Program Evaluation and Enhancement Report -2017: Biology

1. What was the Biology Program created to do in the first place?

Science programs including biology programs at WNMU were created very early in the history of the University. Biology programs at WNMU include seven specific majors (BA/BS Biology, BA/BS Botany, BA/BS Cell & Molecular Biology, BA/BS Forest Wildlife, BAS Forest Wildlife/Law Enforcement, BS Medical Technology, BA/BS Zoology) and four specific minors (Biology, Botany, Cell & Molecular Biology, Zoology). Three additional majors offered at WNMU (BA/BS Environmental Sustainability, BA/BS General Science, BA/BS Science Education) incorporate numerous biology courses in their respective degree plans. The above majors and minors have varying degrees of course overlap in their requirements allowing us to offer a variety of degrees with relatively small numbers of courses that are exclusive to any single degree.

Programs in biology were created to produce well prepared graduates for a number of careers, as well as preparing students professional programs and for graduate studies. A large number of our graduates will ultimately find employment working for land or resource management agencies including the Arizona Game and Fish Department (AZGFD), New Mexico Department of Game and Fish (NMDGF), New Mexico State Parks (EMNRD), U.S. Forest Service (USFS), Bureau of Land Management (BLM), National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), and Environmental Protection Agency (EPA). The degrees that we offer which prepare students for agency careers are BA/BS Biology, BA/BS Botany, BA/BS Forest Wildlife, BAS Forest Wildlife/Law Enforcement, BA/BS Zoology, and BA/BS Environmental Sustainability. These degrees have a strong emphasis on organismal biology and natural habitats. Additionally, a large percentage of our students are interested in medical related careers such as Pre-Med, Pre-Pharmacy or Medical Technology. Most of these students major in Cell & Molecular Biology, often in association with a concentration in Chemistry or Medical Technology. A smaller number of our graduates are headed toward degrees in Science Education with an Emphasis in Biology.

Biology courses serve functions beyond state-mandated General Education courses at the university. Biology courses support degrees other program areas such as Nursing and Occupational Therapy. Biology courses play an important part of the Area IV General Education core.

2. What is the program doing now?

All measures regarding the biology programs at WNMU indicate that these programs are in high demand and highly successful. Between Fall 2014 and Fall 2016, 70% of WNMU Biology courses were offered on the Silver City campus with 8% of classes offered on the Deming campus and 14.8 % of biology courses are offered online. The majority (88% over the years) of biology classes are taught by tenure-track faculty with terminal degrees.

Credit Hour production:

Between Fall 2014 and Fall 2016, roughly 70% of these credit hours were at the lower division level and 30% were at the upper division level. In 2013, Biology classes represented 11.5% of the credit hours generated by WNMU. Between Fall 2014 and Fall 2016 Biology classes represented 5.6% of the credit hours generated at the university. This decline in the percentage of credit hours represented by Biology courses probably is accounted for the growth in graduate programs and on-line programs over the same time period.

Course Enrollments:

Between 2007 and 2013, the average number of students in lower division biology classes was 23.75 students per class. During the same time period the average number of students in upper division biology classes was 12.15 students per class. Between Fall 2014 and Fall 2016, the average number of students in lower division

