UNIVERSITY OF SAN FRANCISCO | College of Arts and Sciences

Masters of Science in Environmental Management (MSEM)

ASSESSMENT REPORT
ACADEMIC YEAR 2018 – 2019

I. LOGISTCS

1. Contact People:

Allison Luengen, MSEM Graduate Program Director, aluengen@usfca.edu

Sindy Vela, MSEM Graduate Program Manager, svela@usfca.edu

2. Type of Program:

Graduate

3. Curricular Map:

There have not been any revisions to the curricular map. It is attached in Table 1.

II. MISSION STATEMENT & PROGRAM LEARNING OUTCOMES

1. Mission Statement

The mission statement has not changed.

Mission Statement for MS Degree in Environmental Management (MSEM):

The Environmental Management Program will educate graduate students to provide management solutions to environmental problems using innovative, interdisciplinary approaches in an environmentally just manner.

Table 1. Curricular map for the MSEM Program, showing the extent to the learning outcomes are covered in each course. The three core courses evaluated in this year's assessment are highlighted in yellow. I = Introduced, D = Developed, M = Mastered.

Learning outcomes/Course	Demonstrate an interdisciplinary approach in analysis of environmental issues and management strategies.	Utilize both theory and applied knowledge to evaluate and recommend management strategies for environmental issues.	Choose and apply appropriate tools, techniques, and technologies to analyze environmental issues.	Skillfully communicate environmental management issues through written reports, oral, and visual presentations.
Aquatic Pollution	M	M	I	M
Climate Change Mit.	D-M	D-M	D	D
Data Analysis	M	M	M	M
Ecology	I	I,D	I	I
Energy Auditing	NA	NA	D	D
Env.Eng. I + II	N/A	N/A	D	D
Environmental Chemistry	N/A	I/D	I	D
Env Economics	N/A	I	D	N/A
Environmental Health	M	D	I	D
Environmental Policy	D-M	D	I	D
Env Toxicology	M	D	D	D
Field Survey Management	I	I	D	M
GO Remediation	D	D	D	D
Hazardous Waste Mgt.	I	I	D	I
Marine Resources	D	M	I	M
Master's Project ENVM 698	M	M	M	M
Natural Resource Ec.	N/A	D	D	N/A
Quantitative Methods	N/A	N/A	D	I
Research Methods	M	D	M	D
Risk Management	D	D	D	D
Risk Assessment	M	D	D	N/A
Risk Management* AK	M	M	D	M
Stream + Riparian Eco.	D	D	D	D
Sustainability Leadership	D	D	D	D
Sustainability: the Future	D	D	D	D
Sustainable Building	D	D	D	D
Sustainable Design	M	M	D	M
Urban Resilience	D-M	D-M	D	D
Water in Env Management	I	I	D	D
Water Treatment	D	D	D	D
Wildlife Conservation	I, D	D	D	D

2. Program Learning Outcomes

Yes, there has been a minor change to the program learning outcomes. In learning outcome 3, the "and" was changed to "or."

Students who graduate from the MSEM program will be able to:

1. Demonstrate an interdisciplinary approach in analysis of environmental issues and management strategies.
2. Utilize both theory and applied knowledge to evaluate and recommend management strategies for environmental issues.
3. Choose and apply appropriate tools, techniques, ~~and~~ or technologies to analyze environmental issues.
4. Skillfully communicate environmental management issues through written reports and oral and visual presentations.

3. Learning Outcomes Assessed for MSEM in 2018-2019

This year, we assessed program learning outcome #3: Choose and apply appropriate tools, techniques, or technologies to analyze environmental issues.

4. Rubric

The rubric used to assess learning outcome #3 is given in Table 2.

Table 2. Rubric showing that for assessment, learning outcome #3 was broken down into three outcomes. Each work product was then given a score from 0 – 3 pts for each outcome.

