enhance teaching and student learning. Resources available to facilitate effective teaching are adequate and appreciated.

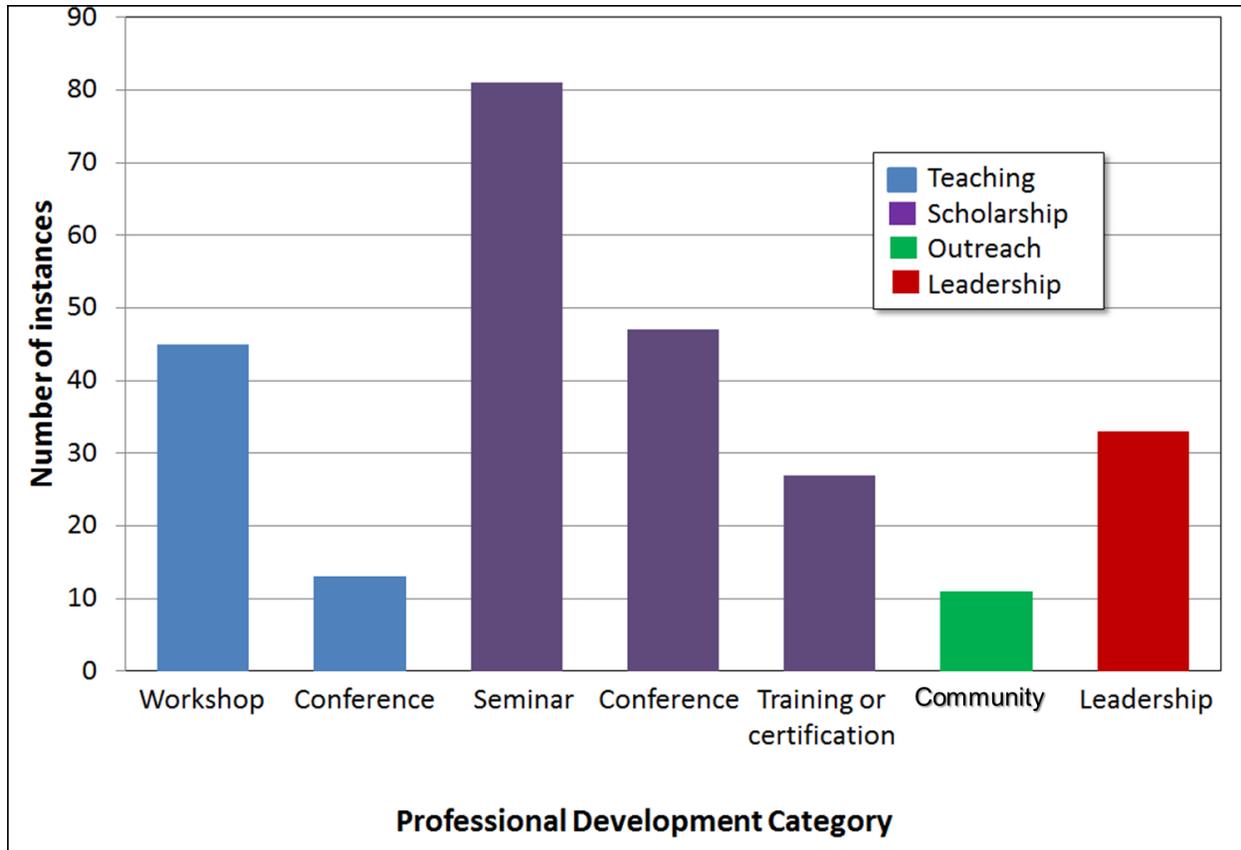


Figure 5. Number of instances where 10 NRM Program faculty participated in activities related to teaching, scholarship, outreach, or leadership during 2010–2015. Leadership activities included trainings, workshops, or seminars related to leadership positions of NRM faculty (i.e., Biology Department Chair, General Education Director, Associate Dean).

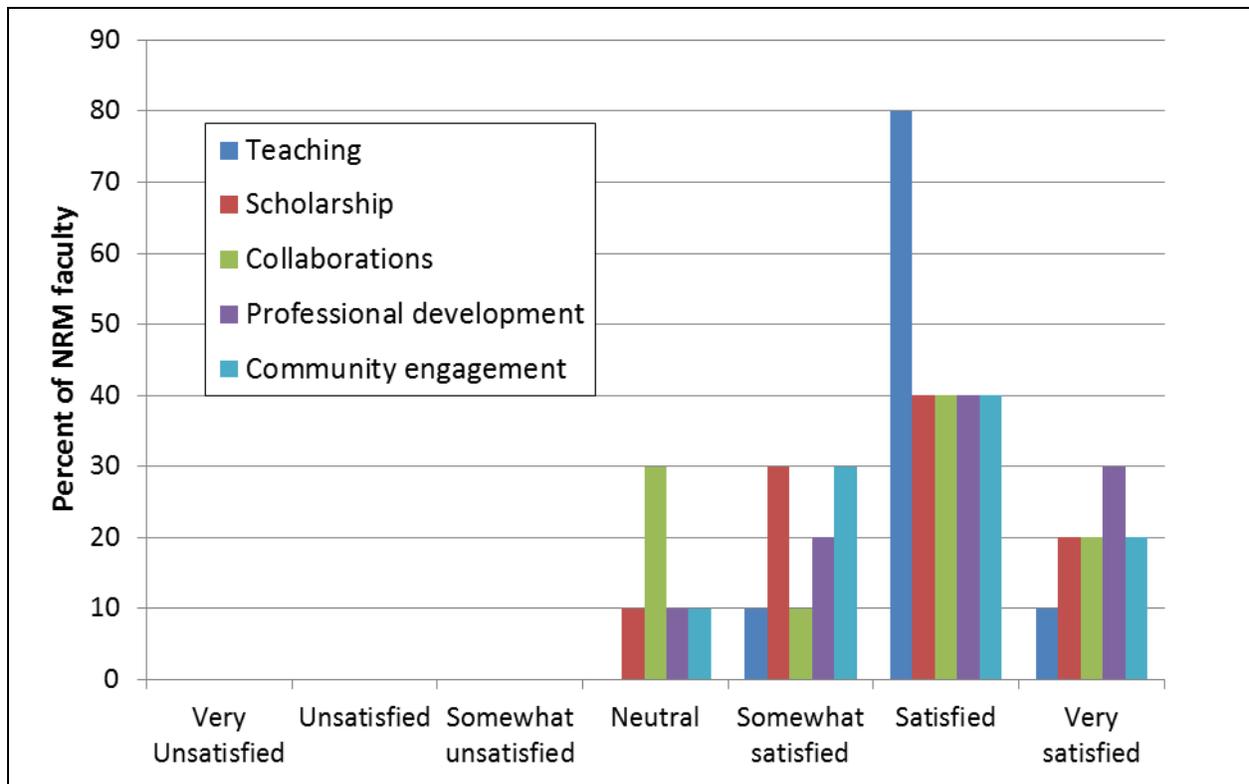


Figure 6. Satisfaction of NRM faculty with resources related to teaching, scholarship, collaborations, professional development, and community engagement.

*Objective B: To seek resources for faculty research/scholarship.*

#### Assessment Measures

- i. Assess Annual Faculty Activity Reports to evaluate accomplishments. Performance metrics included the number of faculty members submitting a grant proposal for research or scholarly activity, and the number of faculty attending professional conferences between 2010–2015. The criterion for meeting this objective was 75% or more of faculty members submitting a research grant or attending at least one professional conference.
- ii. An internal faculty survey was developed to ask faculty whether they have adequate resources to promote teaching effectiveness, research/scholarship, professional interactions/collaborations, as well as community service. The survey also enquired about resources they have to promote professional development and what additional resources would enhance professional development.

## Assessment Results

- i. Between 2010–2015, nine of ten NRM faculty members submitted grant proposals for activities related to scholarship. Nearly 90 proposals were submitted and 80 were funded during that time period. A median of 8.5 proposals per faculty member were submitted, including those where 2 or more faculty members were co-investigators or collaborators. Secured grant funding totaled over \$4.6 million in funding for scholarship (Table 2). Portions of externally-funded grants may have gone to fund activities of faculty at other institutions with which GVSU faculty collaborated. Regardless, the grant activity reported represents significant and rigorous efforts among NRM faculty to develop and implement research projects. Many such projects present opportunities for undergraduates.

The majority of the funding came from federal agencies including the National Science Foundation, US Department of Energy, US Forest Service, US Fish and Wildlife Service, and NASA (via the Michigan Space Grant Consortium). Private organizations including Pierce Cedar Creek Institute, the Detroit Zoo, and special interest groups contributed the next largest amount of funding. State organizations, internal funding (through the Center for Scholarship and Creative Excellence, Faculty Teaching and Learning Center, and S<sup>3</sup>) were also very important sources of funding for scholarship activities (Table 2).

Table 2. Source of funding and amounts secured by NRM Faculty from 2010–2015.

	2010	2011	2012	2013	2014	2015	TOTAL
Internal	\$11,341	\$12,591	\$21,475	\$26,175	\$45,737	\$12,790	<b>\$130,109</b>
State		\$37,230	\$139,912				<b>\$177,142</b>
Regional		\$4,000	\$4,000				<b>\$8,000</b>
Federal	\$144,326	\$3,327,626	\$234,400	\$16,738	\$10,000	\$139,434	<b>\$3,872,524</b>
Private	\$5,000	\$11,455	\$11,455	\$22,000	\$35,210	\$335,086	<b>\$420,206</b>
<b>TOTAL</b>	<b>\$160,667</b>	<b>\$3,392,902</b>	<b>\$411,242</b>	<b>\$64,913</b>	<b>\$90,947</b>	<b>\$487,310</b>	<b>\$4,607,981<sup>a</sup></b>

<sup>a</sup>This value represents the total funding received on all grants where NRM faculty were principle investigators, co-investigators, or collaborators with investigators at GVSU or other institutions. Portions of externally-funded grants may have gone to other institutions.

