UNIVERSITY OF WYOMING

College of Arts and Sciences
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8 September 2016

MEMO

TO: Kate Miller
Provost/VPAA

FROM: Paula M. Lutz
Dean, Arts and Sciences

RE: Program Review for Statistics M.S. degree—Dean's recommendation

The M.S. in Statistics has produced twenty-four applied masters students in the past six years (FY11-FY16). Interest appears to be increasing in this degree in recent years. Six active faculty remain in the department, with two 'on loan' for administrative duties elsewhere in the university.

The masters curriculum is unique in its value as service teaching for other disciplines (>34) across campus. In FY16, 226 graduate students *outside Statistics* took ~680 credit hours in the department. The dean agrees with the comment in the program review that the "…applied masters curriculum is central to the teaching and research mission of the University of Wyoming…" Outside of the courses for service teaching, only one additional course is required for the applied M.S.—STAT5470, the data analysis project—making the degree virtually cost-free.

The dean's recommendation is to maintain the M.S. in Statistics. In the first round of program reviews, the B.S. in Statistics was reviewed and the following comments were made: *"It is the Dean's recommendation that this degree (B.S.) be "re-vamped" with a 'Data Analytics' track added, and that serious consideration be given to an interdisciplinary degree as well. The department's Ph.D. accepted no new students this academic year; that degree should be considered for closure so that emphasis may be placed on the M.S., the B.S. (in new form), and minors. The small number of faculty (six) is also a concern. A merger with another department such as Mathematics is being discussed."* The dean remains committed to these goals—a renovated B.S., consideration of closure of the Ph.D., and renewed emphasis on the M.S., with discussion of a departmental merger in the future.

Program Review of the Statistics Applied Masters at UW

Department of Statistics, College of Arts and Sciences

Head: Ken Gerow; gerow@uwyo.edu, 766-6600.

Program Productivity

We have graduated 24 Applied Masters students from AY 2010-2011 through AY 2015-2016. Table 1 shows the numbers of enrolled undergraduate majors and minors over the past five years.

Table 1. Increase in Numbers of Enrolled Graduate Majors and Minors (recorded for Spring Semester of noted year)

	2011	2016	% Increase	Average yearly increase
Majors	6	10	66%	13%
Minors	5	12	140%	28%
Total	11	22	100%	20%

Program Quality

(a) Program accreditation. Not applicable.

(b) Credentials of faculty (currently active full-time: 6, including Head). Of the six, four are white males, one is a white female, and one is an Asian-American female.

Professors

1. Richard Anderson-Sprecher, Ph. D. Statistics, University of Iowa.
2. Ken Gerow, Ph. D. Biometry, Cornell University; Head of Department.
3. Snehalata Huzurbazar, Ph.D. Statistics, Colorado State University.

Timothy Robinson, Ph.D. Statistics, Virginia Tech (seconded into Directorship of WWAMI since summer 2014).

Stephen Bieber, Ph.D. Quantitative Psychology, University of California-Berkeley (seconded into Directorship of WYSAC since summer 2015).

Associate Professors

4. Shaun Wulff, Ph.D. Statistics, Oregon State University.

Assistant Professor

5. Annalisa Piccorelli, Ph.D. Epidemiology and Biostatistics, Case Western Reserve University.

Assistant APL

6. Scott Crawford, Ph.D. Statistics, Texas A & M University.

Grants Awarded to Tenured and Tenure-track faculty during AYs 2011 through 2016

Details are in Appendix A; a summary follows.

Over academic years 2011-2012 through 2015-2016, department colleagues have been involved (as PI or Co-PI) on a total of $6,792,720 in funded research. The vast majority of that is in a single grant in which Shaun Wulff is a Co-PI; that award is worth $5,247,094.