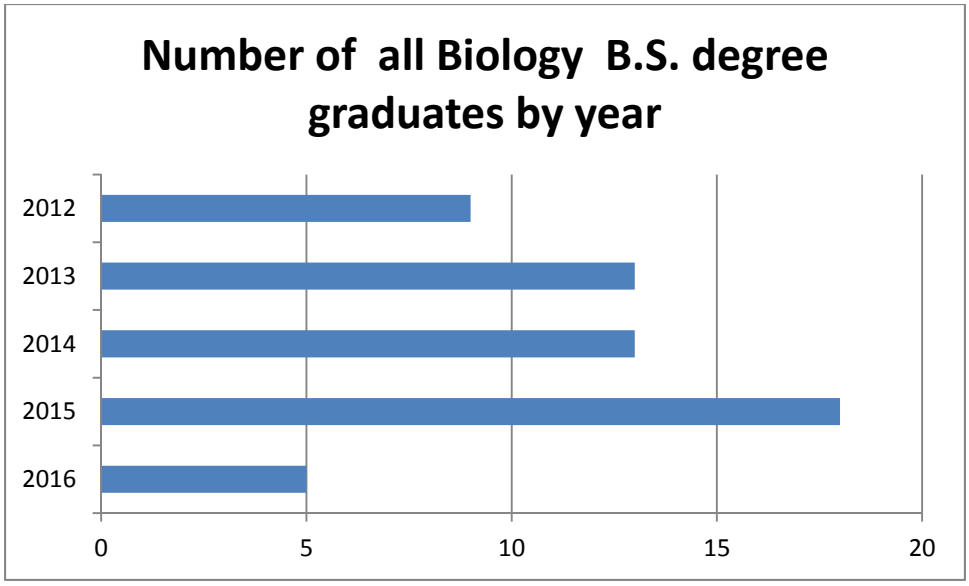
biology classes was 18.6 students per class. For the same time period the average number of students in upper division biology classes was 11.15 students per class. These minor declines in the enrollment per section are explained by the general decline in face to face students while on-line and graduate courses have grown.

Number of Majors:
In 2014, all biology majors and minors combined exclusive of Science Education majors included 102 students. The table below shows the number of Biology majors and minors by major for Fall 2015 and Fall 2016. This table shows that biology majors continue to represent a large proportion of the majors on campus and remain strong.

Major	FALL-15 MAJOR	FALL-15 MINOR	FALL-15 Total Majors and Minors	FALL-16 MAJOR	FALL-16 MINOR	FALL-16 Total Majors and Minors
Biology	21	4	25	19	4	23
Botany	6	5	11	11	5	16
Cell and Molecular Biology	11	16	27	31	14	45
Forest Wildlife	15	0	15	13	0	13
Forest Wildlife Law Enforcement	21	0	21	15	0	15
Pre-Forestry	0	0	0	0	0	0
Pre-Medicine	2	0	2	3	0	3
Pre-Pharmacy	0	0	0	2	0	2
Science conc. in Env. Sustain	5	0	5	5	0	5
Science Education	3	0	3	3	0	3
Zoology	25	1	26	28	2	30
		Total	**135**		**Total**	**155**

Degrees/ Graduates:
The number of graduates from biology programs has averaged 11.9 between 2007 and 2013 with a low of 6 and a high of 21 over this time period.

The table below shows Biology degree graduates by year exclusive of Science Education majors and Environmental Sustainability majors. Over 20 students are expected to graduate from Biology programs in the spring of 2017. These data indicate the strength of the Biology programs.



Graduates performace in the job market:
Our graduates perform well in the job market and are sought after by employers. One demonstration of this was that in 2015 the NM Department of Game and Fish hired six officers statewide, *including five of our graduates*. Employers report the high caliber of our graduates and the combination of skills and knowledge that our graduates possess . Graduates feel that they were well prepared for their careers. Graduate schools report that they are very happy with skills and knowledge that our graduates possess and that they find our graduates better prepared for graduate school than graduates from other colleges.

Overall Performance:
Based on the numbers of majors, numbers of graduates and the appropriate preparation of graduates, Biology programs appear to be successful and make an important contribution to the overall success of the university.

3. Should it be doing what it is doing now?

As evidenced by the data in the previous section, the Biology programs at WNMU are strong, performing well, and make an important contribution to the university as a whole.

The Biology programs (Biology, Botany, Cell & Molecular Biology, Forest Wildlife, Forest Wildlife/Law Enforcement, Medical Technology, Zoology) offer a suite of majors that are in high demand by students. The Botany and Zoology degrees are the only such bachelor's degrees offered by state institutions in New Mexico. The Forest Wildlife and Forest Wildlife Law Enforcement majors are known within the state as producing graduates who are ready for work. One common attribute of these programs is the hands-on, practical experiences gained by students. Whether it is field identification, field survey techniques, field trapping techniques, or hands-on laboratory techniques, our graduates depart WNMU with a set of experiences that students attending biology programs at larger institutions do not access. Students have frequently reported that these experiences made the difference in successful job searches. Employers and graduate advisors have also reported that hands-on, practical experiences provided to our students have been important to the success of our graduates. Small class sizes in upper division, face-to-face courses make it possible to offer individualized opportunities to students. The value-added experiences that our majors receive are not possible in the on-line format or in institutions with larger class sizes.