Additionally, eight of ten faculty members attended at least one professional conference annually between 2010–2015. Conferences included The Wildlife Society Annual Conference, 15th National Conference & Global Forum on Science, Policy, and the Environment: Energy and Climate Change, The Midwest Fish and Wildlife Conference, Michigan Partners in Amphibian and Reptile Conservation, 7th Annual Meeting of the Midwest-Great Lakes Chapter of the Society for Ecological Restoration International, and others. Collectively, faculty members attended 47 conferences, more than 80 research

seminars, and 27 workshops, training, or certification programs related to their scholarly work (Figure 5).

- ii. During winter 2016, we developed a survey for the NRM faculty (tenure-track, visitor, affiliate) to assess the perceived adequacy of resources to promote research and scholarship. Two questions directly addressed satisfaction with the availability and quality of resources related to research and scholarship. Most faculty were largely satisfied with the availability of resources allocated for research (Figure 6). Specifically, research lab space, library resources, institutional research support (e.g., Center for Scholarly and Creative Excellence) are more than satisfactory to meet teaching needs. Twenty percent of NRM faculty however, appear to be unsatisfied with the availability or functionality of computers/technology needed for research, and institutional research support. On a question asking, "If you could choose one category to allocate additional resources, which would most enhance your work at GVSU?" most respondents selected research/scholarship (30%), professional collaborations (20%), or professional development (20%).

## Discussion

The NRM Program faculty are actively seeking resources for scholarship, and are successful in obtaining those resources. Internal funding provided an important source of support and were largely used, appreciated, and effective. The NRM faculty disseminated results from research projects in 46 peer-reviewed journal articles, 8 book chapters, and 8 outreach or special-interest articles. Peer-reviewed journals included *Ecological Restoration*, *Michigan Academician*, *Molecular Ecology*, *Landscape Ecology*, *Journal of Wildlife Management*, *Wilson Journal of Ornithology*, *International Journal of Renewable Energy Research*, *Integrated Environmental Assessment and Management*, and others. Additionally, faculty were authors, co-authors, or presenters on over 150 professional oral or poster presentations. Clearly, NRM Program faculty are very effective in conducting scholarly work and disseminating results widely throughout their professional peer-groups and within the community. Currently, there are 10 NRM Program faculty, but with reassigned time for administrative duties, the NRM program effectively has approximately 8 full-time faculty equivalents. Maintaining this level of scholarship may be challenging in the future if faculty continue to hold administrative positions or if additional faculty engage in such positions.

*Objective C: To seek adequate opportunities for professional interaction and collaboration as well as community service.*

## Assessment Measures

- i. Assess Annual Faculty Activity Reports to evaluate accomplishments. The assessment measure was the number of unit, university, and community service activities in which the NRM faculty

members participate, as listed on Faculty Activity Reports. Between 2010–2015, 100% of faculty participated in at least three activities at each of the unit, university, and community levels.

### Assessment Results

- i. Between 2010–2015, NRM Program faculty participated in a total of 192 service activities at the department level, 188 at the university level, and 144 at the community level (Figure 7). Faculty clearly show a high level of engagement in several service activities at multiple levels. On average, NRM Program faculty engage in 3.7 departmental service activities per year, 3.5 service university-level activities per year, and 2.6 community-level activities per year.

### Discussion

All faculty have participated in at least 3 service activities within the department and at the university level. Nine out of ten faculty members have participated in at least 3 service activities within the community. One faculty member documented 1 service activity within the community, but given that this faculty member started this position in the fall of 2015, only one semester was reported. All faculty members are making good service contributions at all levels.

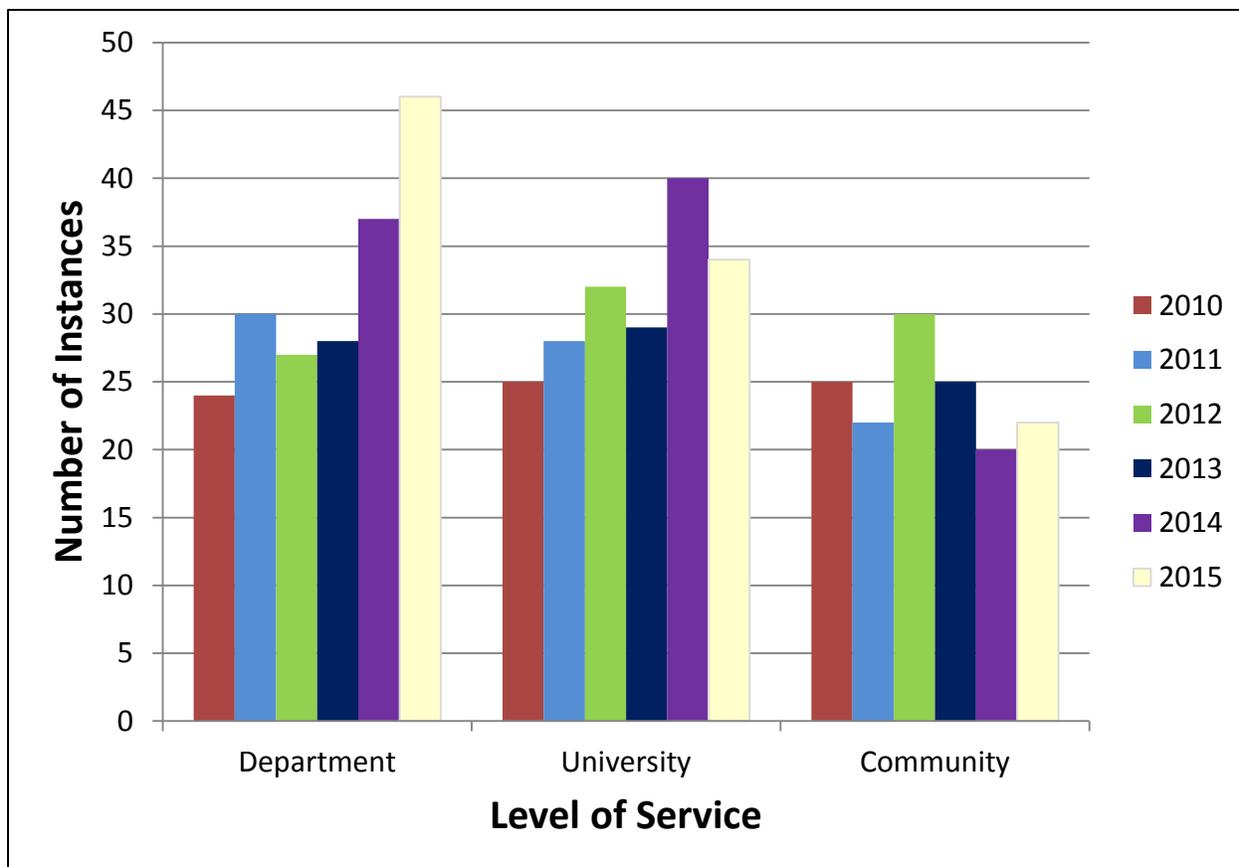


Figure 7. Service activity of NRM Program faculty between 2010–2015.

Service activities were diverse. Some activities required a few hours of time, and others required weeks or more of service. Many activities were ongoing (Table 3).

### Conclusion and Future Directions

The NRM Program Faculty are actively seeking resources and opportunities to enhance professional development in the areas of teaching, scholarship, and service. Faculty members participate in teaching-related workshops, seek grant money for research related to the scholarship of teaching, attend professional conferences, conduct grant-funded research, participate in seminars and workshops, earn professional certifications, and engage in service activities within the department, university, and community. Program faculty members continue to develop professionally as educators, scholars, and citizen-scientists. For future assessments, our protocol will be to maintain or improve current levels of professional development in the areas of teaching, scholarship, and service. A goal

Table 3. Examples of service activities in which NRM faculty participated during 2015.

<b>Department</b>	
	Graduation Ceremonies and Convocations
Sustainable Agriculture Project Advisory Committee	GVSU Ravines Natural Area Committee
Soil and Water Conservation Society Advisor	CLAS Advising Day
Biology Department Graduate Program Committee	Brooks College Faculty Council
Biology Department Curriculum Committee	Brooks Leadership Council
GIS Consultant	Faculty Grievance Committee
VAA Committee	Academic Affairs Committee for Oversight of Credit by Examination
Curriculum Management	Learning Communities, Committee Member
GVSU Convocation	Civic Engagement Committee
GVSU Majors Fair	Higher Learning Commission Reaccreditation Team
Sportsmen for Youth	EDPAC Transfer, Committee Member
GVSU Laker Experience Day	Keynote Speaker - Residence Hall Advisors Start-up Meeting
Waddell-Treanor Scholarship Committee	
	<b>Professional</b>
	Society of Ecological Restoration International Midwest -Great Lakes Chapter, Board of Directors Michigan Representative
<b>University</b>	
NRM Program Committee	Steering Committee for 76th Midwest Fish and Wildlife Conference
Academic Technology Advisory Committee	External Reviewer for Mitacs Accelerate Grant Proposal
GIS Committee	Research and Reports in Biodiversity Studies, Editorial Review Board
Reviewer for Midwest Association of Graduate Schools	Eastern Massasauga Working Group, Committee Member
Undergraduate Research Fair	Upper Midwest and Great Lakes Landscape Conservation Cooperative
G3 Camp Presenter, Session Chair	UN Regional Center of Expertise-Education for Sustainable Devel.
Inclusion Advocate	Sigma Xi Membership Application Reviewer
Core Committee, Office for Community Engagement	
Steering Committee, Office for Community Engagement	<b>Community</b>
GVSU Strategic Positioning Committee	National Weather Service, Cooperative Weather Observer
University Self-Study Leadership Committee Member	Pierce Cedar Creek Advisory Board
Institutional Animal Care and Use Committee	Land Conservancy of West Michigan Stewardship Committee
Ravines Committee	GVSU Peregrine Falcon Project
Office of Sustainability Practice	City of Grand Haven Forestry Consultant
Campus Sustainability Advisory Committee	Blandford Nature Center Forestry Consultant
University Climate Action Council	City of Zeeland, Service Learning Projects
National Council for Science and the Environment, GVSU liason	Meijer Gardens

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## STUDENT GOALS

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**Student Goal # 1: To prepare students for careers in which they can use their education in natural resources management.**

*Objective A: Students will obtain jobs that require them to employ their education in natural resources management.*

### Assessment Measures

- i. Annual senior exit surveys to determine whether students have successfully found employment in a natural resources management field. The target was that 75% of respondents indicated that they would be pursuing a job related to NRM.
- ii. Assessment will occur every five years through surveying graduates within the past five years to determine whether they are successfully finding employment in natural resources management field. The target was at least 75% of alumni being employed in NRM-related fields.