Outcomes	**Exceptional (3)**	**Proficient (2)**	**Approaching Proficient (1)**	**Below Proficient (0)**
Choosing the tool or technique or technology	Students selected a tool or technique that was appropriate for the problem presented	The general tool or technique is fine, but it is missing a few of the details	The tool or technique is not the ideal choice	It is the wrong tool or technique
Use of tool or technique or technology	Students were able to correctly apply their chosen technique	There are some minor mistakes	There are multiple minor mistakes	There are major mistakes
Analysis/Interpretation of tool or technique or technology	Students were able to draw conclusions about environmental issues.	Students drew conclusions but there was more room to explain	Students drew conclusions but there are minor mistakes	Students drew conclusions but there are major mistakes or they did not draw conclusions

III. METHDOLOGY

Work products for direct assessment- Three work products were assessed, one for each of the core classes. There are three core classes in the program: Environmental Chemistry, Ecology, and Quantitative Methods, all taught in Fall 2018. These core courses are required of all MSEM students, unless they have waived out of them (due to having taken a similar course already as an undergraduate). A question from the final exam from each course was selected to assess the learning outcome. Note that for Environmental Chemistry, there were two sections taught in Fall 2019. The second section was impacted by the wildfires and the exam had to administered electronically (with corresponding modifications) so only the first section was evaluated. Also, in the final exam for Ecology, students were given a choice of which questions to answer so only 15 students in the class selected the question that was used for assessment.

Scoring- A 3-point scale was used to evaluate each of the outcomes listed in the rubric (Table 2). For each outcome, a score of 3 represents exceptional, a score of 2 represents proficient, a score of 1 is approaching proficient, and a score of 0 is below proficient. An overall score of 9 (exceptional for all three outcomes) would be a perfect score.

Committee- The committee that evaluating the work products consisted of three faculty members in the department: Tom McDonald, April Randle, and Allison Luengen. The goal was to have each course evaluated by someone who is in that direct field and by someone who is generally familiar with that field, but whose research/teaching primarily lies elsewhere. The faculty who assessed each work product are shown in the Table 3. Tom and Allison evaluated Quantitative Methods course. April and Allison evaluated Ecology. Tom and April evaluated Environmental Chemistry. Tom and Allison had not taught any of these courses. April had taught Ecology, but in a small department, with a limited number of people available, some overlap between the faculty teaching the course and the assessment committee was unavoidable. Also, as described above, it made sense to have an ecologist look at the Ecology work products.

Table 3. Scheme showing how the core courses were assessed. An “X” indicates that the faculty member who assessed the work products for each course.

Faculty member	Expertise of faculty member	Ecology	Environmental Chemistry	Quantitative Methods
Allison	Environmental Health, Environmental Chemistry	x		x
Tom	Environmental Engineering, Quantitative methods		x	x
April	Ecology	x	x	

Merging the data- The average score from each of the two faculty members was used to assign a final score to each work product. It was not necessary to weigh faculty scores because there was no systematic difference scores from different faculty members (Table 4). For example, both April and Tom evaluated the same Environmental Chemistry work products. For the rubric outcome focused on choosing the tool or technique, both April and Tom gave the same average score of 92% (Table 4). For the use of the tool or technique, April’s score was 5% higher than Tom’s. However, for the analysis/interpretation, Tom’s score was 3% higher than April’s. Given the lack of systematic differences, an average seemed like the best approach.

Table 4. Average score (by faculty member) for each component of the rubric.

	Ecology		Env Chem		Quant Methods	
Outcome (from rubric)	Allison’s average	April’s average	April’s average	Tom's average	Allison’s average	Tom's average
Choosing the tool or technique	91	96	92	92	74	80
Use of tool or technique	82	86	91	86	72	74
Analysis/ Interpretation	73	65	72	75	80	77

Data Analysis – Each work product was given an overall score, ranging from 0 to 9 points (up to 3 points possible for each outcome in Table 2) by two different faculty members. The average score from the two faculty members was computed for each work product from each class. For example, in Ecology, 15 work products were assessed (each one by two faculty members) and average scores are shown in Table 5 and Appendix 1. Note that this evaluation scheme generated scores that were not whole numbers. The number of students achieving each learning outcome, which is frequency data, was then visualized with histograms (Fig. 1).

Table 5. Raw data for each work product from the Ecology course. Score is the average given by the two faculty members. A score of 9 is a perfect score from both faculty reviewers.

Ecology (score out of 9)
8
4.25
7
9
6
7.5
4.5
8.5
8
8.25
9
9
9
7.75
6.25

Categorizing the data by mastery level – To group the assessment scores into 4 categories (complete mastery, mastered most parts, mastered some parts, and not mastered), each category was assigned a range of scores. The natural breaking points in the histogram (Fig. 1) were used to help with this assignment as there is no *a priori* reason to assign certain scores to these qualitative categories. For example, for Ecology, scores of ≥ 8.5 were counted as complete mastery (Fig. 1). A score of 8.5 would mean that one reviewer scored the work product as exceptional in every category and the other reviewer scored the work product as exceptional in two categories and proficient in one category. Thus, complete mastery in Ecology is a high standard. Note that in the discussion below, outcomes are also discussed as the sum of the work products falling into the complete mastery category *plus* those falling into the mastered most parts category. Categories of mastery level are illustrated for each course in Fig.1.

