

# 2021-2022 Program Review



## CAN Program Review (Instructional) - Earth Science (Fall 2021)

### STEP 1: Program Review Narratives

*2021-2022*

#### **Instructional Program Review (IPR)**

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#### **Program Context**

**1. Mission:** Mission statement: The Earth Science Department endeavors to prepare students for successful transfer to 4-year institutions, provide the prerequisite Earth science foundation for further study in Earth science fields, foster critical thinking and active learning, and fulfill the needs and interests of students by having a well-rounded curriculum of lecture and laboratories.

Currently our program focuses primarily on transfer students. Most students take Earth science courses to fulfill general education requirements and/or degree requirements for their 4-year degrees. We would like to work to grow our own degree programs. Further, we see a need to develop pathways for Earth science career/technical training, and we are beginning to research possibilities.

All courses in our department help students develop their critical thinking, communication, and quantitative reasoning skills.

**2. Articulation:** There are no known curricular or degree requirement changes at the high school level that would impact our program, though we do acknowledge that our program would benefit from developing closer ties to the local high school programs.

The full-time faculty member of our department was involved in the Faculty Discipline Research Group (FDRG) that developed the original Transfer Model Curriculum (TMC) for Environmental Science. The state of California approved the TMC template for Environmental Science in Spring 2017 and our ENVS AS-T was among the first two programs in the state to be approved when it launched in 2018. The ENVS TMC will undergo 5-year review this academic year, though unfortunately our full-time faculty member is too busy to participate in this process. We will look out for any changes in the TMC over the next year, so that our ENVS AS-T can be amended, if needed.

The state-wide TMC for Geology underwent 5-year review in 2016. No changes were made. Since 2016, we have planned to create a Geology AS-T. One new course (Historical Geology) must be created and then the degree template needs to be developed and submitted to our curriculum committee and the state. The course outline was started, but not finished. It stalled simply due to lack of faculty time. Currently we lose a small number of geology students to our sister schools where the Geology AS-T is available.

The state-wide TMC for Geography underwent 5-year review in 2017. There was one minor change made to the TMC in 2017, and although it doesn't impact the courses students would take to complete our Geography AA-T, we should likely note the change on our AA-T so that students are properly informed. This change will be made when we also add our new Geography lab (GEOG 101) class to the Geography AA-T.

It's important to our department to keep current with our transfer degrees, and in the future, we hope to better use these degrees to stimulate additional interest in our department, especially as we move toward guided pathways.

**3. Community & Labor Needs:** In our previous program review we noted that Earth science jobs outpaced general employment growth, with all 5 Earth science jobs profiled grew "faster" or "much faster" than the national average. Further, California had the highest or second highest employment level in all five jobs profiled.

For this program review we continued to use data from the most recent Occupational Outlook Handbook published by United State Department of Labor Bureau of Labor Statistics. We looked at the same five jobs as we did for last program review (environmental technician, environmental scientist, geological/hydrological technician, geoscientists, and hydrologist, and we

also added geographer. Five of the six Earth science jobs profiled in the handbook are growing “as fast” or “faster” than the national average. (Geographers only grew 1%, so it is in the “little or no change” category.) With the exception of geographer, California continues to have the highest or second highest employment level in all jobs we profiled. (California is 3rd for geographers.) Additionally, cities in our region are in the top 10 cities in the country for both employment level and pay for hydrologists, environmental scientists, and environmental technicians.

Earth science related jobs continue to grow “as fast” or “faster” than the national average, but it was interesting to see that job growth had slowed slightly. (Previously these jobs were growing “faster” or “much faster” than the national average.) COVID may have played a role, as federal, state, and local resources were diverted to COVID response. Locally, we know of several positions that were closed or rescinded, so perhaps that is part of a larger trend. Government labs in particular did not hire our students and currently-employed hours were cut.

However, we are optimistic that growth will soon again accelerate, especially if the current infrastructure bill in Congress were to pass. Even if the bill does not pass, California (and the SF Bay Area in particular) has a heightened focus on water, energy, solid waste management, and climate change, and the local resource and economic needs related to those issues is only going to increase over the next decade.

Many, but not all, career opportunities in Earth science-related fields require a 4-year degree. Further, in the SF Bay Area some of the technical jobs, which typically require 2-year degrees, are actually filled by people with 4-year degrees. This was especially true during the last recession. Thus, clearly it is important that we continue to develop and market our transfer degree programs.

Our department would like to also develop effective new pathways (i.e. certificates or degrees) for career/technical education related to Earth science. The Occupational Outlook Handbook notes there is a demand for skilled environmental science technical workers in California and our region. Students with 2-year degrees are appropriate for these positions, and with the improved economy there are likely again opportunities for these students. The major industries for technical employment in environmental science are consulting, analysis labs, and local, state, and federal government. More research is needed on local industry demand, top local employers, and the programs already available at nearby institutions. We will work with the Director of Workforce Development to help develop our programs. Notably, the Workforce Development program has started a Water Treatment and Distribution Program, which can help students (with an Associates degree or less) get into drinking water or wastewater careers. Our department has helped to recruit students for this program and will continue to explore avenues for collaboration.

### **Looking Back**

**4. Curricular Changes:** The department offers classes in 5 disciplines, including: Environmental Science (ENVS), Geography (GEOG), Geology (GEOL), Meteorology (METE), and Oceanography (OCEN). METE is only offered in the summer, the other 4 disciplines are offered each semester.