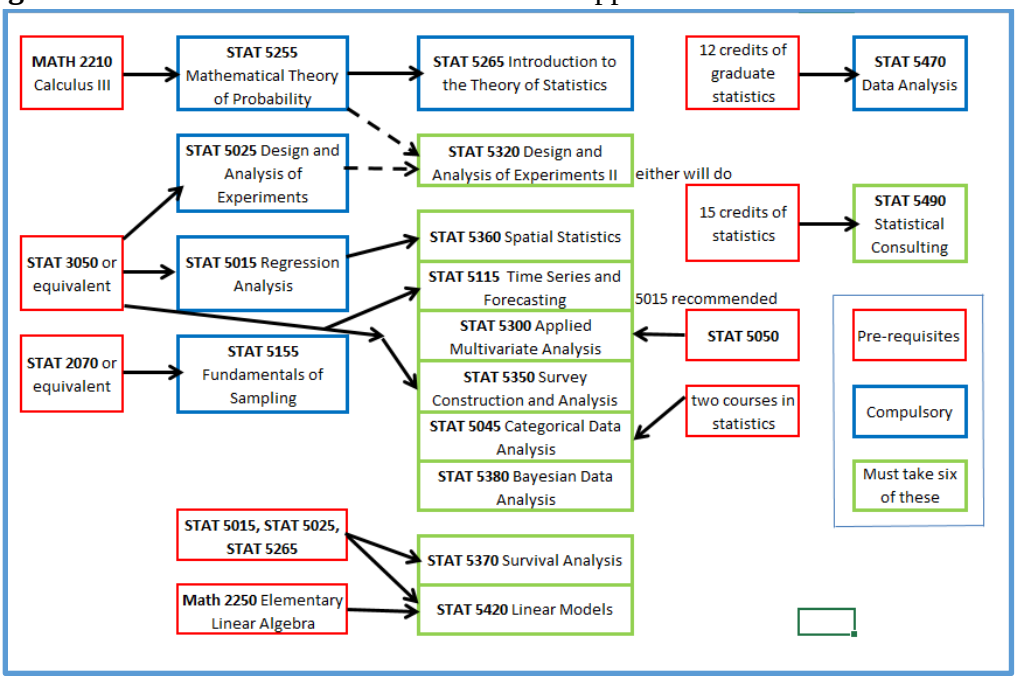
Graduate Student Committees. Another aspect of our research/teaching activities is our role on graduate committees outside of our department. In the period encompassing calendar years 2011 through 2015, we collectively served on well over 100 such committees, supporting research across virtually all of the science departments on campus.

(c) Program Reputation

To address the question of program demand, I will address the demand for the curriculum on which rests our program, namely our 4XXX/5XXX service courses. These courses collectively served over 34 majors in AY 2015-2016, teaching 226 non-statistics students (many of which have taken more than one class); almost 680 credit hours (Appendix A). Regression (STAT 4015/5015) is in greatest demand; in AY 2011, 19 students enrolled in this course (29 in AY 2012). In the current year, 53 students registered for this course, necessitating multiple offerings (two sections in Fall 2015; one in Spring 2016). Design and Analysis of Experiments (STAT 4025/5025) and Applied Multivariate Analysis (STAT 4300/5300) routinely serve close to two dozen students. Other courses are smaller in number but serve real needs for a variety of scientific disciplines (Appendix A). These upper level courses are required by our Masters students, who compose only a very small minority of the enrollment in them. For those students outside of the statistics department, these courses serve as electives or requirements for our popular graduate minor in statistics The fundamental importance of these courses is their role as service teaching; our Applied Master's students benefit from their being offered.

(d) Curriculum of major. The only course that is dedicated to our Applied Master's degree is STAT5470 (Data Analysis). This course is often taught as an independent study in which case it is an overload by faculty, representing no financial encumbrance. Beyond that course, the entire curriculum for the Applied Master's consists of applied service courses (STAT 3050 and all the 4XXX (which also appear as 5XXX for graduate students) courses, which are available to all of the undergraduate and graduate degree programs at UW (Figure 1).

Figure 1. Flow chart of the curriculum of our Applied Master's



(e) Distance Delivery. Currently no elements of the program are offered via distance delivery.