Overall the biology programs at WNMU are very strong, but we do have a few classes (4-5 out of all the courses with the BIOL prefix) that occasionally have had trouble making due to low enrollment. We are looking closely at the courses used by all of our majors and minors (see attached spreadsheet comparing the

courses used by majors and minors) to see if there are ways to change our course offering for majors, course rotations, or requirements to enhance the enrollment in these classes.

One degree option, Environmental Sustainability has had a declining number of majors since its inception in 2010. At its inception the Environmental Sustainability major had over 20 students. Numbers have declined over time to approximately five majors in the current year. The root of the problem seems to have been a degree program that was not giving students the knowledge and skills that employers in the field were seeking. To solve this problem a committee with members from the Business, Natural Sciences, Humanities, and Social Sciences has reworked the degree to include the background and skills that employers are looking for. The new degree is called Sustainable Development and should be approved by the C & I Committee this spring (2017).

While biology programs are strong, they could benefit from a larger number of students brought into the university through a significant increase in University recruitment. Over the past few years, face-to-face undergraduate enrollment on the Silver City campus has declined while on-line and graduate programs have increased. Although the biology majors continue to be strong, if this trend continues all face-to face programs on the Silver City campus will decline in viability. To this end it is critical that overall university recruitment be increased.

4. If not what should it be doing?

As evidenced by the data in section two, the Biology programs at WNMU are strong, performing well, and make an important contribution to the university as a whole.

The biology programs (Biology, Botany, Cell & Molecular Biology, Forest Wildlife, Forest Wildlife/Law Enforcement, Medical Technology, Zoology) offer majors hands-on, practical experiences. Many lower division biology courses exhibit larger class sizes. Such large class sizes make the maintenance of smaller class sizes in upper division classes viable in the long-term. Small class sizes in upper division courses make it possible to offer individualized opportunities to students.

The new and improved degree, Sustainable Development, should be approved by the C & I Committee during Spring 2017. The rework of this degree should provide students with the background and experiences that should increase their success in obtaining career specific employment. The rework also should increase the number of students choosing this major, and increase enrollments in the future.

5. How should it do what it should be doing?

Based on the data generated by and feedback from Biology programs, the Department of Natural Sciences seems to have a successful approach to delivering quality biology education. Maintaining relatively small, face-to-face classes facilitates the success of our graduates (See sections 2 and 3).

Program Evaluation and Enhancement Report- 2017: Chemistry

1. What was the Chemistry Program created to do in the first place?

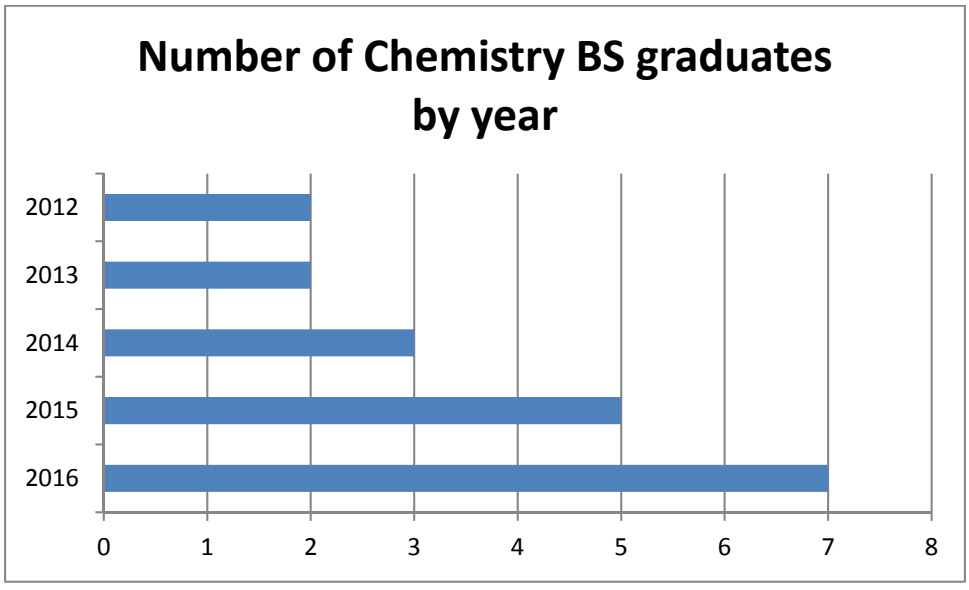
The chemistry program at WNMU was created initially to fulfill a societal need for experts in the fields of material and molecular science. For reference, chemical manufacturing exports totaled $794.7 billion or 13.9 percent of all manufacturing shipments in 2012. The production of pharmaceuticals, plastics and resins, petrochemicals, food and drug additives, cosmetics, paints, adhesives, pesticides, and other chemically related products require personnel educated in basic chemistry (the chemical industry employed about 75,670 scientists in 2012 in the U.S.). Additionally, chemistry majors can serve a role in the locally important extraction technology (mining) or energy production fields. The bachelor's program also prepares students for entry into graduate school in chemistry as well as medical, dental, pharmacy, and other pre-professional programs.