Indirect Assessment – To address the question of how well our department's admissions process predicted which students struggle in the core courses, we used indirect methods. This analysis consisted of looking for relationships between the grades that the students earned in the core courses and their admissions score. The MSEM program has an elaborate process for scoring applications for admission. Each application is reviewed by at least two faculty members (more if there is a split decision) and ranked in four different categories: transcript, personal narrative, experience, and fit with the program. Each faculty member's average ranking is weighted so that all faculty members have the same average ranking. The students are assigned an adjusted admissions score, with a maximum of 10 points.

IV. RESULTS

Students generally mastered the outcomes at the level they were intended to, as indicated by the histograms in Fig 1. The histograms show that the data are skewed – mainly that most data points fall on the side with the relatively high scores. For example, 73% of students had complete mastery or had mastered most parts of the learning outcomes in Ecology. In Environmental Chemistry, 92% of the students had complete mastery or had mastered most of the outcome. Scores in Quantitative Methods were slightly lower, with 67% of the students demonstrating complete mastery or mastering most of the outcome.

If a more generous standard, mainly the number of students mastering at least some parts of the outcomes is applied, the percentage of students achieving those outcomes is 87% for Ecology, 92% for Environmental Chemistry, and 85% for Quantitative Methods.

An alternative way to evaluate the data is to compute the average score for each of the three outcomes from the rubric for each class. This analysis is useful for comparing with assessment results from previous years, which were calculated as a simple average. Unlike a histogram, which is a way to look at frequency data, the average does not capture the shape of the distribution. However, the average is an easy way to look at scores for each of the outcomes in the rubric (Table 2). This analysis (Table 6) shows that the weak outcomes in Ecology and Environmental Chemistry were analysis and interpretation (only 69% in both courses) whereas choosing the tool or technique was very strong (94% and 92%, respectively). Interestingly, Quantitative Methods had the reverse pattern, with higher scores for the interpretation (79%) relative to choosing (77%) and applying (73%) the technique (Table 3). When the three outcomes were averaged to achieve an overall percentage for each class (Table 3), the average scores in Ecology and Environmental Chemistry were 82 and 83%, respectively. In Quantitative Methods, the score was 76%.

Major Findings

This is the first time we have assessed the core courses so the data cannot be compared with that of prior years but can be indirectly compared to assessments in other areas of the curriculum. In 2016 – 2017, the MSEM program assessed learning outcome #1, which is to demonstrate an interdisciplinary approach in analysis of environmental issues and management strategies. Work products came from the MS Project course, which is the program's capstone course. The score was computed as an average, which was 88%. In 2015 – 2016, the program assessed learning outcome #4, which is to skillfully communicate environmental management issues through written reports and oral and visual presentations. The work product was the presentation at the end of the MS Project course. The average score was 90%.

In 2018 – 2019, the average scores (82%, 83%, and 76%) for learning outcome #3 in each of the three core courses were lower than those measured in the capstone course (88% and 90%). However, the scores in the core classes were from students in the first semester of the program, and for many of them, a core class was their very first class in the program. Furthermore, according to the curricular map (Table 1), the learning outcomes had been introduced or developed in the core courses, but not mastered. It is both expected (and good) that their scores in the capstone class (after 2 years in the program) are higher than in the core classes. There are some limitations with directly comparing the results because different learning outcomes were assessed in the core classes versus the project class. However, it does appear that students are mastering more of the learning outcomes as they progress in the program.

One notable trend in the histograms (Fig. 1) is the left-hand tail, where a handful of students are not mastering the learning outcomes. It is notable that this tail in quantitative methods is partially responsible for the lower average (Table 6) in Quantitative Methods (76%) versus Ecology (82%) and Environmental Chemistry (83%). A similar percentage of students (30 – 40%) demonstrated complete mastery in all three core courses (Fig. 1).