### Assessment Results

- i. Most (87%) seniors who completed an exit survey felt that they would secure a job by the September following graduation. Ninety-percent of those seniors responded that their employment would be NRM-related. Response rate was relatively low (n = 46 responses out of more than 120 students). In the future, exit surveys will be administered in the classroom as opposed to Blackboard, where it is difficult to ensure complete participation.
- ii. An alumni survey was administered during the fall of 2013. We received responses from 146 alumni. Approximately half the respondents graduated between 2009–2013, and 92% of the respondents graduated between 2002–2013. Results indicated that nearly 97% of NRM graduates are currently employed: 67% are employed with full-time jobs, 18% are working part-time jobs, and 12% are employed in seasonal positions. Seventy percent of employed alumni are working in NRM-related professional positions (67%) or pursuing advanced degrees (3%).

On a question related to job satisfaction, most (78.4%) respondents indicated that the nature of their work is rewarding. Additionally, most (67.4%) respondents have opportunities for professional advancement within their current positions. Slightly more than half (54.6%) of the respondents were satisfied with their current salary. Thirty-one percent of the respondents were earning \$35,000 to \$49,000 annually. Nearly 18% were earning greater than \$50,000.

### Discussion

Results indicate that seniors in the NRM program are enthusiastic about pursuing an NRM related job and securing one by the September following graduation. Graduates of the NRM program are pursuing employment related to natural resources, are successful in securing positions, and are largely satisfied

with the work they are doing. Employment from GVSU graduates consists of resource biologists, resource managers, forestry technicians, wildlife technicians, educators, GIS specialists, conservationists, planners, and others. Graduates work for agencies including the Michigan Department of Environmental Quality, Michigan Department of Natural Resources, US Forest Service, US Fish and Wildlife Service, USDA Natural Resources Conservation Service, Consulting companies Parks, or local farms.

Although 70% of reporting alumni listed an NRM-related employer, it was not far from the cutoff of 75%. Some respondents reported positions that were too vague to reliably be reported as NRM-related. Thus, our result may be a conservative estimate and the percent of reporting alumni may actually be higher than 70%. While the 75% target was not met, the results show that NRM Program alumni are overall successful in pursuing careers and are largely satisfied with their positions. In comparison, the most recent previous alumni survey, conducted in 2000, found that 60% of alumni were employed in the NRM field, so if anything, our alumni are more successful in obtaining NRM-related employment now than in the past. The reported salary range of alumni was slightly lower than the median earnings for full-time workers with a Bachelor's degree (\$56,472) according to the 2019 US Census (US Census Bureau [www.census.gov]). However, half of the respondents to the alumni survey had graduated between 2009–2013; thus, the reported salaries are likely more representative of salaries for recent graduates rather than average salaries for NRM-related positions.

*Objective B: Students will be admitted to advanced educational programs in natural resources management or other relevant fields.*

#### Assessment Measures

- i. Annual senior exit surveys to determine whether students have successfully been admitted to graduate school in a natural resources management field.
- ii. Assessment will occur every five years through surveying graduates within the past five years to determine whether they have successfully been admitted to graduate school in natural resources management field.

#### Assessment Results

- i. Five respondents (11%) on the senior exit surveys indicated that they thought they would be enrolled in graduate school the September following graduation. The target was that at least 10% of respondents plan to enroll in graduate or professional school.
- ii. Thirty-five percent (n = 50 individuals) of the respondents indicated that they have completed additional certification or degree programs following graduating with a B.S. in Natural Resources Management from GVSU. Most individuals (n = 31) pursued a M.S. degree related to natural resources or biology. Additionally, four individuals continued to earn a Ph.D., one individual earned a D.V.M., and twenty-four individuals earned professional certifications including

Wilderness First Responder, Wildland Firefighting, Certified Arborist, or Non-profit and Public Administration. The target was at least 10% of listed alumni having earned an advanced degree.

## Discussion

The target for this objective was based on the proportion of the US population with an advanced degree prior to 2009 when the previous strategic plan for the NRM program was written. According to the US Census, circa 2011 11% of the general population had a degree beyond the bachelor level; 8% have a Master's Degree. The number of individuals seeking advanced degrees has been steadily rising since the economic downturn in 2008. For instance, the number of individuals who have completed some graduate school training has increased by 24% between 2008–2013 (US Census [www.census.gov]). The percent of seniors in the NRM program who aspire to enroll in graduate school is consistent with the nationwide trend. Approximately 21% of alumni survey respondents reported earning a Master's Degree, which also reflects the nationwide trend. Results suggest that NRM alumni aspire for continued professional development through advanced degrees, and are successful in making contributions within the field.

## Conclusion and Future Directions

Entry into the NRM profession is highly competitive, especially during the economic recession (2008–2009) and in a few years following. The NRM Program, however, has effectively prepared students to enter careers in a broad range of natural resources management fields. Many NRM Program students plan to enter NRM-related careers, and those who persist in pursuing this goal succeed in doing so.

The NRM Program faculty members encourage students to enter NRM-related careers and advanced studies. Faculty members post job, internship, and graduate assistant opportunities on bulletin boards, Blackboard, and through email announcements. Representatives from the GVSU Career Center make presentations in NRM 150, the required introductory course for all NRM majors, each semester to familiarize students with the career development resources available to them through the university. Program faculty will continue to provide the skills and encouragement for successful NRM-related careers and advanced education.

Current discussions among the NRM Program faculty address future plans of establishing an external advisory council consisting of professionals within NRM fields outside academia. The purpose of the council would be to review our curriculum and provide recommendations to ensure that our program is reflecting current needs in NRM fields. We also have a goal of being accredited as a Natural Resources Management program through the Society of American Foresters, which would provide the program with professional recognition and a national standing. Our aim is to ensure that the NRM program at GVSU remains state-of-the-art and to maximize the potentials of our graduates to secure fulfilling positions in NRM-related fields.

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## STUDENT LEARNING GOALS

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**Learning Goal #1: To prepare students to be proficient in scientific oral and written communication.**

*Objective A: Students will communicate scientific observations, analyses, and arguments in a written format typically required by natural resources management professionals in their fields.*

### Assessment Measures

- i. Assess the quality of students' capstone (NRM 495 / 496) written reports. The target was 80% of students performing at a C or better, and 60% of students performing at a B or better.
- ii. Assess the quality of student writing in BIO 460 (SWS). The target was 80% of students performing at a C or better, and 60% of students performing at a B or better.

### Assessment Results

- i. Within the assessment timeframe (2010–2015), approximately 225 students enrolled 15 sections of capstone were analyzed for writing quality. The target of 80% of students performing at a C or better, and 60% of students performing at a B or better was met in all years of assessment (Figure 8). In all years except 2012–2013, greater than 80% of students scored a B or better on their written reports.
- ii. The quality of student writing in BIO 460 was not assessed during this period due to the SWS designation of this class being dropped.

### Discussion

By the time students take capstone, they have developed strong writing abilities and are able to produce professional quality reports based on projects that they designed and conducted independently. Patterns of performance are fairly consistent among years. Capstone projects may take the form of either a standard scientific manuscript or an adaptive resource management plan. Students clearly demonstrated proficiency in communicating in both formats. These results are consistent with those from the alumni survey indicating graduates agreed or strongly agreed that the NRM curriculum prepared them well in written communication (Figure 3).

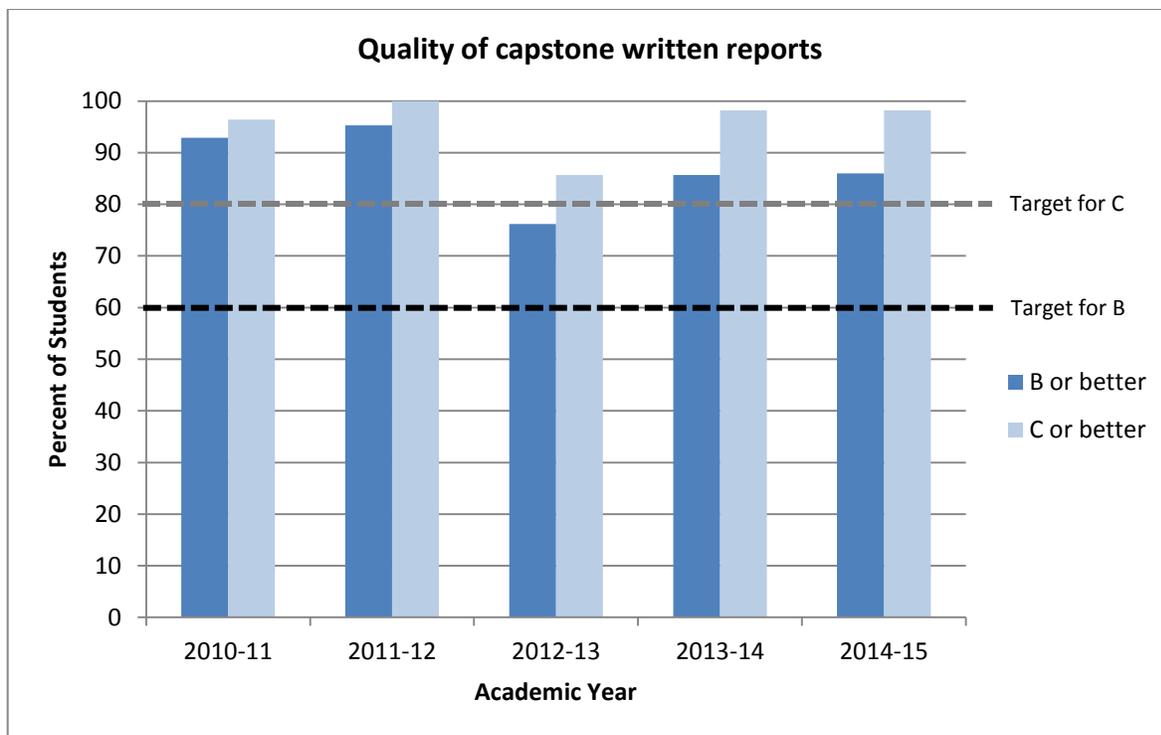


Figure 8. Quality of students' written capstone reports between 2010–2015.