We no longer offer evening classes, due to their chronic low enrollment. Online classes have taken their place. For the last 4 years, METE and GEOG have been offered only online. For GEOG the addition of online classes, initially to grow the program to a second section each term, resulted in an inability to fill the face-to-face sections. This is not ideal, as the online format is not ideal for all students. We hope to successfully rebuild face-to-face or hybrid GEOG sections (at least in GEOG 100), while still maintaining strong online enrollment. We will work with our dean to figure out creative scheduling ideas. ENVS and OCEN have both online and face-to-face classes, and we feel strongly that they both need to maintain a face-to-face presence on campus. Prior to the pandemic, Geology was only offered face-to-face. It moved online due to COVID. We’d like to return to face-to-face instruction.

We have not offered Cultural Geography since Spring 2019 when we lost a long-time adjunct instructor. That is a loss of 3-4 sections per year that would probably fill. We should look into hiring for this course and to have more flexibility for staffing our other Geography sections.

A long-time instructor of Oceanography retired in Spring 2020. We have been able to staff her sections, though it is unclear if we will be able to continue to staff the face-to-face sections post-COVID. We need to work to ensure that we have at least one face-to-face section of OCEN 100. We could also use another adjunct Geology instructor who is available to teach face-to-face classes, or we should move our full-time instructor to that class. Enrollment in Geology has declined significantly and continuously since the full-time instructor stopped teaching it in F17.

**5A. Progress Report - IPC Feedback:** Our last program review was lauded as “exemplary” and there were no “overall recommendations”. Within the specific sections, there was one recommendation.

RECOMMENDATION for Online Completion and Success (Section 8B): Information needed for changes that could be implemented.

RESPONSE: Elsewhere in the previous program review we did mention several strategies we intended to employ to improve online success (e.g. work with the Learning Center to increase online tutoring access, engage students in authentic research and projects related to the discipline and student interest, etc...), but we did not include that information in Section 8B. For our current program review, we will be sure to include ideas for changes in sections that discuss student success .

**5B. Progress Report - Prior Program Goals:** In our last program review, we identified the following 7 program objectives:

1. Revise current Environmental Science AS degree: initiated, not completed

Limited progress has been made on this important objective. With only one full-time faculty member (who also happens to have significant release time for other duties), we simply have not found time to fully address this objective. This is unfortunate, as currently the degree is redundant with the AS-T and thus confusing and not really useful for students. However, with revision, it will likely garner more student interest and help students fulfill their transfer goals. Some sporadic work was done on this objective in 2019, as we did complete the first part of the action plan by looking at the specific lower division degree requirements for nearby CSU ENVIS programs. However, to ensure we are up-to-date, we need to begin again. On a positive note, an Environmental Science Lab class will be an important part of the revised ENVIS AS degree, and we have developed an ENVIS 101 that will launch in Spring 2022. Further, Physical Geography Lab will also likely be part of this future degree, and GEOG 101 has been developed and will launch in Fall 2022. This objective will continue to be a high priority.

2. Create a Geology AS-T degree: initiated, not completed

Little progress has been made on this important objective, for the same reason as noted above in Objective #1. Enrollment in geology courses have dropped significantly over the past 4 years, as mentioned in section 4 and 7. However, we think some of that enrollment could be recouped and that it is still important to develop an AS-T, especially as we move to guided pathways. (See sections 4, 7B, 8A, and 11 for more discussion.) We are lacking only one course and that course is offered consistently at one of our sister schools. The course outline for that course has been initiated, it would likely take only 2-3 day's work to get the course and program ready to submit to the curriculum committee.

3. Create a lab class (ENVIS 101) to accompany ENVIS 115: completed

This objective was completed. ENVIS 101 is UC/CSU transferable and meets the GE lab requirement for UC/CSU. The course will launch in Spring 2022. The launch was delayed a year due to COVID. We anticipate that this lab course will also boost enrollment in the related lecture class (ENVIS 115).

4. Develop print and online marketing materials for Earth Science programs: little progress

We did not find time to do much work on this objective, in part because we wanted to first update the ENVIS and GEOL programs (objectives 1-3 above), and that work was not fully completed. No print-based marketing material was developed, but we did work some on the program maps through the Guided Pathways initiative. The program maps are probably the most important marketing material for us to focus on. That work was started, but not completed.

5. Explore the development of a CTE program for ENVIS: some progress

The Workforce Development program has started a Water Treatment and Distribution Program. This program provides avenues for employment for students with an Associate degree (or less). As noted in section 3 above, Geological and Hydrologic technician jobs are growing faster than the national average. The Earth Science program has had limited involvement thus far, but looks forward to further collaboration.

Labor statistics indicate there is even more demand for Environmental Science Technicians in California and especially in the SF Bay Area. More research and community networking is needed in order for us to develop a successful program.

6. Collaborate with STEM Center to improve student success and develop pathways for first semester student: initiated, but not completed

This objective pre-dated the college's implementation of the program mapper. We did work a bit with STEM Center staff to update the program mapper for one of our programs, but there are still errors that need to be addressed. Further, we need to get more involved in the Guided Pathways work to develop pathways that include GEOL 100 or ENVIS 115 for first year STEM students. This can simultaneously help identify students interested in Earth science, provide an option for students who later do not persist in some of the other STEM fields. Further, we have not yet firmly established in-person and online tutoring in all of our disciplines.

7. Improve student success by increasing hands-on activities and student research opportunities in our classes: initiated

(equipment was purchased), but not completed (COVID stalled use of the equipment).