The score given to the applicants during admissions (Fig. 2) did not clearly predict their performance in the core courses. There was no clear correlation between the score during admissions and the grades for any of the three core courses. Some students with particularly low admissions rankings (e.g., 6 and below) received low grades in the core courses; others received high scores (Fig. 2). The only group that consistently earned high grades in the core courses were those with very high (≥9) admissions scores, which were only a small group of our students.

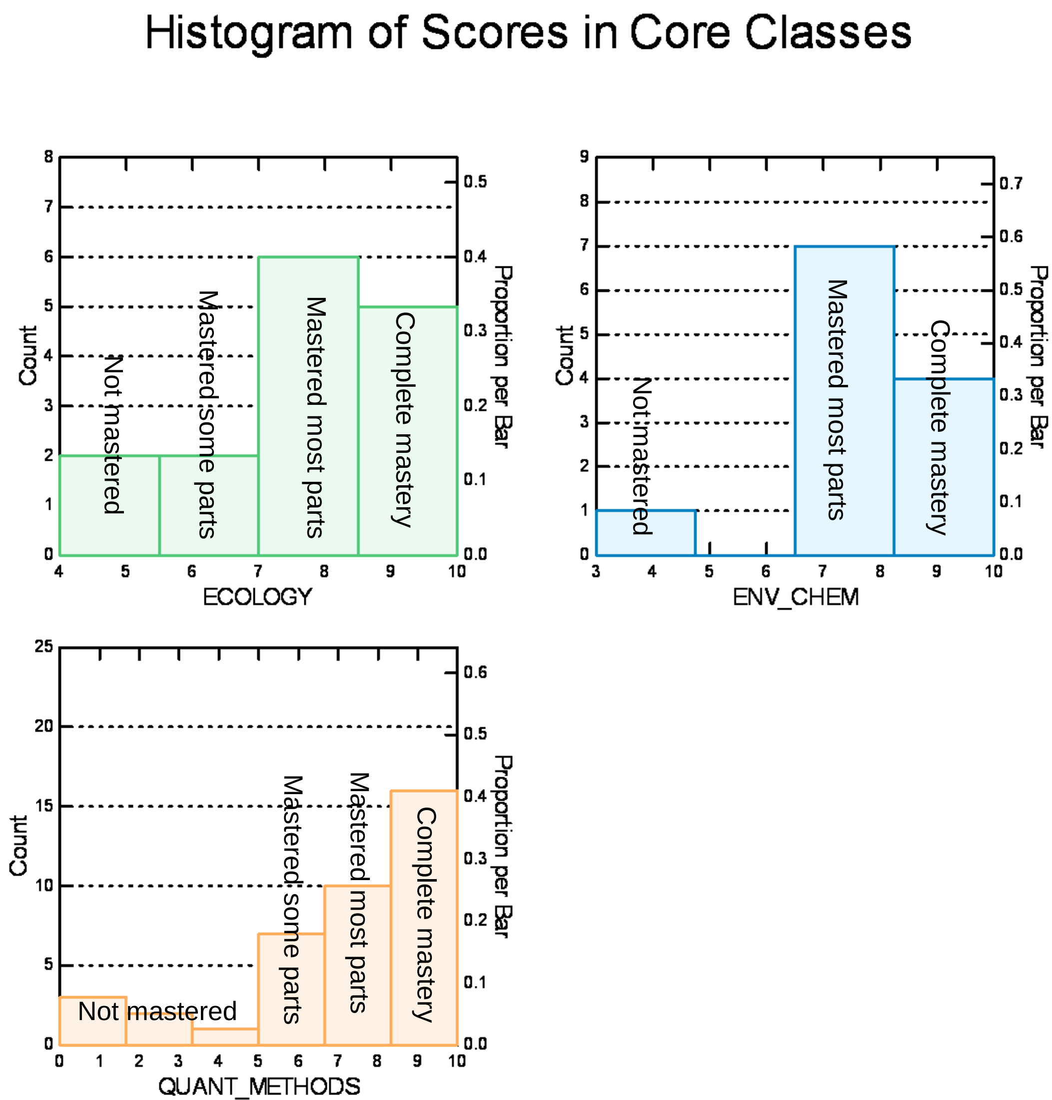

Fig. 1. Histogram of scores in each of the three core courses. The graphs show the number of students (left-hand axes) or the proportion of students (right-hand axes) achieving each score. The maximum score was 9. By convention, a data point falling on the line is included in the next-highest class. For example, in the Ecology histogram, scores of 8.5 or 9 would be in the bar on the far right. That bar shows that 5 students, or 30% of the total, had a score ≥ 8.5 points.