*Objective B: Students will effectively orally communicate scientific observations, analyses, and arguments in group interactions and public presentations.*

#### Assessment Measures

- i. Assess the quality of students' public oral NRM 495 presentations. The target was 80% of students performing at a C or better, and 60% of students performing at a B or better.
- ii. Assess the quality of student contributions to group discussions in NRM 495. The target was 80% of students performing at a C or better, and 60% of students performing at a B or better.

#### Assessment Results

- i. Within the assessment timeframe (2010–2015), approximately 225 students enrolled in 15 sections of capstone were analyzed for the quality of their oral presentations. Student presentations were consistently high in quality, but were slightly lower during the academic year 2012–2013. However, the target of 80% of students performing at a C or better, and 60% of students performing at a B or better was met in all years of assessment (Figure 9). All capstone instructors used a consistent rubric for assessing oral presentations.

- ii. The quality of participation in group discussion in capstone courses was slightly lower than that of oral presentations; however, the target was met in all years except 2010–2011, when 57% of students received a B or better (Figure 10).

Discussion

Both assessment measures met the target for the objective. While the quality of public presentations was consistently high, the quality of daily discussion participation was slightly weaker. The NRM Program has for many years required the students in the winter semester of capstone to present their work at Student Scholars Day. Students in the fall section present at an NRM Program function. To the extent that student performance in classroom discussions tends to be slightly weaker than their public presentation performance, this may represent a student perception that the informal discussion aspect of their coursework is less relevant professionally than their public presentations. Results of these assessment metrics were consistent with those from the alumni survey where alumni largely agreed that the NRM Program prepared them well for oral presentations; however, the proportion of respondents agreeing was slightly lower than those agreeing that the NRM Program prepared them well for written forms of communication. The NRM Program will continue to work towards strengthening students’ oral communication skills.

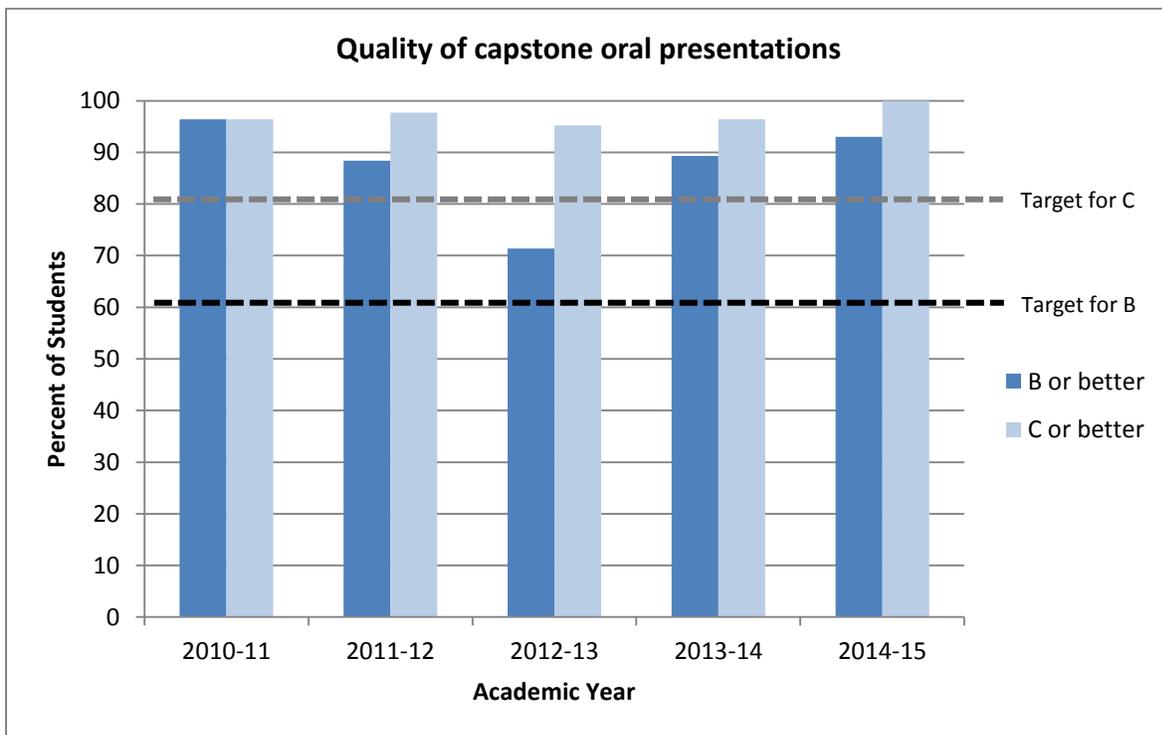


Figure 9. Quality of students’ capstone oral presentations between 2010–2015.

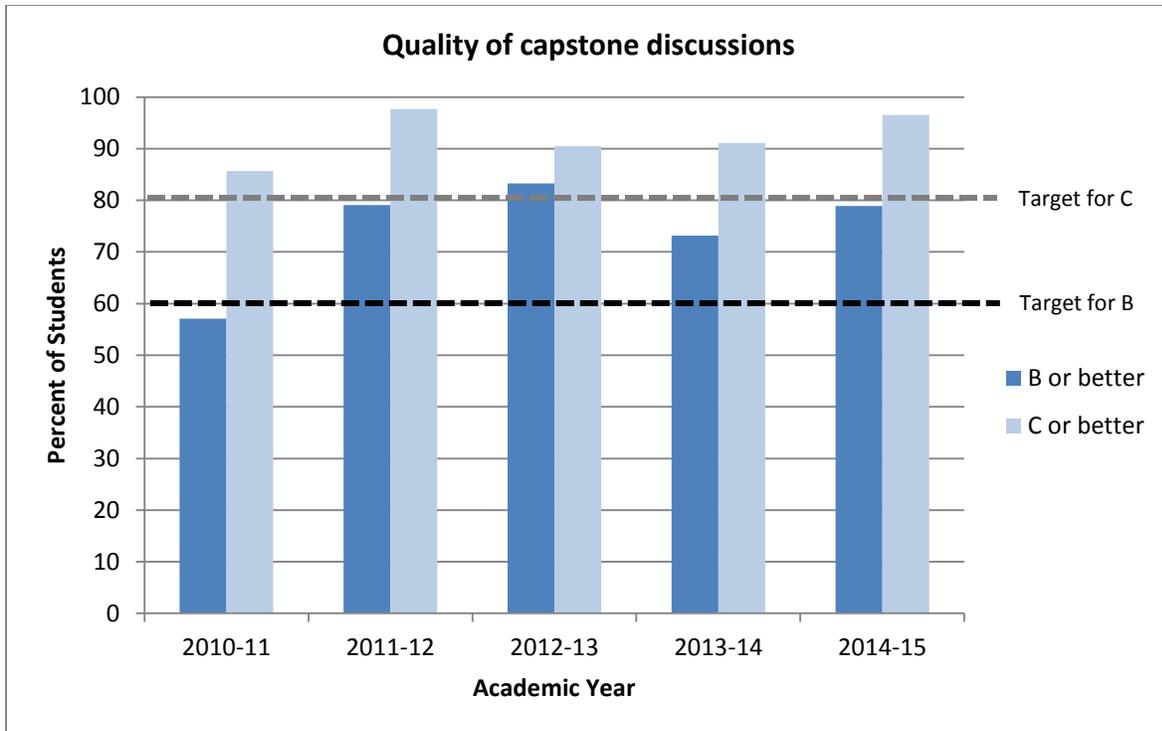


Figure 10. Quality of capstone students' participation in oral group discussions between 2010–2015.

**Learning Goal #2: To provide students with knowledge of the unifying ecological and scientific principles and major professional concepts in natural resources management.**

*Objective A: Students will demonstrate mastery of the interdisciplinary ecosystem approach to natural resources management.*

Assessment Measures

- i. Assess the quality of students' NRM 320 final projects. The target was 80% of students performing at a C or better, and 60% of students performing at a B or better.
- ii. Comparative measure of a standardized assessment instrument between NRM 150 and 495. An assessment rubric was developed, but after reflection NRM Program faculty agreed that a comparative measure between NRM 150 and NRM 495 was not meaningful. Attempting to use NRM 150 as a comparison proved difficult because the course included many non-NRM majors, NRM students taking NRM 150 as seniors, and some NRM majors who may never take NRM 495. Thus, we used a surrogate measure for Student Learning Goal #2, Objective A by comparing performance among years of students in capstone courses. All students who complete capstone are at similar stages in their academic careers (i.e., seniors nearing graduation), and all have completed the majority of the NRM major requirements by the time they enroll in capstone.

Assessment Results

- i. During the assessment timeframe (2010–2015), approximately 250 NRM 320 projects were analyzed by two instructors. The target of at least 80% of students performing at a C or better, and 60% of students performing at a B or better was met (Figure 11).
- ii. Overall performance on capstone courses is fairly consistent among all years, with most students performing at B or better (Figure 12). Results suggest that most students are able to integrate expectations for written and oral communication with content mastery to achieve a professional level of competence requiring an understanding of interdisciplinary natural resources management issues.

Discussion

The systems approach is fundamental to managing resource systems. Students appear to have gained proficiency in modeling systems and making inferences within a management context. Most students in all years scored a B or better on their NRM 320 projects and on their general performance in capstone. Evidently, the NRM program included a slightly weaker cohort of students who enrolled in NRM 320 during 2011–2012 and capstone in 2012–2013. The slightly lower performance in NRM 320 and capstone for this cohort suggests an anomaly and is not representative of the NRM program overall.