Hands-on activities in our lecture classes increase student interest and success. Further authentic research opportunities based on student interest are also likely to increase interest and success. To facilitate more hands-on activities and research opportunities we have recently purchased microscopes and water-testing equipment. The microscopes have expanded opportunities for student learning in Geology and Oceanography lab classes, and they will also be used in our future Environmental Science Lab. The water testing kit will be used in our Oceanography and Environmental Science classes. It will likely also be used by honors students throughout our department. We were recently approved to purchase classroom globes for Geography, Geology, and Oceanography classes, but we are having trouble finding a good supplier.

This objective is much more difficult in a completely online class environment. We have new equipment, but students are not in the lab to use it.

**6A. Impact of Resource Applications:** We were able to purchase new microscopes which were used in our Oceanography labs in Spring 2020. We anticipate they will also be used in the new ENVS 101 lab. Since that time, all courses (including labs) have been online. We were not able to find a vendor that had globes that met our needs. We will continue to pursue this. The globes will be used in face-to-face sections of GEOG 100, GEOL 100, GEOL 101, and OCEN 101. Additionally, the globes will have extensive use in our new Physical Geography Lab (GEOG 101).

**6B. Impact of Staffing Changes:** We addressed this a bit in Section 4 above. We lost a long-time adjunct instructor in Geography after Spring 2019, which results in a loss of 3-4 sections per year. We should look into hiring adjuncts in GEOG to increase offerings (e.g. GEOG 110 and 150) and to have more flexibility for staffing our other Geography sections.

Also, we lost a long-time instructor of Oceanography in Spring 2020. We have been able to staff her sections because COVID pushed them online. However, we need to work to ensure we can continue to face-to-face sections of both OCEN 100 and OCEN 101 post-COVID.

The only full-time member of the department currently has 40% reassign time as Honors Coordinator. With just 60% time in the department, she finds it difficult to find time to do the extra non-instructional work that needs to be done for the department (e.g. marketing the program, developing partnerships with transfer schools, curriculum work, degree development, helping adjuncts with PLO/SLO, etc...).

### **Current State of the Program**

#### **7A. Enrollment Trends:**

In our previous program review, we reported that the Earth Science department census headcount, end-of-term headcount, FTES, load, and fill rates all increased significantly each year from 2013/14 to 2016/17. Our census headcount and end-of-term headcount increases each year ranged from 12.8% to 27%, depending on the year and metric. During that same 3-year time period, the overall college census headcount decreased 3.0% (2013/14 - 2014/15), 2.8% (2013/14 - 2014/15), and 8.0% (2013/14 to 2014/15). We were pleased to be growing even during a period of decreased enrollment for the college. During that time-period, we increased departmental section offerings and fill rates were very high.

Since 2016/17 our enrollment (and thus FTES) have declined. From 2016/17 to 2017/18 there was just a slight change, approximately 1% decline. From 2017/18 to 2018/19 to 2019/20, enrollment declined significantly (15%, 20%), and we then we saw a modest increase in enrollment (3%) from 2019/20 to 2020/21. From 2017/18 to 2020/21, the number of sections decreased from 27 to 19. This decline in sections was part of the reason for our enrollment decline. In some cases, we did not have instructors, so sections that would likely have filled were dropped. (This is discussed further in Section 7B.) FTEF went up approximately 8% from 2016/17 to 2017/18, as sections were added during that time due to previous years' increased enrollment. Since that time FTEF and Load has declined, as we have offered fewer sections. Fill rates in our classes have declined as well, but still remain above the college average.

Department-wide, we always see significantly greater headcounts in the spring semester, compared to the fall semester... generally around a 30% increase, but as high as 80% in 2017/18. Perhaps new incoming students are not taking science GE classes their first semester and/or students are putting off their GE science courses until the spring semester prior to transfer. As a result of this phenomena, we offer more sections in spring, and even so we also generally maintain high fill rates. Also, we need to keep this in mind when we consider how to grow our program.

Looking at specific disciplines within our department, Oceanography continues to be our highest enrolled and most productive discipline. We have consistently offered 10-11 sections per year and over the last 5 years OCEN fill rates averaged over 97%. OCEN loads decreased when we moved up to 11 sections per year, but have risen again since we are back down to 10 sections. With the loss of GEOG sections, ENVS is now the second most enrolled discipline, followed by GEOG, GEOL, and then METE. ENVS 115 loads decreased when we went from 3 to 4 sections. We anticipate a slight rise in enrollment when the related lab (ENVS 101) is launched and hope to build this program further. GEOG enrollment dropped from approximately 260 students in

six sections 2016/17 and 2017/18 to 43 students in 2 sections in 2019/20 and 2020/21, and we are currently only teaching one course (GEOG 100) and only online. As noted previously, the drop in GEOG sections was due in large part to lack of an instructor. GEOL sections have decreased from 5 sections in 2016/17 to 2 sections in 2020/21. Meteorology 100 is the only class offered in METE, and we offer one section in the summer as an online class. Enrollment remained pretty consistent through 2019/20, but dropped in 2020/21.

**7B. Significant Changes in Your Program:** Oceanography has been pretty stable. However, our long-time adjunct instructor who built the program retired in Spring 2020. Her presence was impactful in the face-to-face sections, which were almost always over-enrolled and had high retention and success rates. Further, she developed the OCEN 101 lab, which similarly did very well. During COVID everything moved online, but we are eager to get a highly effective instructor willing to teach (and build) our OCEN 100 and OCEN 101 face-to-face sections.