Table 6. Percent of students achieving the learning outcome, calculated as the average of all scores.

	Percent of students achieving the learning outcomes		
Outcome	Ecology	Env Chem	Quant Methods
Choosing the tool or technique	94	92	77
Use of tool or technique	84	89	73
Analysis/ Interpretation	69	69	79
Overall average	82	83	76

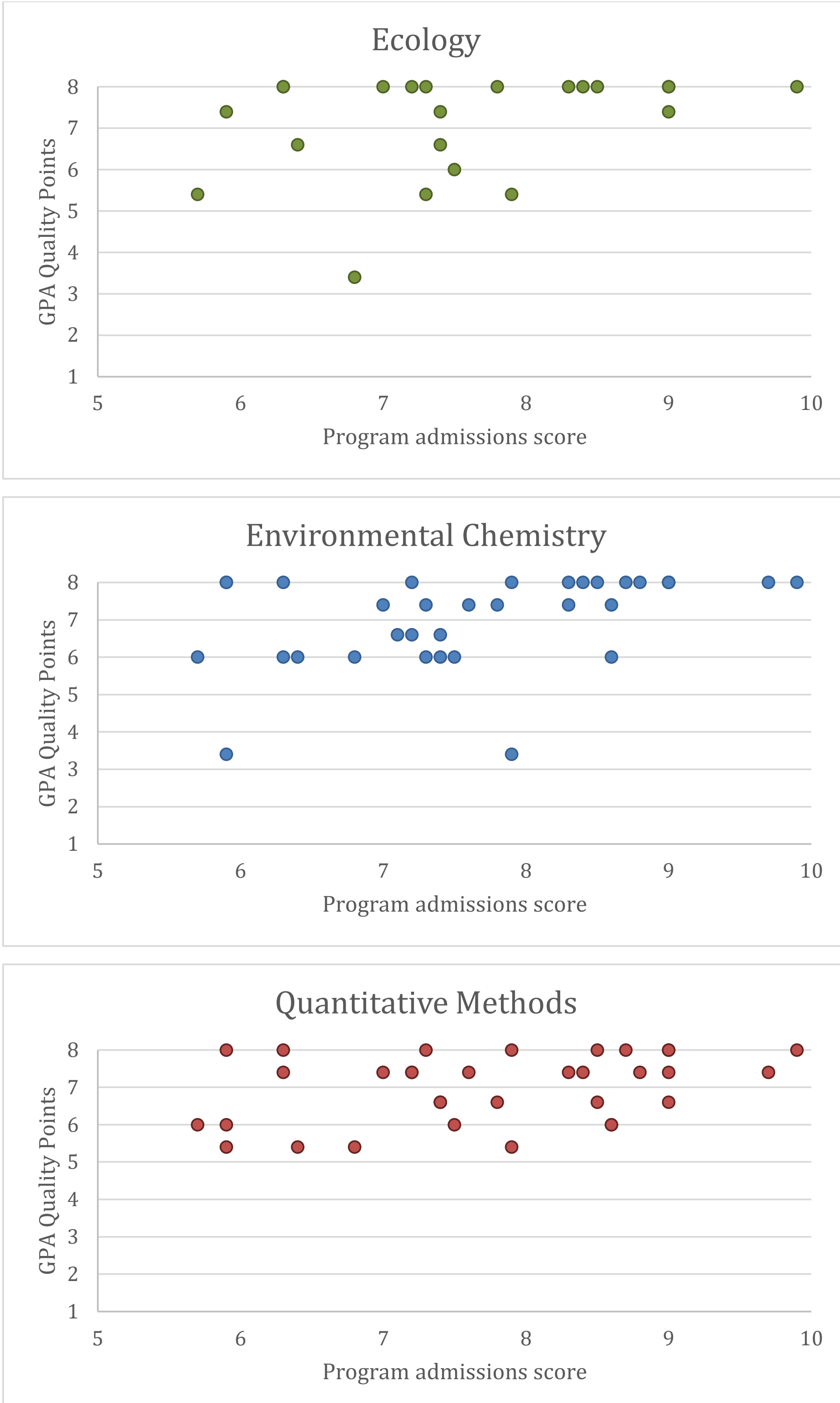

Fig 2. Admissions score of the student versus grade in each of the course classes, given as GPA quality points. For program admissions, students are ranked on a 10 point scale (10 is the maximum). The grades in the classes are shown as quality points and these are all two-units classes (e.g., A = 8.0, B = 6.0, C = 4.0). Scores less than a B (6.0 in this figure) are problematic for graduate students.