2. What is the program doing now?

The program is largely fulfilling the role it was created to do originally with a growth in student enrollment in chemistry.

In the past three years, the university as a whole has had a flat or slightly declining enrollment with the most decline over the past 3 years seen the on campus undergraduate programs. Physical Science/ Chemistry enrollments have slightly declined during this period. In 2014, there were 38 chemistry majors. The number of majors in chemistry have remained fairly constant since 2014 (Fall-2015 majors:36/ minors:15) – (Fall-2016 majors:32/ minors:16), (Spring 2017 majors:40/minors:16). Student credit hour production in the program has declined from 2,172 (F-14 + S-15) to 1,455 (F-16 + S-17). Most of this decline has occurred due to declining enrollment in General Education science classes.

There has been a steady increase in the number of chemistry B.S. graduates each year. Ten chemistry major graduates are expected in spring 2017.



Other manifestations the large number of majors and minors in chemistry are the necessity for more frequent offering of upper division chemistry courses. The program is offering most of its upper division courses every year now.

Shawn please update the areas in yellow below:

In 2013, we were awarded a Community Investment Fund from Freeport McMoRan called the Rural Access to Research Excellence project which provided $30,000 to purchase a small NMR instrument. In the fall of 2014, we were fortunate to receive a five-year New Mexico IDeA Network for Biomedical Research Excellence (INBRE) grant for $283,910 to study Natural Product Exploration in Tarantula Hawk Wasp Venom Using LC-MS/MS. In 2015, we received an EPSCoR Subaward (063037-874Q) for $50,000 to study the Optimization of Algal Culture and Lipid Extraction Techniques for Use in Biodiesel Production. Related to this grant, our students applied for a Student Research and Professional Development Funds (SRPD Funds, $4151) to attend the Algae Biomass Summit 2015 in Washington, DC on Sept. 29 - Oct 2. This year we are fortunate to have NM EPSCoR's STEM Advancement Program (STEMAP) Solar Energy Materials grant ($13,000) supporting 3 students' energy research. In total, this is $376,910 of external and $4151 of internal funding.

The Chemistry program also supports MCAT preparation programs, as well as middle school and high school science camps during the summer with funding of around $190,000 in the summer of 2014. This program was renewed for 2015 and 2016. Many jobs were located for our graduates in analytical chemistry (LC-MS/MS work), sales (Mako Medical Laboratories) or research and development (Fuji Film). Crosschecking our curriculum with information from the outside world is an important part of our program development strategy. One of our students, Jordan Gutierrez, was accepted into the Undergraduate Pipeline Network, which is a mentor program for students that monitors their progress from undergraduate through medical school. This program is highly competitive and prestigious. Another one of our students, Adriana Grijalva, was accepted into the Frontiers in the Chemistry of Materials program at UT Austin for summer 2016. This is also a highly competitive and prestigious program.

3. Should it be doing what it is doing now?

The Chemistry program is largely doing what it should be doing. We need to continue to recruit students, to provide further program growth.