In Environmental Science, we have built to offering 4 sections per year of ENVS 115 and enrollment is growing slowly. Considering that the college-wide enrollment is declining, the slight enrollment increases in ENVS 115 are promising. We offer one online and one face-to-face section each semester.

As noted in Section 7A, Geography has had significant decline in enrollment. This is primarily due to the loss of an adjunct instructor who had been teaching GEOG 110 during the semester and GEOG 100 in the summer. When offered, these three sections were all filling. Thus, we believe this loss of enrollment is reversible. GEOG 100 enrollment has also declined in part because Skyline ramped up their section offerings considerably, and thus we no longer had as much cross-district enrollment. Also as our enrollment declined, we dropped the face-to-face GEOG 100 section. We'd like to figure out a way to successfully offer GEOG 100 face-to-face, as the online offering does not meet all student's needs.

Geology enrollment has also declined significantly, from 5 sections and 131 students in 2016/17 to 2 sections and just 32 students in 2020/21. As enrollment dropped, we also stopped offering the lab (GEOL 101) each semester, and there was no lab offered in 2018/19 and 2020/21. Not offering the lab on a consistent basis, likely has accelerated the decline of the lecture course enrollment. Further, Skyline stopped teaching GEOL 100 and GEOL 101, moving instead toward one combined class. Thus, we likely lost some cross-district enrollment. Additionally, starting Fall 2017, the GEOL courses moved from being taught by a full-time instructor to an adjunct instructor, and there was less on-campus marketing for the courses as well. With college enrollment declining and the addition of other GE science options, it is unlikely that we will build the Geology program back up to the same numbers. However, we do want to work to increase enrollment and to be able to offer the lecture and lab on a consistent basis, preferably in a face-to-face or hybrid format. There are several AS-A/T degree programs that require Geology 100/101.

**7C. Planning for Your Program:** It's important that our program get more involved in Guided Pathways and be more proactive in our involvement with academic counseling. Earth science related careers opportunities are likely to continue to increase in California, especially as our state and country work to address climate change, energy issues, and water issues. Additionally, students who don't persist in some of our engineering programs may find it easy to transfer into our programs. The Guided Pathways model should be able to help these students find our programs, but we also need to ensure that we are visible and offering the courses needed.

To increase retention and success, we would like to connect our curriculum more directly to our local community and our students lives. As an example, we've done this most effectively in the past through field trip based labs and projects in OCEN 100/101. We would like to expand the number of such opportunities (across our curriculum), deepen some of existing projects by better tying them to curriculum, and work to develop more authentic research projects within our courses through course undergraduate research experiences (CUREs) and through our college Honors program. Oceanography (our largest discipline) has the longest continuous history with field-based learning, as for over 14 years students have gone out on the SF Bay to collect and analyze physical, chemical, and biological data, and they have also done field-trip based projects along the ocean coast. Indeed, we feel these trips are part of what has led to the growth of this program. Further, based on the 6 years data provided by PRIE, each year OCEN class retention/success has exceeded our department average by 2-4% (retention) and 5-9% (success). The numbers are even stronger if we look at traditionally under-represented groups. e.g. OCEN success rates exceed our departmental average by 3% for Black/African American students, by 8% for Hispanic/Latinx and Filipino students, 10% for Asian students, and 14% for Pacific Islanders. Incorporation of field-based projects likely does not account for all of this increased retention/success, but we feel that it is significant enough to expand our field-based projects to other classes.

As we have opened more online classes, our face-to-face enrollment has generally decreased. For GEOG this resulted in being unable to fill our face-to-face section of GEOG 100, which we see as a problem. In the recent past, we were being careful to balance the addition of online sections in ENVS and OCEN to ensure we didn't destroy our face-to-face section in those disciplines. Also, at times we have found it difficult to find instructors to teach face-to-face sections. With COVID, everything went online... and we are a little concerned about being able to rebuild our face-to-face offerings. We will continue to work with

our dean for scheduling ideas.

We briefly address each discipline in our department below.

**Oceanography:** We would like to continue to offer both online and face-to-face sections of OCEN 100. Prior to COVID we were committed to always having at least one face-to-face section, but now due to COVID and the loss of an adjunct faculty member, everything is online. We may need to hire a new adjunct faculty member to teach the face-to-face section. Additionally, prior to COVID we were adamant about only offering face-to-face sections of the lab. We would like to go back to offering primarily face-to-face labs, with the possibility of one hybrid lab. We want to keep our existing field trip field components (e.g. Marine Science Institute, tide pool field trip, etc...) and expand to offer students more opportunities for authentic research by deepening our relationship with MSI and/or through CUREs.

**Environmental Science:** We are launching an Environmental Science lab in Spring 2022. We anticipate a slight bump in ENVS 115 enrollment as a result. We intentionally are launching the lab in the spring semester, as we typically have higher enrollment in spring. Eventually we hope to offer the lab in both fall and spring. We also hope the revision of our Environmental Science AS program will help boost enrollment in both ENVS 115 and ENVS 101. ENVS 101 offers us a great opportunity to incorporate more authentic research opportunities and community-based learning into the ENVS curriculum. We hope to include ENVS 101 in the MSI research boat trips. Further we would like to develop longer term projects with some of our existing/past community partners (e.g. Grassroots Ecology, San Mateo Resource Conservation District, SMCCCD Facilities, etc...) These projects may take the form of single lab/field activities and/or a longer CURE.