(f) Program Assessment.

The student learning outcomes for our applied Master's program are shown here, along with a curriculum map that ties them to specific requirements within the program.

Learning Outcomes

(1) Understand theoretical underpinnings of the science and practice of statistical methods
(2) Build a robust toolkit of statistical methods with which to address a wide variety of applications.
(3) Develop statistical programming skills relevant for application of certain modern methods.
(4) Conduct independent data analyses
(5) Present findings and information orally and in writing
(6) Interact professionally with others.

Curriculum Map (tying outcomes to programmatic elements wherein teaching and mentoring towards those outcomes is directed)

M.Sc Requirements	**Student Learning Outcomes**					
	(1)	(2)	(3)	(4)	(5)	(6)
5XXX courses	X	X	X	X	X	X
Teaching assistantship					X	X
Data analysis project	X	X	X	X	X	X

Since the data analysis project is both the capstone experience in the program, and ties to all of the outcomes, we used it as the basis of our program assessment (we are currently in Tier Two of the UW Assessment program based on the current review). The projects examined showed the students all capable of using sophisticated methods (including bootstrapping and interesting and useful transformations of variables). Overall, their organization and style and grammar were well done. One lack we noted was graphical summaries: they tended to focus on numerical aspects of analyses. We will put more emphasis on graphical summaries in our coursework and in mentoring them through their projects.

(g) Strategic Plan. The department has been working towards a so-called "five-year program" within which a student could cruise straight through a bachelor's degree and obtain an applied Master's degree, all in five years. Progress on that has been stalled due to attention being required elsewhere (managing our teaching with a shrunken department, accommodating the new USP program, and other matters).

Mission Centrality

The fact that our applied Master's curriculum is central to the teaching and research mission of the University of Wyoming is made manifest by the very large number of majors (and of students in them) who take our 4XXX/5XXX service courses (Appendix A). In particular, none of our 4XXX/5XXX classes are required for other majors, although several programs have requirements along the lines of "some number of credits from the following list". Those students taking those courses shows the value of them.

Cost: Is the program financially viable?

Based on OIA data, our student credit hours per FTE ratio for FY15 were 7420/6 = 1237 (Table 13). Direct instructional expenditures were $1,118,035 (Table 16). Cost per student FTE was $4402, and per total degrees awarded was $223,607 (Table 17). Nonpersonnel expenditures per FTE was $27,394/6 = $4566. Three graduate classes fell under university minima. Research expenditures per tenure-track FTE were $233,916/6 = $46,783.

On the other hand, all the classes but one that support our Applied Master's degree are service classes taken by a large number of students from across campus (Appendix A). From that perspective, then, the degree program is virtually cost-free.

Appendix A: Non-Statistics Majors served by our Service courses.

Table A1. Numbers of Majors taking Upper Level Service courses (each is also offered as 5XXX); data are from AY 2011-2012 through 2015-2016.

Course	4015	4300	4255	4025	4155	4045	4350	4265	4115
Statistics	14	12	23	6	6	6	6	12	6
Civil Engineering	24	5	1	6	1	4	3		
Zoology and Physiology	14	4	1	3	3	1	1		
Mathematics	5	5	2	3	4	1	2	1	1
Psychology	2	6		1	2	2			2
Economics		4	2	2	1			1	1
Petroleum Engineering	3	2		1		2			1
Agronomy	2	3		2					
Geology	1		1	1	2	1	1		
ıgeland Ecol and Watershed Mgmt	3	2			1		1		
Accounting	1	1		1		2	1		
Animal and Vet Science	4	1		1					
Botany	1	1		1			1		
Chemical Engineering	3		1						
Communication	1	1		1		1			
Ecology	2			1	1				
Geography	3	1							
Kinesiology	1	2		1					
Management and Marketing	1	1					2		
Criminal Justice	1			1	1				
Geophysics			2					1	
Mechanical Engineering	1	1		1					
Microbiology	1	1		1					
Soil Science	1	1		1					
Undeclared	1		1	1					
Computer Science			2						
Curriculum and Instruction		1	1						
Education		1							1
Electrical Engineering	1							1	
Secondary Educ/Math	1				1				
Sociology	2								
Ag and Applied Econ		1							
A&S Undeclared	1								
History	1								
Hydrologic Science	1								
Religious Studies									1
Number of non-majors served:	83	45	14	30	17	14	12	4	7