4. If not what should it be doing?

The Chemistry program could serve our University function better by developing a strong connection with our local mining community. In addition, we can strengthen our environmental applications. Finally, the chemistry program should build personnel levels up to four full-time faculty and one administrative assistant and be set aside into its own department.

5. How should it do what it should be doing?

The process of improving the chemistry program is ongoing with faculty making efforts currently to reach the goals outlined in the previous question.

Program Evaluation and Enhancement Report -2017: Outdoor Program

1. What was the Outdoor Program created to do in the first place?

Housed in the Department of Natural Sciences, the Outdoor Program (OP) was launched in July of 2012 to promote an environmental ethos among Western New Mexico University students using the world's first Wilderness area, the Gila. The OP uses curricular and co-curricular outdoor experiential, adventure-based programming to promote student development of environmental literacy, leadership, and civic engagement.

2. What is the program doing now?

The curricular component of the Outdoor Program includes a minor in Outdoor Leadership Studies (Launched FA2014), as well as frequently crosslisted courses through the Millenium III Honor's Program. The co-curricular (non-credit bearing) component of the program includes Freshman Orientation, low- to no-cost single and multi-day outdoor trips, and opportunities for outdoor gear rental facility (The Outpost. The gear rental facility is open to the public, and Western Institute for Lifelong Learning members are able to participate in outdoor trips at a reduced rate (because WILL members are covered by WNMU insurance). The OP also collaborates with the Office Of External Affair Language Institute during June/July to create outdoor opportunities for Language Institute guests.

Since its inception, the program has served more than 1581 students through curricular and co-curricular activities including student leadership and teambuilding trainings, the development of a university search and rescue team, and new student orientations. During the summer of 2016, The Outpost gear rental facility moved to Bernard Hall and, over the last 9 months has rented more than 300 different pieces of outdoor gear to at least 73 student, faculty/staff and/or community members. As of this spring, 3 students have declared a minor in Outdoor Leadership Studies and this number is anticipated to increase as the Outdoor Program and Social Work Department recently received WNMU Collaborative Research funding to develop an undergraduate- and graduate-level certificate in Outdoor Behavioral Health.

This semester, the Outdoor Program collaborated with faculty from four Natural Sciences Department courses (Ecology, Introduction to Geographic Information Systems, Foundations of Search and Rescue and Mammalogy) to offer a multi-day outdoor field-experience for more than 40 students at City of Rocks. Natural Science students collected field data and are in the process of analyzing findings that will be presented during the Academic Research Symposium in May.

Importantly, on January 13, 2017, the newly developed Mustang Search and Rescue (SAR) Team was recognized by New Mexico State Police as a state resource. As such, Mustang SAR members are eligible to respond and participate in SAR missions. Western New Mexico University's SAR team participates in regular trainings and provides students opportunities for civic engagement.

The Outdoor Program is currently collaborating with Fort Lewis College (Adventure Education Program faculty) to advance the WNMU Outdoor Program's student training protocol and prepare for program accreditation. The results of the collaborative project will advance student leadership opportunities and will be important to new student orientation beginning in 2018. With a university wide identity that includes our "place", incoming students will be introduced to the Gila and immediately come to appreciate and understand WNMU's unique identity.

Ultimately, the program aims to educate diverse learners who achieve career goals, gain civic literacy, practice social responsibility and engage in practices that promote a sustainable future.

3. Should it be doing what it is doing now?

Yes. Since its inception in the fall of 2012, at least 1600 students *and* community members have participated in an Outdoor Program (OP) related class, training, or event, with many students participating in multiple events/classes. As evidenced by the number of students and community members who enroll in curricular classes, co-curricular trips and services, the OP is showing signs of stability and growth.

The Outdoor Program is actively collaborating with other departments and anticipates playing a role in WNMU's Applied Liberal Arts and Sciences courses through trips and instruction. As previously mentioned, the program is actively developing a robust student leadership training program to prepare peer leaders for pre-orientation wilderness tripd for incoming freshmen. Outdoor Orientation Programs (OOPS) have been shown to significantly enhance student retention (e.g. AEE 2011; Bell, Holmes and Williams 2010; Bell 2006; Brown 1998), and, given WNMU's proximity to the Gila and identity that includes our place, an outdoor orientation makes sens.