V. CLOSING THE LOOP: ACTION PLAN BASED ON ASSESSMENT RESULTS

1. Potential changes

Regarding the next steps, the tail of students (Fig. 1) not achieving the learning outcomes in the core courses is the most striking conclusion from this assessment. This struggling group is of great concern to the department. This problem applies to only a handful of students (e.g., 6 out of 39 students in Quantitative Methods). However, this small group of struggling students poses a pedagogical challenge for the faculty because they are often at a different level than the rest of the students in the course. A great deal of time accordingly gets invested in this very small group. In addition, although additional assessment tracking the fate of these students in the program would be helpful, our sense is that some of these students continue to struggle, with the occasional student being asked to leave the program and/or quitting.

The program has been aware for some time that a handful of students tend to struggle and has already tried to address this issue with solutions such as providing tutoring and extensive support from faculty. The faculty have also put in place a Refresher Workshop, held the day after orientation, to cover basic algebra and Excel skills. However, despite the incredible efforts of Professor Amalia Kokkinaki, who has led this workshop, a single day cannot give some students the material that others have covered in a four-year degree. Furthermore, this approach then transfers the teaching load of the department into service (because the workshop doesn't count toward teaching load), and the faculty in our department already have more service commitments than they can handle. Accordingly, the program is considering other approaches: 1) admissions changes or 2) curricular changes.

One solution may be for the program to be more restrictive in its admissions, to try to avoid admitting the handful of students who struggle in the core courses. The program prefers to admit students who have an undergraduate degree in the natural sciences and have relevant work experience in the environmental field. However, every year the program accepts a group of students who have non-science undergraduate majors, of all varieties, and may have been out of school for some time. These applicants are ranked lower during admissions, but the program still admits a sizeable number of them, potentially up to about 25% of our incoming class. There is some uncertainty in the percentage of non-science students admitted because it is hard to easily classify the students who have had Environmental Studies as an undergraduate major; some of those programs contain lots of science and others very little. In addition, the program has accepted science majors with undergraduate GPAs as low as 2.5, mostly due to pressure from the University to keep admissions numbers up. Some students are also admitted with very little experience in the environmental field although the program originally was targeted at working professionals in the environmental field. Accordingly, the question has come up, could we avoid the tail of struggling students by being stricter during admissions?

One significant downside to being stricter during admissions is that the size of MSEM cohorts may shrink. MSEM has been under steady pressure to accept more and more students over time, as a result of the University's push to increase enrollment in graduate programs. The program has not always been able to meet the numbers suggested by the university, even though some students with low admissions ranks have been accepted to fulfill admissions targets.

Looking at the admissions rank versus the grades achieved by the students in the core courses (Fig. 2) suggests that eliminating the lowest ranked applicants would not necessarily improve performance in the core courses. The students who performed poorly (with a grade less than a B) in the core classes were generally ranked in the middle to middle/low end of the admitted group. Thus, to eliminate the handful of students who did poorly in the core courses, we would have to reject the entire middle to middle/low end of the applicant pool. This approach would not be feasible because it would presumably cut the size of our incoming cohort in half. Alternatively, more analysis could be done to see if other metrics (e.g., undergraduate GPA?) are better predictors of performance in core courses than the current admissions system.

Another alternative is curricular changes to support this group of struggling students. One proposal has been to make Introduction to Environmental Science a course required for all incoming students without that background. As part of the admissions process, the faculty evaluate the transcripts from each applicant so it would be fairly easy to identify this group of students. In fact, we put Introduction to Environmental Science on the books for Fall 2019 and during admissions in Spring 2018, we selected a group of students who would likely benefit from that course. However, that group consisted of only about 9 students, and the Provost subsequently declared that 12 students was the minimum necessary to run a course so the course did not run in Fall 2019. To ensure that the course would run, it would have to be a mandatory part of the curriculum; we were hoping to test it before we made a curricular change. However, one option is for the faculty to make a curricular change that would require Introduction to Environmental Science for some students. If the course was a requirement, it could run with less than 12 students, in so far as we understand the current rules.