**Geography:** As noted in Section 7B, we feel that some of the decline in Geography enrollment is reversible by again offering GEOG 110 (Cultural Geography) and by offering GEOG 110 and/or GEOG 100 (Physical Geography) in the summer. However, we need to increase our adjunct pool. We also have a new GEOG 101 (Physical Geography lab) class that may help boost enrollment in GEOG 100. We will look at district-wide offering of both GEOG 100 and GEOG 101 to help us determine when/how to offer the lab.

**Geology:** Geology enrollment is in decline district-wide, especially since COVID. At Cañada, we don't want to lose these classes permanently, especially since they are part of several degree programs (e.g. Civil Engineering, Environmental Science, Geography, etc..) We need work with our dean, the STEM Center, and others to figure out how/when to best offer GEOL 100 and GEOL 101 in a routine and predictable manner. Further, we will need to better market the class on campus and perhaps to concurrent high school students interested in engineering. We may also shift a full-time instructor to these courses, which may make field trips and field opportunities more feasible and sustainable.

Our department needs to do much more marketing/outreach on campus, and relatedly we need to update our website. As the college enrollments continue to decline, we likely also need to develop better connections with high school feeder programs, and increase the retention/success rates of our current students.

**8A. Access & Completion:** Overall, for 4 of the last 5 years, our department completion rate was generally 1-3% above the college-wide completion rate, with the exception of 2020/21 when we were 1% below the college-wide completion rate. Perhaps not having face-to-face labs during COVID caused a slight decline in completion rate. Overall our department success rates generally exceed the college success rates by 3-4%.

Of our 5 disciplines, GEOG has the lowest completion and success rates. The average retention rate over 5 years was 79.8% and the average success rate was 60%. There are likely several underlying reasons. E.g. All of our GEOG classes are online. There are no face-to-face options. Geography is also often (incorrectly) assumed (by counselors and students) to be the easiest choice to complete a science GE. Thus, students who are already apprehensive about science are also taking the class online. For many, a face-to-face option might be better. To improve these metrics, we would like to try to offer a face-to-face (or hybrid) section of Geography 100 and also offer our new Physical Geography Lab (GEOG 101). Engaging with material in a lab setting may help increase lecture class retention and success.

METE has our highest retention and success rates. We only offer one section per year, and it is in the summer. We assume that a significant number of the students in our summer METE course are students home for the summer from 4-year universities.

Our department also hopes to work more closely with the Learning Center to provide tutoring. We have done this sporadically in the past, but we need a more focused and consistent effort.

Our department officially has five degree programs (ENVS AS-T, ENVS AS, GEOG AA-T, GEOG AA, and Earth Science AS. All five need some attention.

The Environmental Science AS-T degree program map needs revision to refine the suggested sequence of classes and to show students the options that exist. With the exception of one lab, a student could complete the map as written, though there is another lab that could be used instead. This program has a very high number of units and uses the GE Breadth for STEM requirements (i.e. fewer GE classes than the standard CSU GE pattern). Even so, most students will likely need to take an extra semester or take classes during a summer term in order to complete the degree. As noted in Section 4, the ENVS AS-T is due for 5-year review at the state level. We will keep an eye out for changes.

The Environmental Science AS degree was written PRIOR to the establishment of an AS-T degree, and it is redundant with the AS-T. We need to rework the ENVS AS program to align with the transfer requirements for ENVS programs at our nearby transfer schools. The ENVS AS-T is a lengthy program and nearly impossible to complete in 2 years. Although it will prepare students for any CSU and most UC ENVS programs, many CSU schools will allow students to transfer with fewer courses, and it is likely in our student's best interest to revise our ENVS AS degree to help guide students interested in a quicker transfer to local transfer schools.

The Geography AA-T degree program map needs revision as the map does not accurately map the degree. Currently the degree could not be completed at Cañada because two necessary GEOG class have not been offered recently. These courses are offered elsewhere in the district, though we could fairly easily offer them at Cañada (once we find an instructor). With updates and more promotion, we think this degree program has good potential for growth.

The Geography AA degree program predates the Geography AA-T and is now redundant and likely should either be updated or banked.

The Earth Science AS degree program is not a transfer degree. Students who have used it in the recent past are generally interested in transferring to local state schools in Geology. We should consider developing an AS-T in Geology and/or reviewing the Earth Science AS degree to ensure that it efficiently prepares students to transfer into Earth Science-related degrees at our local transfer schools. Currently all the courses are offered routinely at Cañada.

**8B. Student Equity:** For access, our department classes don't have any large equity gaps, though in the last two years, Asians are under-enrolled by 5-6%. Asians are highly underrepresented professionally in most Earth science fields. Better marketing material for our department will likely help, and we will keep this equity gap in mind as we develop marketing materials.

We have a significant success gap for Filipino students and Pacific Islander students, though the sample size is very small. We also have a success gap for Black-Non-Hispanic students, though again the sample size is very small. To address these success gaps, and to better serve all students, we hope to incorporate more antiracist concepts into our courses, and we will encourage our faculty to take part in CORA training and/or related professional learning opportunities. Additionally, we plan to make better use of intervention strategies (e.g. early alert, tutoring) and our community resources (e.g. engaging students in local projects, guest lecturers, etc.). Also, importantly, we hope to better connect curriculum to our local community and students lives through expanding field trip opportunities, deepening our collaboration with community partners, and developing more authentic research projects through CUREs, Honors, etc...