The OP appears to be making some impact on student retention and completion. Data provided from the Office of Student Affairs indicates that 78% of students who have participated in a course or co-curricular activity have either graduated or are currently enrolled in the university. (Data source: Adele Springer, Office of Academic Affairs 2017).

It may be interesting to note that concurrent students from Aldo Leopold High School have begun to regularly enroll in OLST courses, suggesting that outdoor courses may be important to this alternative high school that incorporates the outdoors in the experiential curricula.

4. If not, what should it be doing? And (5.) How should it do what it should be doing?

The program will benefit from continuing to work with the Honors Program and to cross-list unique courses/workshops that are interdisciplinary and of great interest to millennial students. Other opportunities, such as offering a required freshmen or senior colloquium as a component of ALAS courses will help to advance the vision of the OP in promoting an environmental ethos, as well as in advancing the WNMU mission of producing diverse learners who are civically engaged.

With a formal and robust student leadership training program, the Outdoor Program is well poised to work with Student Affairs to offer an *outdoor orientation program* for incoming freshmen beginning SU2018 (*Isaac Brundage, pers. comm., 03/24/17*). Currently, none of New Mexico's public higher education institutes provide an outdoor orientation program (Bell et al. 2010) and this is surprising. Students who participate in outdoor orientation programs have an easier time transitioning to college (Wolfe and Kay 2011; Brown, 1998; Davis-Berman and Berman 1996; Devlin 1996); maintain higher grade point averages than their non-participating peer cohort (Coyle 2005; Barefoot et al. 1998; Gass 1987); tend to complete their program of study (Brown 1998; Davis-Berman and Berman 1996; Gass 1990); express an increased sense of belonging among their peers (Bell, 2006; Austin, et. al. 2003), and demonstrate a high level of commitment to the university itself (Wolfe and Kay 2011; Brown 1998). An outdoor orientation program could benefit WNMU by improving rates of graduation and decreasing attrition (e.g. Wolfe and Kay 2011; Austin, et al. 2009; Bell 2006; Brown 1998; Davis-Berman and Berman, 1996; Gass 1990; Devlin 1996).

Program Evaluation and Enhancement Report-2017: Geology Program

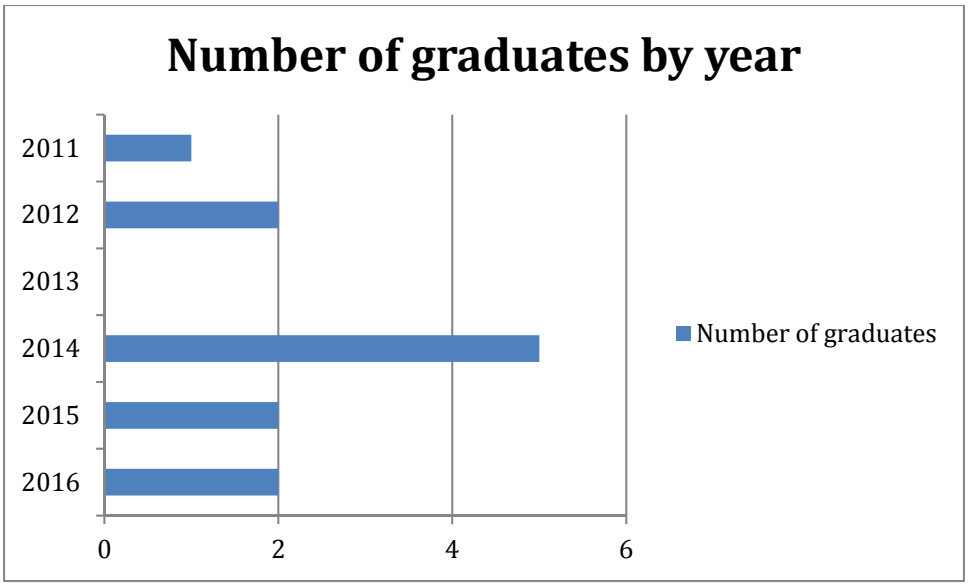
Five Core Questions

1. **What was the Geology program created to do in the first place?**

   Geology is a multidisciplinary study of earth processes with a basis in the fundamental fields of math and science, including chemistry, physics, and biology. Geology looks to understand the physics and chemistry of the interactions of the systems of the Earth (e.g., Geosphere, Atmosphere, Biosphere, and Hydrosphere) that have operated throughout history. Particular to our region of the western U.S., geologic surveys were of critical importance to describe the terrain and rock formations that are of economic importance, such as the Wheeler Survey of 1869 – 1871. Many early Geology programs were designed to train students to survey and explore our landscape for metal and energy resources. The Geology program at WNMU has traditionally had an emphasis economic geology, particularly metal resources, given the culture of mining in the region.