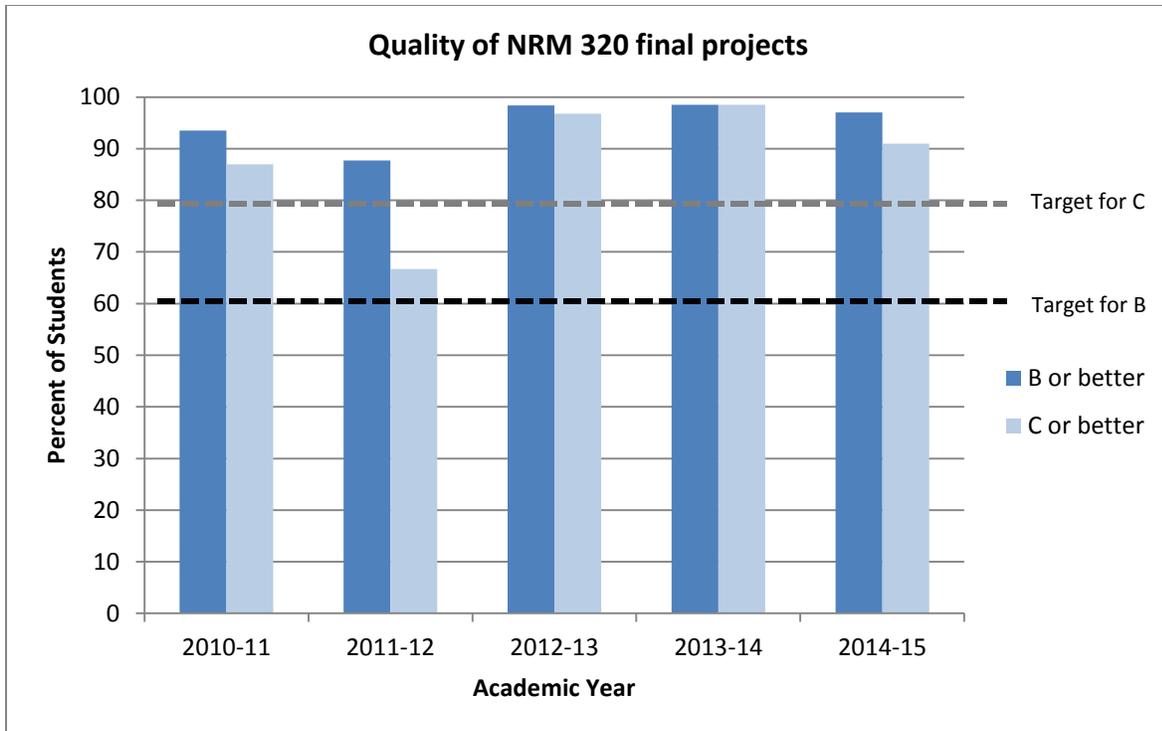


Figure 11. Quality of student projects in NRM 320 between 2010–2015.

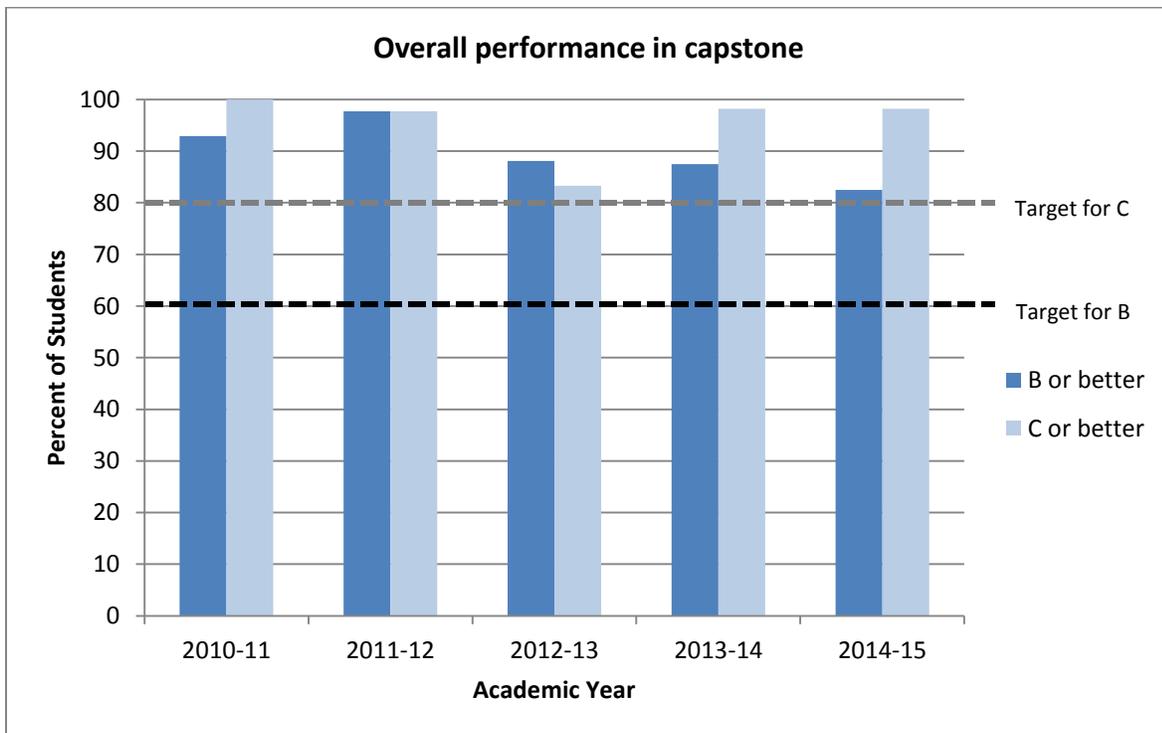


Figure 12. Overall student performance in capstone courses between 2010–2015.

*Objective B: Students will investigate natural resources management issues using diverse approaches from a number of different fields relevant to natural resources management.*

### Assessment Measures

- i. Assess the diversity of approaches used in NRM 495 projects.
- ii. Assess the diversity of approaches used in course projects in NRM 320.
- iii. Assess the diversity of courses taken by students throughout the NRM curriculum including NRM and cognate courses.

[NOTE: No specific quantitative target for these measures was proposed. We made a qualitative assessment of the results to determine if the program is adequately exposing students to a variety of approaches to resource management issues and to what extent the students will apply these approaches in their projects.]

### Assessment Results

- i. Within 2010–2015, a total of 218 NRM 495 and NRM 496 (Capstone) projects were included in the analysis. Capstone project topics were categorized into 13 subject areas (Figure 13). Within the subject areas, topics and approaches differed. For instance, in the “wildlife” category, projects focused on ecology, populations, management, endangered species, or others. Overall, it was evident that a diversity of topics were studied; however, wildlife clearly represented the majority (24%), followed by projects related to water (15%), forests (11%), and restoration (10%; Figure 13). As a whole, student projects included a diversity of approaches representing individual student interests while also demonstrating the incorporation of diverse skill sets developed in required and elective coursework (see Figures 14–15).
- ii. The NRM 320 course is designed to help students learn a systems-approach to management and construct simple systems models on which to infer management practices. Within 2010–2015, a total of 81 NRM 320 projects were included in the analysis (Figure 14). Project topics were categorized into the same 13 subject areas; however, three of the subject areas represented in capstone (i.e., waste, policy, and parks) were not represented in the NRM 320 projects. At the time students took NRM 320, it is likely that they had not yet taken policy (NRM 451), wildland recreation management (NRM 420), or pollution (NRM 330). Similar to capstone projects, most (37%) of the project topics in NRM 320 represented wildlife (Figure 14). This trend is probably due to the relatively large amount and availability of wildlife-related data such as population numbers, habitat characteristics, or birth/death rates that are frequently needed to model populations. All projects required students to integrate information from a variety of disciplines and to apply this information to develop models for their projects. Thus, it is evident that students have applied a variety of approaches to resource management issues.

iii. Of 21 NRM courses, 4 are required and 17 are electives including special topics, internships, readings, and independent research. NRM 250 (*Resource Measurements and Maps*), NRM 281 (*Principles of Soil Science*), and NRM 451 (*Natural Resources Policy*) were taken by at least 85% of NRM students (Figure 15). Special topics courses offering content in emerging issues or new advancements in the field are also popular among NRM students with 66% of students having taken NRM 480 and 40% of students having taken NRM 380. The relatively high percent of students who took NRM 480 may be inflated because the alternate capstone (NRM 456/457) was offered as NRM 480 for three years before becoming a permanent course. Other “special topics” courses included *Ecological Restoration*, *Introduction to Fire Management*, *Global Agricultural Sustainability*, and *Agroecology*. Other popular courses include NRM 395 (*GIS Applications in Resource Management*) and NRM 452 (*Watershed and Wetlands Management*), with over 50% of NRM students enrolling in those courses. Internships are also an important part of credits for over half of NRM students. NRM 240 (*Principles of Climatology*), NRM 450 (*Applied Spatial Analysis of Natural Resources*), and NRM 300 (*Ethical Recreation*) were taken by less than 20% of NRM students; however, these courses were not offered every year within the evaluation period. Additionally, the cap on NRM 300 is set at 11 due to the intense field nature of the course.

The NRM program required students to take 40 credits of science electives consisting of biology courses at the 200-level or higher, math (MTH 122 or higher), chemistry (CHM 109 or 115), statistics (STA 215 or higher), geology (GEO 111), geography, or computer Information science. It is not surprising that, 300-level biology courses are popular among NRM students (Table 3), as many NRM students declare a minor in biology. Biology courses were, by far, those taken most frequently by NRM students to meet their science elective requirements. Geography courses at the 300-level, specifically, GPY 307 (*Introduction to GIS*), were also taken by NRM students. GPY 307 is a requirement for the GIS Certification through the Geography Department. Many NRM students earned a certificate in GIS, which helps their marketability for NRM jobs.

Table 3. Enrollment in science elective courses at Grand Valley State University by NRM students between 2010–2015. The enrollment data below does not include transferred courses.

	Course level				TOTAL
	100-199	222-299	300-399	400-499	
Biology		25	308	128	461
Math	87	40	5	3	135
Chemistry	48	28	1	1	78
Statistics		217	5		222
Geology	54	4	82	11	151
Geography		57	89	25	171
CIS <sup>1</sup>	39				39

<sup>1</sup>CIS 150 (Introduction to Computing) was the only CIS class taken by NRM students.