Historically, Earth science professions have suffered from a lack of diversity, nation-wide. Part of our department's role is to help fix this! The data we used for this program review focused on our courses, but we would also like to see students from traditionally under-represented groups persist in our degree programs. As previously noted, we need to revise our degree programs, and there is work to be done to close success gaps in our courses. Further, we need to ramp up marketing and outreach and work more closely with other campus support groups (e.g. EOPS, BTO, Umoja, Promise, STEM Center, etc...)

We also need to get more involved in the Guided Pathways initiative, as our programs may appeal to students who first express interest in engineering or biology or other more well-known fields. Additionally, our programs might help catch students who are struggling in other programs. For example, students who don't persist in engineering due to waning interest in engineering courses and/or difficulties in higher math may find they are interested in Earth science fields, particularly environmental science and geology.

**8C. Completion - Success Online:** In every semester, regardless of the contact type, our department's average success rates are higher than the college average, and over the last 5 years that gap is consistently widening.

Within our department, face-to-face courses generally have higher success rates than online classes. In 2016/17, 2017/18, and 2018/19, the success rates for face-to-face courses in our department were higher than success rates in online courses by 4.5%, 7.6%, and 7% respectively. In 2019/20, face-to-face courses again had a significantly higher success rates in the non-COVID fall semester, but online classes had a slightly higher success rate in the COVID- impacted spring semester. This simply shows that

courses that were scheduled online for Spring 2020 were not as impacted by the COVID disruption.

Similarly, looking at success rates during COVID-impacted 2020/21, our face-to-face synchronous Zoom success rates are below our previous years' face-to-face success rates, and our online classes had slightly (0.5%) higher success rates than our face-to-face (synchronous Zoom). This suggests that our synchronous face-to-face Zoom classes are not yet fully meeting the needs of some of our traditional face-to-face students.

Importantly, even though our departmental retention and success rates for online classes are high, we do still have some courses that we would like to see improvement for online success rates. Strategies that we are pursuing include increased our use of Early Alert, revised syllabus policies, and possible move to a hybrid format.

**9A. SLO Assessment - Compliance:** We have a 3-year assessment plan. For simplicity, we decided to assess courses every other year by discipline. OCEN, GEOL, and METE are grouped in one year, and ENVS and GEOG are grouped in the next year. Within those groupings, OCEN and ENVS classes are assessed fall semesters and GEOG and GEOL classes are addressed spring semesters. METE classes are only offered in the summer, so our sole METE course will be assessed in summer. Thus, there is one discipline assessed each semester.

Strangely our 3-year assessment plan now looks off by one year. Based on memory and the language in our previous program review, we thought OCEN, GEOL, and METE should be 2020/21 and ENVS and GEOG should be 2021/22. We are not sure about how to fix this and will consult with the Instructional Assessment Coordinator. OCEN courses are current with assessment, but ENVS, GEOG, GEOL, and METE are all missing assessment data. Our department had a few years in a row of being on track with inputting assessment data, which is a major improvement for us, but we are again behind. Currently, all but 2 of our department's courses are taught by adjunct faculty and we again have several new faculty. We need to work to get caught up and train adjunct faculty.

Looking at the Improve dashboard, there are several red flags for courses that are missing SLOs and/or assessment methods. The two courses lacking SLOs are new courses (ENVS 101 and GEOG 101) and have not yet been offered. The three courses that are lacking assessment methods (GEOG 110, GEOG 150, GEOL 121) have not been offered over the last 2 years. We hope to offer both Geography courses soon, so we will work with future adjunct instructor to get the assessment methods input into Improve.

**9B. SLO Assessment - Impact:** Two OCEN faculty discussed the OCEN 100 and OCEN 101 assessment results. The assessment criteria were met in both classes, but we would still like to see improvement in the OCEN lab's students' ability to use the scientific method. We discussed ideas for better modeling of the scientific method in earlier labs, prior to the lab where students design their own study. We also discussed that the GEOL 101 lab does not incorporate as intensive instruction in the scientific method as the OCEN 101 lab.

**10. PLO Assessment:** Our program has 3 PLOs, and we have developed an assessment plan, but we have not mapped are PLOs to SLOs. Honestly, with only one full-time faculty (who also has 40% re-assigned time out of the department), the loss of a long-time adjunct who helped coordinate our assessment, and a changing array of adjunct faculty teaching most of the courses... this is something that has simply fallen through the cracks. We need to work more on this.

**Program Review Narrative Status:** Complete

## Goal Description: Update Environmental Science AS-T.

The program map for ENVS AS-T needs revision to correctly show course options available for students within the degree and to ensure proper course sequencing. Further, the transfer model curriculum (TMC) for ENVS is scheduled to be updated at the state level in 2022, so we need to ensure that we update our AS-T degree after any TMC revisions are made.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney with help from the Articulation Officer and STEM Counselor

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student



# CAN Program Review (Instructional) - Earth Science (Fall 2021)

Completion, Enhance Marketing, Partner with 4-Year Colleges and Universities, Implement Guided Pathways, Implement Guided Pathways

## Goal Description: Revise Environmental Science AS Degree

The current AS degree was designed prior to the approval of our ENVS AS-T, and now the two degrees are redundant. The new ENVS AS degree will have slightly fewer required science courses and more skill-based electives. The degree will be designed to facilitate transfer to our local CSU ENVS programs, some of which require fewer classes than indicated on the ENVS AS-T. As noted in section 3 of our program plan, there is a need in California (and our local area in particular) for workers with 4-year degrees in ENVS. Further, (as noted in section 7 of our program plan), our ENVS AS-T and ENVS AS degrees may be able to help "catch" students who do not persist in some of the other STEM fields. This objective will be completed when we launch a revised ENVS AS degree.