2. **What is the program doing now?**

   The Geology minor is evolving to have a more multidisciplinary focus with classes covering the extent of basic Earth processes (GEOL 101/103: Physical Geology) to all aspects of the hydrologic cycle (i.e., GEOL 401/403: Hydrogeology). As a minor, the Geology program now exists to support students in other majors. In 2011, there were 11 geology minors, by Fall of 2015 the number of minors in geology had dropped to 6, increaseing to 12 by the Fall of 2016. Due to the low number of students minoring in Geology, with the current exception of GEOL 401/403: Hydrogeology in Spring 2017, upper division geology courses have not been meeting target enrollments.



3. **Should it be doing what it's doing now?**

   The low numbers in the miror suggest that it needs to be updated with content and skills more pertinent to current needs in the field. To this end, the current Geology minor is is being redisigned to reduce the number of course options with the goal of concentrating students in the remaining courses. In addition, materials and content for Geology minor courses are being

updated to align them with current standards and practices in the field. These changes should increase course enrollments, increasing the income these courses generate for the university.

4. <u>If not, what should it be doing</u>?

Proposed changes to the Geology minor will streamline the degree plan for students, with a reduced number of course options and those courses being offered more frequently. The changes include:

- Move the **GEOL 340/342 Field & Research Methods** into the minor core requirements. This course is a capstone course wherein students apply their knowledge of earth processes to map and describe geologic formations and geomorphic landscapes within the Silver City, NM landscape. As a capstone course, it should be required of all students obtaining a Geology minor. It will be offered in Spring semester of even years (e.g., Spring 2018).
- Move **GEOL 102/104 Historical Geology** into the minor electives category. This course covers Earth processes through geologic time as well as fossils. Much of geologic time is covered in other geology courses (i.e., GEOL 101/103 Physical Geology and GEOL 301/303 Rocks and Minerals); due to this overlap, it will be moved into the elective category and replaced by the capstone GEOL 340/342 Field & Research Methods in the core requirements of the minor. As GEOL 102/104 covers fossil assemblages in greater detail than other Geology courses, it will remain in the minor electives category for students interested in Geo-biology. It is also currently an option within the GE Science Lab requirement.
- Add **GEOG 361/363 Intro to GIS** into the minor electives. It is important for a geoscience student to be able to think spatially and grasp the spatial relationships between features that shape the landscape (e.g., the erosion of a landscape by a river to form a ridgeline-bounded watershed); as such, the GEOG 361/363: Intro to Geographic Information Systems (GIS) course is a proposed elective for the Geology minor. This course is offered every semester and will replace the GEOL 331/333 Sedimentology elective.
- Change the name of **GEOL 401/403 Hydrogeology** to **GEOL 401/403 Hydrology**. A course name change will be proposed for GEOL 401/403; Hydrogeology traditionally refers to groundwater while Hydrology is an all encompassing term describing water interactions within the hydrologic cycle, including atmospheric, surface, and ground water. With current concern for climate change, potential drought conditions, and limited water resources for populations of the southwest, an understanding of the complete water cycle is crtical for WNMU Geology graduates.