## Discussion

Based on the number and types of subjects represented in capstone and NRM 320 projects, it is reasonable to assume that the objectives pertaining to diversity of approaches used by NRM students were met. Of course, projects relating to wildlife were disproportionately represented in capstone and NRM 320, but sub-categories and methodologies were diverse. For instance, in 2010, a content analysis of capstone projects revealed that students were working in a diversity of natural and social scientific disciplines, focused on the full range of natural resources present in Michigan, and ranged across two or more scientific disciplines (interdisciplinary; see 2014–2015 Assessment Report in WEAVE Online).

The suite of NRM courses offered are also attractive to NRM students, as courses offered annually regularly enroll 30% or more of the NRM student body. With an increasing trend in the number of NRM students over the assessment period (see the 2015 Biology Department Resource Analysis) and a high demand for enrollment in NRM elective courses, it is likely that the NRM program will need to increase the number of sections of elective courses offered in the future. The increasing enrollment and the high demand for space in elective courses will likely result in a need for additional tenure-track faculty.

NRM students have taken advantage of opportunities to minor in biology or earn a certificate in GIS by taking upper-level courses in each discipline. NRM faculty should continue to encourage students to enroll in elective courses offered in supporting disciplines, especially since the number of required credits in elective courses has been eliminated with the 2015 program change due to the reduction in the total number of required program credits.

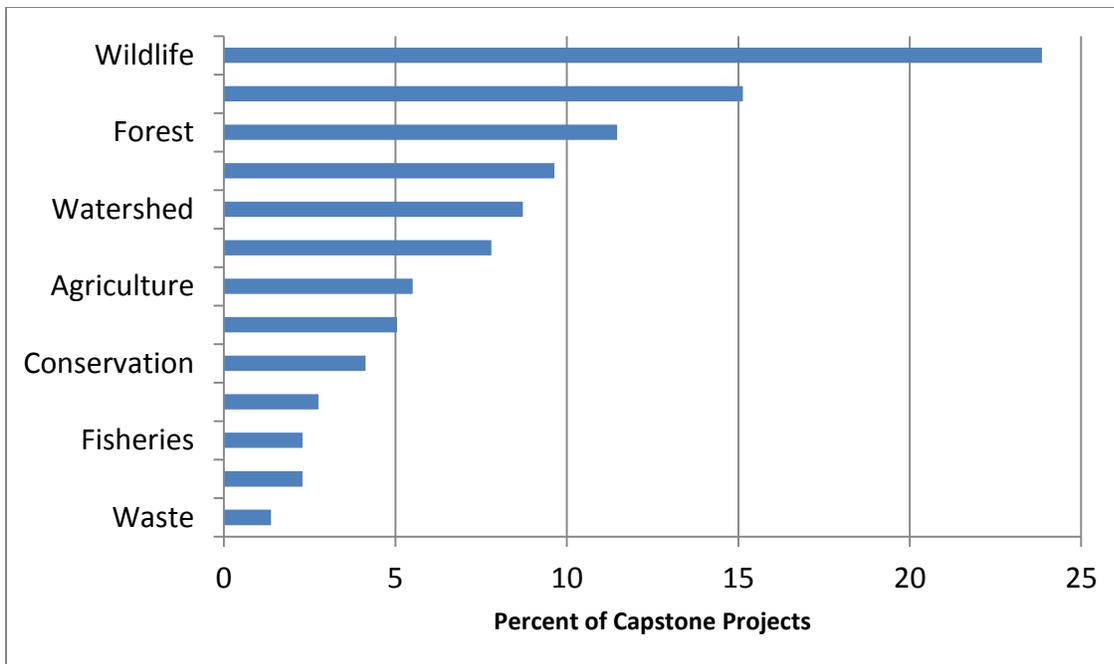


Figure 13. Percent of 218 total NRM 495 or NRM 496 (Capstone) projects represented in different subject areas between 2010–2015.

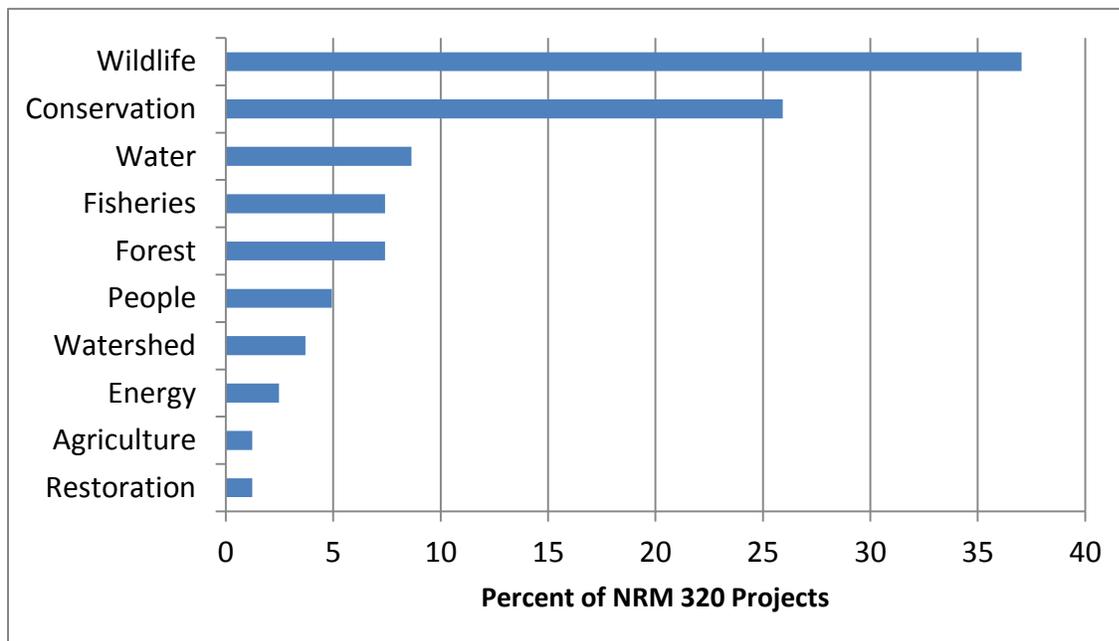
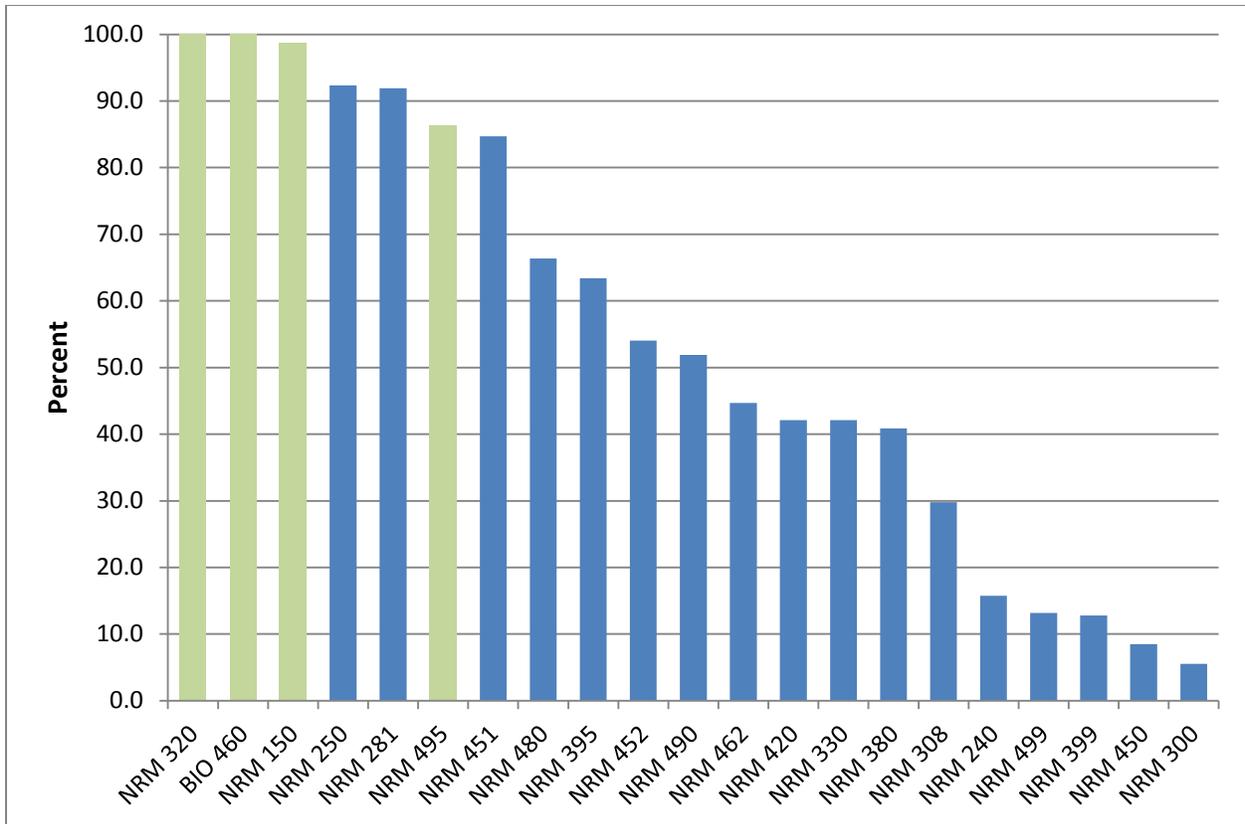


Figure 14. Percent of 81 total NRM 320 (Introduction to Resource Systems) projects represented in different subject areas between 2010–2015.



NRM 320 Intro to Resource Systems (required)	NRM 490 Internship in Resource Management
BIO 460 Terrestrial Ecosystem Ecology (required)	NRM 462 Forest Ecosystem Management
NRM 150 Intro to Natural Resources (required)	NRM 420 Wildland Recreation Management
NRM 250 Resource Measurement and Maps	NRM 330 Environmental Pollution
NRM 281 Principles of Soil Science	NRM 380 Special Topics in NRM
NRM 495 Trends in Natural Resource Management (	NRM 240 Principles of Climatology
NRM 451 Natural Resource Policy	NRM 499 Independent Research
NRM 480 Special Topics in NRM	NRM 399 Readings
NRM 395 GIS Applications in Resource Mgt	NRM 450 Applied Spatial Analysis of NR
NRM 452 Watershed and Wetland Management	NRM 300: Ethical Recreation

Figure 15. Percent of 235 NRM students between 2010–2015 who enrolled in NRM courses. Green bars represent required courses. Blue bars represent electives.