Appendix B: Grants and Contracts Awarded as PI or Co-PI to Tenured and Tenure-track faculty during AYs 2011 through 2016

Scott Crawford:

2014.	$500	Planning and Creation of First Year Seminar UW-ECTL

Ken Gerow

2011-present	$22,000	Biostatistics Support, NPS Fire Ecologists National Park Service

Burke Grandjean

2006-2012	$294,000	Comprehensive Survey of the American Public National Park Service
2011-2012	$10,200	Arrest-related Deaths in Wyoming US Bureau of Justice Statistics
2011-2012	$6,100	Statistical Consulting for Environmental Monitoring National Park Service
2011-2014	$35,000	Building Science Capacity While Addressing Climate Change, U.S. Fish and Wildlife Service
2011-2014	$50,000	Modeling Support for Species Recovery National Park Service
2012	$13,000	International Symposium on National Parks and Climate Change, University of Wyoming
2012-2013	$12,800	Statistical Consulting for Environmental Monitoring National Park Service

Snehalata Huzurbazar

2011-2016	$750,761	Modelling and Analysis of Gene Duplication National Science Foundation
2012-2014	$6,800	Establishing the Feasibility of FDA for Determining the Health Consequences of Body Weight Changes Among Older Adults, Institute of Translational Health Sciences, University of Washington
2013-2018	$140,375	Clinical Translation Research Infrastructure Network National Institute of Health
2014-2015	$25,875	SAMSI Bioinformatics Program Research Participation National Science Foundation
2015	$22,000	Visualizing and Modeling vaginal microbiome data for improved understanding of BV, National Institute of Health
2015	$10,000	Collecting baseline data and documenting best practices for improving recruitment and retention of diverse STEM

		faculty at the University of Wyoming UW Office of Research and Economic Development
Tim Robinson		
2011-2012	$6,100	Statistical Consulting for Environmental Monitoring National Park Service
2011-2012	$22,500	Developing graphical presentations of high dimension design applications in energy research School of Energy Resources, UW
2011-2014	$35,000	Building Science Capacity While Addressing Climate Change, U.S. Fish and Wildlife Service
2011-2014	$15,000	Building Science Capacity to Implement Strategic Habitat Conservation While Addressing Climate Change U.S. Fish and Wildlife Service
2013-2016	$16,700	Statistical Consulting for Environmental Monitoring National Park Service
2015-2018	$95,114	Statistical Support for Inventory and Monitoring U.S. Fish and Wildlife Service
Shaun Wulff		
2014	$3000	Statistical Modeling of Resilient Modulus Wyoming Department of Transportation
2014	$10,533	Improvement to Intraoperative Hearing Assessment and Prevention of Inner-Ear Damage in Humans Oticon Research Grants
2014-2016	$5,224,094	Atmosphere to Grid: Advanced Modeling to Enhance Energy Conversion and Delivery Department of Energy Experimental Program to Stimulate Competitive Research

Academic Program Review: **Statistics MS**

Section 8 – Cost

a) Ratio of student credit hours per FTE (AY 2014/15): **789.5**

b) Direct instructional expenditures (FY 2015): **$1,118,035**

i) Per student FTE: **$4,402**

ii) Per total degrees awarded: **$223,607**

iii) Non-personnel expenditures / total academic FTE: **$4,566**

c) Course enrollment (AY 2014/15)

i) Classes falling under university minimums: **6**

ii) Lower-division courses falling under university minimums: **0**

e) Research expenditure per tenure-track FTE (FY 2015): **$46,783**