Geology Minor:

	Current Minor	**Proposed Minor**	**Proposed Course Offered**
Core Geology Minor Courses	GEOL 101/103 Physical Geology	GEOL 101/103 Physical Geology	Fall (every year,F2F) Spring (every year, Online)
	GEOL 102/104 Historical Geology	GEOL 301/303 Rocks & Minerals	Fall (odd year, F2F)
	GEOL 301/303 Rocks & Minerals	GEOL 340/342 Field & Research Methods	Spring (even year, F2F)
Select 2 from the 3 Courses to Complete the Minor (i.e., Electives)	*GEOL 331/333 Sedimentology*	GEOL 102/104 Historical Geology	Fall (every year, Online)
	GEOL 340/342 Field & Research Methods	GEOG 361/363 Intro to GIS	Fall, Spring (every semester, F2F)

	GEOL 401/403 Hydrogeology	GEOL 401/403 **Hydrology**	Fall (even year, F2F)

With the proposed changes, a student entering the Geology minor in the Fall of an even year (i.e., 2018) may take the following course schedule to complete the program in two years (*core courses marked red*):

Year	Fall	Spring
Year 1	• GEOL 101/103 Physical Geology (F2F, Fall 2018) • GEOL 102/104 Historical Geology (Online, Fall 2018) • GEOL 401/403 Hydrology (F2F, *next offering: Fall 2020*)	• GEOG 361/363 Intro to GIS (F2F, Spring 2019)
Year 2	• GEOL 301/303 Rocks & Minerals (F2F, Fall 2019) • GEOL 102/104 Historical Geology (Online, Fall 2019) • GEOG 361/363 Intro to GIS (F2F, Fall 2019)	• GEOL 340/342 Field & Research Methods (F2F, Spring 2020) • GEOG 361/363 Intro to GIS (F2F, Spring 2020)

With the proposed changes, a student entering the Geology minor in the Fall of an odd year (i.e., 2019) may take the following courses to complete the program in two years (*core courses marked red*):

Year	Fall	Spring
Year 1	• Physical Geology (F2F, Fall 2019) • Rocks & Minerals (F2F, Fall 2019)	• Field & Research Methods (F2F, Spring 2020)
Year 2	• Historical Geology (Online, Fall 2020) • Intro to GIS (F2F, Fall 2020) • Hydrology (F2F, Fall 2020)	• Intro to GIS (F2F, Spring 2021)

5. <u>How should it do - what it should be doing</u>?
With the changes indicated above courses in the Geology minor, particularily with regard to frequency the courses are being offered, should have higher enrollments and thus enhance the univesity income.

To further prepare WNMU students for careers in STEM and STEM-related fields, the Natural Sciences Department will also be offering a GIS-based minor that should attract students from disciplines across the University (e.g., Business, Social Work, Behavioral Sciences). The Geographic Information Systems and Technology (GIST) minor will include the following courses:

Core Requirements:

Proposed Course	***Hours***	***Semester Offered***	***Course Topics***
GIST 361/363 Intro to GIS	4	Fall (F2F) Spring (F2F)	Introduction to: GIS Workflow, Spatial Data,

			Spatial Data Models, Attribute Data, Data Storage Formats Cartography
GIST 362/364: GIS Processing & Analysis	4	Spring (F2F)	Advanced Vector and Raster Analysis, Image Analysis, Network Analysis
GIST 366/368 WebMapping & WebGIS	4	Fall (F2F)	Intro to WebGIS and Apps (ArcGIS Online, Google Earth)

Select Any 2 Electives:

Proposed Course	***Hours***	***Semester Offered***	***Course Topics***
GIST 370/372 Intro to Remote Sensing	4	Fall (F2F)	Introduction to Methods and Analysis in Remote Sensing (GPS, Photogrammetry, UAS, Satellite Imagery)
GIST 410/412: GIS Modeling and Programming	4	Spring (F2F)	Introduction to Scripting, Python Language, GIS Programming with Python
GIST 481: GIS Internship	3 (135 hours of work); SL	Fall (F2F/Online) Spring (F2F/Online)	Student works with Organization, Agency, or Business and Completes Project for Client

Currently, GIS courses are limited by the number of computers we have in our computer lab (10 stations), but with the building remodel we hope to increase the numbers of computer stations up to 20. The development of the GIST minor will make further use of the campus-wide software license purchased by WNMU. The GIST 370/372 Intro to Remote Sensing course will also deploy the Unmanned Aircraft Systems (UAS, or drones) purchased by the University to collect and analyze aerial imagery. These courses will also be cross-listed as GEOG Geography minor, such that Geography students may enroll in these courses to complete their electives. The GIST minor is currently being developed and will be submitted to C&I in Fall of 2017.