## Conclusion and Future Directions

Students in the NRM Program are making good progress in learning the unifying and scientific principles and major professional concepts in natural resources management. Without question, students have demonstrated proficiencies in taking diverse and interdisciplinary approaches to addressing natural resources-related issues. NRM students are also supporting their professional development by enrolling in relevant science elective courses, specifically in upper-level biology and geography.

With the new program change (effective fall 2015), enrollment in NRM courses probably will not change much. The only course where enrollment may change is in NRM 320, which is no longer a required class; it is one option in an analytical competency area. NRM 250, 281, and 451 are required in the new program, but most NRM students elected to take those courses regardless (Figure 14). NRM faculty will need to closely monitor and assess the impact the changes will have on the program, student outcomes, and student learning objectives. If goals are not obtained, the NRM program faculty need to be responsive and adaptive. NRM Program faculty will continue to monitor student outcomes annually, and administer alumni surveys every 5 years.

Several objectives and assessment metrics were revised in the new strategic plan to address shortcomings (Appendix A). Specifically, NRM faculty will implement pre- and post- quizzes in courses including NRM 250 and capstone to quantitatively evaluate the impact of the courses on student proficiencies in competency areas. Establishment of an external advisory council to review the NRM curriculum and provide recommendations for the program will help us ensure that we are assessing the right metrics for evaluating the quality, rigor, and impact of our program on student learning and the NRM profession.

## SECTION V: REFLECTION

### **What are the particular strengths for which the NRM Program would like to be recognized?**

The NRM Program has successfully maintained a state-of-the-art curriculum that attracts an increasing number of students and prepares them well for careers. Results from alumni surveys confirmed that the NRM program provided courses in a breadth of subject areas and technical skills. NRM alumni are successful in securing employment and/or graduate degrees post-graduation. The NRM Program curriculum is comparable to other NRM degree programs in the content offered to students.

Resources to facilitate effective teaching, scholarship, and service are largely available to NRM faculty. The new Kindschi Hall of Science has provided excellent resources for teaching and research. Faculty in the NRM Program are engaged in high-impact teaching and seek resources through FTLC and external grants to enhance teaching. Faculty also are actively engaged in scholarship, which was evidenced by a substantial number of grants awarded, professional oral and poster presentations made, peer-reviewed articles published, and students involved in research projects. The NRM faculty clearly are dedicated to service at multiple levels. Faculty devote time and energy to serving on various committees at department, college, university, and professional-levels, and offer services to several community partners. Four NRM faculty members serve as leaders in administrative positions. In many instances, NRM faculty engage in service activities in synergism with teaching and scholarship activities. Thus, students involved in these activities are also developing community networks and learning to be citizen scientists.

Students in the NRM Program are proficient in scientific oral and written communication, as indicated by scores on capstone presentations and written reports. Through the diversity of project topics and methods used, students also demonstrate knowledge of unifying ecological and scientific principles in natural resources management.

### **What are the particular challenges the unit should address in the next Strategic Plan?**

With implementation of the new program change, effective Fall 2015, it is imperative that NRM program faculty carefully and strategically assess student learning outcomes. A decrease in the number of total required credits may present challenges in terms of offering the high-level of breadth and technical options available with the former program. Other NRM programs in Michigan are in various stages of development, and could potentially compete with the NRM program at GVSU. Pursuing accreditation and establishing an external advisory council to review our curriculum and make recommendations for maintaining rigor will help ensure we are maintaining a state-of-the-art curriculum.

Several NRM faculty serve administrative and leadership roles at department, college, and university levels. As such, time is reassigned from teaching to administrative duties. Of the 10 tenure-track faculty, 50 contact hours consist of reassigned time. Thus, the NRM program effectively has the

equivalent of fewer than 8 full-time faculty when no one is on sabbatical or other leave. It remains challenging to deliver a rigorous program with flexibility for students in terms of electives, number of sections scheduled, and times courses are offered--especially with increasing student enrollment. A future goal may be to increase the number of tenure-track program faculty.

With computer-intensive needs such as coursework in NRM 395 (*GIS Applications in Natural Resources*), NRM 320 (*Introduction to Resource Systems*), graduate research projects, and undergraduate projects, continuous availability of a computer lab is needed. Specialized software (i.e., ArcGIS and STELLA) is installed on the local drives of computers in the Kindschi Hall of Science computer lab; however, the computers are not available to students on weekends, during the evenings, or throughout the day when other courses are occupying the computer lab. Two other computer labs on campus, MAK B2126 and HRY 116, have ArcGIS software installed on local drives, but are occupied with various courses throughout the day. Additionally, advancements in computer software for processing large amounts of genetics and population data necessitate the availability of computer labs for courses and student research.

## SECTION VI: REVISED STRATEGIC PLAN

### NATURAL RESOURCES MANAGEMENT PROGRAM STRATEGIC PLAN 2016–2021

Revised: February 2016

#### *FACULTY*

Alexandra Locher (NRM Program Chair), Todd Aschenbach, Carol Griffin, Paul Keenlance, Neil MacDonald, Shaily Menon, Jennifer Moore, Erik Nordman, Mel Northup, Priscilla Nyamai

#### *CONTEXT FOR PLANNING*

The Natural Resources Management Program supports 220 declared majors and 26 declared minors. Graduates from the Program demonstrate proficiencies in ecological principles, technical skills, social context, communication, collaboration, and project management. An undergraduate degree in Natural Resources Management prepares students to be marketable and competitive for jobs in state or federal agencies, environmental organizations and consulting firms, non-profit organizations, or graduate degrees related to natural resources. Our strategic plan aims to maintain or enhance the quality of our curriculum, faculty, and resources to provide an excellent degree program for current and future students.

#### *VISION*

The Natural Resources Management Program aspires to provide a distinguished degree program.

We recognize that a current, challenging curriculum, highlighted by intensive field and laboratory courses, and which encourages our students to work outside of their comfort zones is a vital component of a quality program. We require a core of courses from biology, chemistry, economics, mathematics, and statistics. On this foundation we offer interdisciplinary courses in Natural Resources Management designed to integrate systems concepts with practical applications.

We recognize that critical components of a superior program include an interdisciplinary systems approach to natural resources management, and development of a working knowledge of the tools and scientific principles available to understand and address complex natural resources management issues. We infuse our curriculum with current examples of the application of a science-based ecosystems approach to natural resources management issues.

We recognize that student involvement in practical hands-on natural resources management experience is a critical component of our program and we aspire to encourage and motivate all of our

undergraduates to participate in natural resources management experiences such as internships, jobs, research, and volunteer service.

We recognize that a diverse faculty engaged in their areas of expertise and responsive to the needs of our students, colleagues, and community is necessary for our program. We support our faculty such that they may perform this role effectively and efficiently.

We aspire to have our graduates active in a field of their choice using the expertise developed in the Natural Resources Management Program. Some may be employed, others may be in graduate or professional programs where they will continue to build their expertise, and yet others may choose an alternative career but still spend a portion of their lives promoting the conservation of natural resources.

### *MISSION*

The Natural Resources Management Program integrates scientific skills, an interdisciplinary systems approach, and hands-on laboratory and field experiences with excellent classroom teaching to prepare students to be critical thinkers, engaged citizens, and creative and competent professionals in natural resources management.

### *VALUES*

The Natural Resources Management Program values an academic environment that features:

- A broad, challenging and current curriculum featuring intensive field and laboratory courses along with excellent classroom instruction;
- Opportunities for undergraduates to obtain hands-on experiences through internships, employment, research, and volunteer service;
- An engaged, diverse, and responsive faculty, dedicated to excellent teaching, scholarship, and professional service;
- A curriculum that fosters an understanding of the methods, tools and skills necessary for natural resources management; and
- Graduates who recognize the value of professional and community service.

## **GOALS AND OBJECTIVES - CURRENT PRIORITIES**

### *STUDENT LEARNING GOALS*

#### **Student Learning Goal #1: Prepare students to be proficient in scientific oral and written communication.**

##### *Objectives:*

- A) Students will effectively communicate, in written form, scientific observations, analyses, and arguments in a format typically required by natural resources management professionals in their fields.
- B) Students will effectively communicate, in oral form, scientific observations, analyses, and arguments in group interactions and public presentations.

##### *Assessment measures:*

###### Objective A:

- i) Assess the quality of capstone written reports.
- ii) Assess the overall quality of writing of NRM students.

###### Assessment details:

- i) We will use the General Education Writing Rubric (Appendix 1) to assess the quality of capstone written reports. This rubric classifies writing quality as “Baseline”, “Progressing”, “Proficient”, or “Distinguished” based on content, organization, expression of ideas, and appropriate grammar, style, and format. Our goal is to achieve and maintain 75% proficiency in writing among all graduates.
- ii) We will obtain data about the writing quality of NRM students from the General Education Program. These data will initially provide a baseline and allow us to evaluate improvement over time.

###### Objective B:

- i) Assess the quality of students’ public oral capstone presentations.

###### Assessment details:

- i) We will use a rubric similar to the General Education Writing Rubric to assess the quality of capstone oral presentations. This rubric will classify oral presentation quality as “Baseline”,

“Progressing”, “Proficient”, or “Distinguished” based on content, organization, visual expression of ideas, and speaking ability. Our goal is to achieve and maintain 75% proficiency in oral presentation ability among all graduates.

**Student Learning Goal #2: Students demonstrate proficiency in knowledge of the unifying scientific principles and major professional concepts in natural resources management.**

*Objectives:*

- A) Understanding of ecological concepts and principles including the structure and function of ecosystems, plant and animal communities, competition, diversity, population dynamics, succession, disturbance, and nutrient cycling.
- B) Ability to identify, measure, and map land areas and conduct spatial analyses.
- C) Evaluation and understanding of the economic, ecological, and social trade-offs of alternative land uses and ecosystem management decisions at local, regional, and global scales

*Assessment measures:*

Objective A:

- i) At least 75% of NRM students in BIO 460 will receive a C or better on an assignment assessing understanding of ecological concepts and principles.