**Goal Status:** 2 - Continuing (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student Completion, Partner with 4-Year Colleges and Universities, Implement Guided Pathways, Implement Guided Pathways

## Action Plans

- 2019-2020** - 1. Review 3 or more local CSU ENVS program degree requirements.  
2. Develop curriculum outline for the degree.  
3. Input into Curricunet and go through the curriculum review process.  
4. Work with articulation officer to submit to state. (Active)

**Who's Responsible for Completing this Action Plan?:** Susan Mahoney

**Estimated Completion Date:** Fall 2021

**2019-2020** - Consider developing a reassign time request to complete program objectives 1-5. Several of these objectives have languished for years due to lack of time. (Active)

**Who's Responsible for Completing this Action Plan?:**

**Estimated Completion Date:**

## Goal Description: Update Geography AA-T and Geography AA

Our Geography AA-T needs minor updating to include our new lab course (GEOG 101) and to add GEOG 150. The program map should also be reviewed. Additionally, we should consider whether the older Geography AA degree is still relevant.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney with help from the Articulation Officer and Social Sciences Department

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student

# CAN Program Review (Instructional) - Earth Science (Fall 2021)

Completion, Partner with 4-Year Colleges and Universities, Implement Guided Pathways, Implement Guided Pathways

## Goal Description: Create Geology AS-T degree

A Geology AS-T degree will help us attract and retain students, and importantly it will help facilitate student transfer to 4-year schools. Currently, we lose interested students to other schools. Students who know they have an interest in geology are less likely to attend Canada, and students who find a passion for Geology after taking a class are likely to move on to a school that offers an AS-T. Additionally, as with our two Environmental Science degrees, a Geology AS-T degree program can likely help "catch" students who are not persisting in other STEM fields (e.g. engineering). (See section 7 above.) Many second or third semester engineering students already have all but one or two of the required Geology AS-T courses completed. The Geology AS-T has few classes, so it is a relatively easy degree to complete and it facilitates successful transfer. Additionally, as noted in section 3 above, there are significant job opportunities in California (and our local area in particular). Interestingly, in many cases professional geologists work alongside professional engineers in consulting firms and at construction sites. This objective will be completed when we launch a GEOL AS-T degree.

**Goal Status:** 2 - Continuing (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student Completion, Partner with 4-Year Colleges and Universities, Implement Guided Pathways, Implement Guided Pathways

## Action Plans

- 2019-2020** - 1. Create Historical Geology course with lab.  
2. Use Geology TMC to create Geology AS-T.  
3. Input into Curricunet and go through the curriculum review process.  
4. Work with articulation officer to submit to state. (Active)

**Who's Responsible for Completing this Action Plan?:** Susan Mahoney

**Estimated Completion Date:** Fall 2020

**2019-2020** - Consider developing a reassign time request to complete program objectives 1-5. Several of these objectives have languished for years due to lack of time. (Active)

**Who's Responsible for Completing this Action Plan?:**

**Estimated Completion Date:**

## Goal Description: Create an easy path to Earth Science degree programs from other STEM programs.

Collaborate with other STEM disciplines within the Science and Health Interest Area to develop pathways that include GEOL or ENVS for first year STEM students. This can simultaneously help identify students interested in Earth science and provide an option for students who later do not persist in some of the other STEM fields.

**Goal Status:** 2 - Continuing (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney

# CAN Program Review (Instructional) - Earth Science (Fall 2021)

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student Completion, Connect Students with Internships and Mentorships, Implement Guided Pathways, Implement Guided Pathways

## Action Plans

**2018-2019** - Attend STEM Center Staff meeting and/or otherwise connect with STEM Center on this issue. (They are already working on it.) (Active)

**Who's Responsible for Completing this Action Plan?:**

**Estimated Completion Date:**

**2019-2020** - Contact Learning Center and STEM Center to inquire about how to set up tutoring. (Active)

**Who's Responsible for Completing this Action Plan?:**

**Estimated Completion Date:**

## Goal Description: Develop print and online marketing materials for Earth Science department programs.

We need to showcase our programs and course offerings. Thoughtful marketing materials and a recruitment plan will help increase underrepresented minority students in our classes and degree programs. Recruitment needs to be done on campus and at our local feeder high schools. We also need further collaboration with our college recruiter and our campus support programs (e.g. EOPS, BTO, Umjoa, Promise, etc..)

**Goal Status:** 2 - Continuing (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney ... with help from Marketing

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success.

**Please select the college strategic initiatives with which your program goal aligns.:** Develop Clear Pathways, Improve Student Completion, Enhance Marketing

## Action Plans

**2020-2021** - Create marketing materials for Earth Science Department programs, specifically the ENVS AS-T, ENVS AS, and GEOL AS-T. Start and completion dates are contingent on completing the degree programs. Also, we need lots of help from Marketing, as we know little/nothing about creating promotional materials. (Active)

**Who's Responsible for Completing this Action Plan?:** Susan Mahoney... and help from Marketing

**Estimated Completion Date:** Fall 2021

**2019-2020** - Work with college recruiter to reach out to local feeder schools. (Active)

**Who's Responsible for Completing this Action Plan?:**

**Estimated Completion Date:**

**2019-2020** - Consider developing a reassign time request to complete program objectives 1-5. Several of these objectives have languished for years due to lack of time. (Active)

**Who's Responsible for Completing this Action Plan?:**

# CAN Program Review (Instructional) - Earth Science (Fall 2021)

Estimated Completion Date:

## Goal Description: Increasing field experiences and student research opportunities in Earth Sciences

Connecting curriculum more directly to our local environment and/or local community can help students engage with the material and see the relevance of the subject matter to their lives. In end-of-class surveys, students often cite field trips as their favorite part of our Earth Science sources. Through this goal, we want to expand some of our existing field trip opportunities to more classes, deepen our curricular relationships with some of our existing community partners, and increase the number of authentic research opportunities for students.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney and Dean Thompson

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community., Organizational Development - Focus institutional resources on the structures, processes, and practices that invest in a diverse student population and prioritize and promote equitable, inclusive, and transformative learning.