Another option may be to create an MA program to serve students without a quantitative background. Faculty plan to explore the options at the upcoming Environmental Sciences Faculty Retreat on Jan. 16. Unfortunately, there is not a clear solution, especially for a program that accepts the diversity of students that MSEM does.

2. Feedback from previous assessment

Previous feedback can be grouped broadly into two categories: 1) feedback on specific items that were missing from the report or could be improved and 2) suggestions to do more with the results. Regarding #1, this year we were sure to include an updated curricular map as well as the rubric used for scoring the work products. In addition, data were presented as histograms (Fig. 1), which allows the reader to see how many students fell into each category, as opposed to overall averages. This year's report is the most complete assessment done for the Environmental Management Program to date.

Regarding the goal of doing more with the data, the Environmental Sciences Department now has a mechanism in place (a winter retreat) where overall picture for the program can be discussed. We have already planned time at this winter's retreat to talk about the problem of the tail of struggling students, and potential solutions, such as curriculum changes.

VI. BIG PICTURE

The Masters Project is a highlight of our program, and from the assessments in past years, is an area where the students really shine. The core courses do seem to be doing a reasonable job of preparing the students overall, although a handful of students do struggle. Two potential solutions include trying to avoid admitting these students or trying to provide extra support, perhaps through adding a required introductory course or offering a different type of degree (M.A.).

VII. FEEDBACK TO YOUR ASSESSMENT TEAM

If the department decides to make changes in response to the assessment data, it would be helpful to have a letter of support from the assessment team. For example, if the program decides to add Introduction to Environmental Sciences as a way to address the tail of students struggling in core courses, a letter supporting that solution based on the assessment data would be helpful because we may then have to justify running a class with fewer than 12 students. It is our hope that this report has outlined some of the challenges facing the program. In some ways, the department seems to be caught between a rock and hard place; we are asked to admit increasing numbers of students, which means that we admit some students who are likely to struggle. However, our ability to provide extra support for those students is handicapped by new policies. Specifically, the 12-student minimum enrollment policy prevented us from running an introductory course this year, and the budget cuts this year limited tutoring and grading hours.

A second way the assessment team could help the department is providing feedback to the administration on the amount of time required for the assessment process. Perhaps as part of the assessment process, the assessment team could collect the data on the amount of time required to gather the data and write the reports and present it to the administration. At a recent COSEC meeting, Dean Marcelo Camperi asked for data on what chairs and directors did over the summer (when they are not paid).

For the record, for three faculty members and the program manager to find time to meet as a group, develop the rubric and assess the work products, time had to be scheduled after Spring commencements, translating into a day of summer work for four people, three of whom were not paid during that period. Analyzing the data (i.e., compiling the results, developing the tables and histograms, etc.) took another day of the graduate program director's time. The time to write the report plus figuring out what needed to be done (e.g., by attending workshops on the assessment process and conferring with the program manager) accounted for another two and a half days. Grant it, this is first time that this director has led assessment so future reports may be quicker and assessing *three* core courses this year was a big undertaking. That being said, the assessment process this year took almost a week of the graduate program director's time. As assessment has become a more rigorous process, there has not been a corresponding increase the release time given to faculty to actually do the assessment. In addition, the program manager also helped compile the data used in the indirect assessment (e.g., grades in core courses and admissions score), and she compiled the curriculum map. The concern is that the assessment process is not fully supported by the number of hours available. The limited time may explain why the previous report was missing pieces. In conclusion, fully compensating the faculty who are doing the assessment work would help ensure faculty buy into the process and are able to devote enough time to develop a high quality product.

Appendix I. Assessment scores for each work product. Note that each score is the average of that given by each of the two faculty members.

Ecology (score out of 9)	Env Chem (score out of 9)	Quant Methods(score out of 9)
8	9	9
4.25	4	6.5
7	8	7.5
9	9	7
6	9	5.5
7.5	6.5	7
4.5	8	9
8.5	7	7
8	7.5	9
8.25	6.75	6
9	8	1
9	8.5	1.5
9		8.5
7.75		8.5
6.25		7.5
		7
		9
		5.5
		9
		8.5
		8.5
		8
		6
		8.5
		8.5
		9
		8
		6
		9
		2.5
		4.5
		2
		9
		9
		0
		7.5
		8.5
		8
		5.5