Assessment details:

i & ii) To assess students’ understanding of ecological concepts and principles, we will evaluate the grade distribution of NRM students completing BIO 460. The BIO 460 curriculum investigates the structure and function of terrestrial ecosystems using a systems approach, and examines biotic and abiotic processes affecting ecosystem dynamics. In BIO 460, students are presented opportunities to reinforce or master ecological concepts and principles that were introduced in BIO 215 or other lower-level courses.

Objective B:

- i) Compare scores in individual students enrolled in NRM 250 (Resource Measurements and Maps) from pre- and post- quizzes on their ability to identify, measure, and map land areas and conduct spatial analyses.

Assessment details:

i & ii) The ability to identify, measure, and map land areas and conduct spatial analyses is imperative for success as an NRM professional. NRM 250 is a required core foundational

course, and it is a prerequisite for several upper-level NRM courses including NRM 395 (Applications of GIS in Natural Resources), NRM 452 (Watershed and Wetland Management), and NRM 462 (Forest Ecosystem Management). Therefore, to quantify proficiency in the NRM 250 curriculum for teaching these skills, we will compare scores on pre- and post-quizzes in NRM 250 addressing resource measurements, map reading, and spatial skills.

Objective C:

- i) Compare composite scores of NRM students enrolled in NRM 150 and Capstone (NRM 495, or NRM 496/497) from quizzes assessing their ability to evaluate and understand the economic, ecological, and social trade-offs of alternative land uses and ecosystem management decisions at local, regional, and global scales.
- ii) At least 75% of NRM students in NRM 451 will receive a C or better on an assignment assessing understanding of economic and social concepts and principles.

Assessment details:

i & ii) The Capstone course allows students to synthesize materials from the NRM program and demonstrate proficiencies in their ability to implement management approaches that integrate economic, ecological, and social aspects of systems. Assessment of scores on a pre-quiz will allow us to identify specific strengths and/or weaknesses of the NRM program in evaluating and understanding trade-offs among alternative land use practices and ecosystem management decisions at multiple spatial scales. Additionally, comparison of scores on pre- and post-quizzes will allow assessment of the success of capstone in helping students master skills in synthesizing and integrating materials from the NRM program.

*FACULTY GOAL*

**Faculty Goal #1: Encourage and enhance faculty professional development, scholarship, and service.**

*Objectives:*

- A) Maintain or improve current levels of faculty professional development activities related to teaching or research

- B) Maintain or improve current levels of funding acquisition, conference or outreach presentations, or publications of scholarly works.
- C) Maintain or improve current levels of faculty involvement with community partners.

*Assessment measures:*

Objectives A, B, & C

- i) Review annual Faculty Activity Reports to evaluate accomplishments related teaching, scholarship, and community service.

Assessment details:

Excellence in teaching, scholarship, and service is important for well-respected and competent faculty. Thus, it is imperative to keep current on new advancements in these areas, secure professional networks, provide opportunities for faculty and students, and maintain a state-of-the art program. Annual faculty activity reports will indicate the amount of effort and types (i.e., institutional, regional, national) of activities faculty pursue related to teaching excellence, and their roles (i.e., participants, mentors, presenters). Additionally, faculty activity reports will indicate efforts related to grant applications, funding acquisition, and types of scholarly and creative projects. Finally, assessment of faculty engagement in community partnerships and service will indicate the level of community engagement and service outside the institution. Professional networks and impacts made within the community strengthen the image of the institution and the competencies of the faculty.

## STUDENT GOALS

### **Student Goal #1: Prepare students for careers in which they use their education in natural resources management**

#### *Objectives:*

- A) At least 90% of undergraduate students will participate in two or more high-impact learning experiences (employment, internship, volunteer, or research) prior to graduation.
- B) At least 75% of NRM graduates are employed in an NRM-related field within 5 years of graduation.

#### *Assessment measures:*

##### Objective A:

- i) An exit survey will be administered to students enrolled in Capstone (NRM 495, or NRM 496/497) to identify the frequency of students engaged in high-impact learning and/or volunteer experiences prior to graduation, and the types of experiences students engaged in.

##### Assessment details:

- i) An exit survey will be administered to all students in Capstone to determine the percent of students who have participated in high-impact learning experiences during their enrollment in the NRM program.

##### Objective B:

- i) Assessment will occur every five years through surveying graduates within the past five years to determine whether they have obtained jobs or advanced degrees related to natural resources management.

##### Assessment details:

- i) An alumni survey will be developed and administered to all graduates within the past five years that the Alumni Association can locate. This will allow us to assess whether graduates within five years of graduating are employed in a natural resources management field, have completed graduate degrees, or are currently enrolled in a graduate program. It will also allow us to track changes in employment over the five years following graduation. Trends in employment rates will be noted. Employment rates partially reflect many facets of the quality of our undergraduate education, including student learning, school reputation, and advising. Accordingly, any consistent trends will be noted and curriculum, faculty, and program goals modified as appropriate.

## PROGRAM GOALS

### Program Goal #1: Maintain a state-of-the-art natural resources management curriculum.

#### *Objective:*

- A) Ensure that adequate facilities and resources exist to support the student body and curriculum.
- B) Within 5 years, apply for accreditation of NRM programs through the Society of American Foresters.
- C) Within 5 years, establish an external advisory council to review the NRM curriculum to ensure that our program is reflecting current needs in NRM-related fields.

#### *Assessment measures:*

##### Objective A:

- i) Comparison of curriculum to that of peer institutions.
- ii) Assess senior exit surveys and alumni surveys to evaluate students' and graduates' perceptions of professional preparedness.

##### Assessment details:

A question on the senior exit survey asking students to rate the quality of equipment and resources available to them for lab or research activities will assess the adequacy of our facilities to support the curriculum. Comparison between the NRM curriculum at GVSU and that of peer institutions will indicate how well-rounded our program is relative to other natural resources-related programs. We will note similarities and differences among all programs assessed, and infer strengths and improvement areas needed based on the professional competencies required for successful employment. Responses from participants of the senior exit surveys and alumni surveys will provide feedback on how well the NRM program prepared students to secure professional positions in their respective disciplines. The feedback will allow us to monitor the success of our curriculum and make changes as needed.

##### Objective B:

- i) Apply for accreditation within 5 years.

##### Assessment details:

Accreditation of the NRM program through a professional organization such as the Society of American Foresters will promote our program as a rigorous and recognized natural resources program nationally. Our students will be more competitive for some professional positions, as some jobs require degrees from accredited institutions.

Objective C:

- i) Establish an external advisory council within 5 years.

Assessment details:

To ensure direct linkages between curriculum taught in lower-level courses and curriculum in upper-level courses designed to help students master material, we will conduct a rigorous curriculum mapping project. An external review council will help ensure that our program is preparing students to be competent professionals in a broad range of NRM-related fields.

Appendix 1. General Education written communication rubric.



**WRITTEN COMMUNICATION**

SKILLS DEVELOPMENT TRAJECTORY IN GENERAL EDUCATION COURSES				
WRITTEN COMMUNICATION is the practice of creating and refining messages that educated readers will value. People with a general education use thoughtful writing processes to develop effective written materials for a variety of audiences and purposes, entering larger discussions by using formats and conventions that are important to their readers.				
Students will:	Distinguished	Proficient (Level of most graduating seniors)	Progressing	Baseline (Level of most entering freshmen)
Develop content that is appropriate to a specific disciplinary or professional context	<ul style="list-style-type: none"> <li>Uses appropriate, relevant, and compelling content to illustrate control and understanding of the topic and to demonstrate the author's ability to shape the whole work</li> </ul>	<ul style="list-style-type: none"> <li>Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work</li> </ul>	<ul style="list-style-type: none"> <li>Uses appropriate and relevant content to develop and explore ideas through most of the work</li> </ul>	<ul style="list-style-type: none"> <li>Uses appropriate and relevant content to develop simple ideas in some parts of the work</li> </ul>
Organize written material to suit the purposes of the document and meet the needs of the intended audience	<ul style="list-style-type: none"> <li>Uses organizational and formatting conventions to promote coherence, cohesion, and flow in ways skillfully suited to the context and purpose</li> </ul>	<ul style="list-style-type: none"> <li>Consistently uses organizational and formatting conventions to promote coherence, cohesion, and flow that is reasonably suited to the context and purpose</li> </ul>	<ul style="list-style-type: none"> <li>Follows appropriate expectations of basic organization and format, showing awareness of different contexts and purposes</li> </ul>	<ul style="list-style-type: none"> <li>Attempts to use a consistent system for basic organization and presentation</li> </ul>
Express ideas using language that meets the needs and expectations of the intended audience	<ul style="list-style-type: none"> <li>Uses language that skillfully communicates meaning with clarity and fluency, adapting style skillfully to audience, context, and purpose</li> </ul>	<ul style="list-style-type: none"> <li>Uses straightforward language that successfully engages readers and conveys meaning with little confusion or distraction, adapting style adequately to audience, context, and purpose</li> </ul>	<ul style="list-style-type: none"> <li>Uses language that generally conveys meaning with clarity, showing awareness of audience, context, and purpose</li> </ul>	<ul style="list-style-type: none"> <li>Uses language that generally conveys meaning but lacks clarity and focus and sometimes confuses and distracts readers</li> </ul>
Use conventions of grammar, punctuation, usage, formatting, citation, and documentation appropriate to the specific writing situation	<ul style="list-style-type: none"> <li>Skillfully integrates high-quality, credible, appropriate, and relevant sources to develop ideas</li> <li>Finished work is nearly free from distracting errors</li> </ul>	<ul style="list-style-type: none"> <li>Accurately integrates credible, appropriate, and relevant sources to support ideas</li> <li>Finished work has very few distracting errors</li> </ul>	<ul style="list-style-type: none"> <li>Generally integrates credible, relevant and appropriate sources into the writing to support ideas</li> <li>Finished work is easily understood, despite a few distracting errors</li> </ul>	<ul style="list-style-type: none"> <li>Uses credible, relevant sources to develop content, but without consistent integration</li> <li>Finished work has some distracting errors but can be understood without strain</li> </ul>

This rubric was adapted from the AAC&U VALUE rubric.

Updated 11-21-14