**Please select the college strategic initiatives with which your program goal aligns.:** Improve Student Completion, Connect Students with Internships and Mentorships, Build Relationships with Employers

## Resource Requests

**Funding for Marine Science Institute San Francisco Bay Research Field Trip each semester** - For over a decade we have offered the MSI boat trip to Oceanography students. Funding for this trip has never come out of our direct departmental budget, and with turnover of faculty and administrators, it is not totally clear how this trip is funded. However, it is clear that the trip is important to continue, and we plan to expand it to ENV5 101. Thus we included it here to ensure funding. We will also pursue how to include it in our annual budget. Historically we have offered one trip each semester, with the addition of additional students from ENV5 101, we will need to expand to two trips.

**Status:** New Request - Active

**Type of Resource:** Other

**Cost:** 5200

**One-Time or Recurring Cost?:** Recurring Cost

**Critical Question: How does this resource request support closing the equity gap?:** Our department had a significant success gap for Filipino students and Pacific Islander students. Notably though, our OCEN discipline exceeds our departmental average success rates by 8% for Filipino students and by 14% for Pacific Islanders. Our strong hands-on lab/field experiences in OCEN are likely part of that success. Thus, we would like to thus continue our MSI SF Bay field trip each semester and expand to be able to offer this experience to our ENV5 students as well.

**Critical Question: How does this resource request support Latinx and AANAPISI students?:** The literature (e.g. Weaver et al, 2008 and many others) suggests that undergrad research experiences help retain students and set students up for success in STEM. Our experience with OCEN courses supports this, as our OCEN classes have high success rates for Filipino, Pacific Islander, Asian, and Hispanic students compared to our departmental average. The MSI boat trip gives students the experience of collecting and analyzing physical, chemical, and biological data on the SF Bay. We would like to continue these trips and also work with MSI to get more students involved in MSI-related research by using more MSI data sets in our labs and by increasing the number of our students who work as MSI interns.

**Resource Priority Ranking:** High Priority

**Increased Field Experiences for Earth Science Students** - Our OCEN discipline has consistently offered field trips where students collect and analyze real world data. We would like our other disciplines to develop field experiences as well. We plan to build on

# CAN Program Review (Instructional) - Earth Science (Fall 2021)

relationships we have with existing community projects, as this may help build synergy to advance existing projects, and it will help our students network in their community. Each semester, we set up field trip opportunities (e.g. restoration projects, wastewater treatment plant, material recovery facility, campus sustainability tours, etc.) for ENVS 115 students, though now with the addition of Environmental Science Lab (ENVS 101), we can make these opportunities more robust and include opportunities for authentic student research. These past field trips have not been funded by the college budget. This is not sustainable, especially as we develop these opportunities into longer term projects and CUREs.

**Status:** New Request - Active

**Type of Resource:** Other

**Cost:** 2000

**One-Time or Recurring Cost?:** One-Time Cost

**Critical Question: How does this resource request support closing the equity gap?:** As noted in our MSI SF Bay Research Field Trip resource request, our department has a significant success gap for Filipino students and Pacific Islander students. However, the OCEN discipline within our department does very well with these students. OCEN classes typically have had a more robust field component than our other disciplines, and we would like to explore offering more field and research opportunities in our other departmental disciplines as a means of increasing student success.

**Critical Question: How does this resource request support Latinx and AANAPISI students?:** As noted in our MSI SF Bay Research Field Trip resource request, undergraduate research experiences help retain students and set students up for success in STEM fields. Further, recent research suggests that more needs to be done to maintain Latinx student interest in Earth Science. The interest level is on par with other groups in K-12 and diminishes in post-secondary. Connecting students with Earth Science related projects in their local communities through field trips and research opportunities can help students find relevance in the curriculum and thus increase course success. These experiences may also help increase the number of students pursuing Earth Science-related degrees.

**Resource Priority Ranking:** High Priority

## Goal Description: SLO and PLO update and use

We need to redevelop our assessment plan and map our SLO to PLO and ILO. Further, we need to follow the plan and routinely assess all classes and also use assessment for course and program improvement.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney and all department faculty

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success.

**Please select the college strategic initiatives with which your program goal aligns.:** Improve Student Completion

## Goal Description: Improve Student Success through adoption of antiracist course design strategies

We will encourage Earth science faculty to participate in CORA (or other similar) workshops and then to implement strategies into their courses.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney and other department faculty

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success., Community Connections - Build and strengthen collaborative relationships and partnerships that support the needs of, reflect, and enrich our diverse and vibrant local community.,

# CAN Program Review (Instructional) - Earth Science (Fall 2021)

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Organizational Development - Focus institutional resources on the structures, processes, and practices that invest in a diverse student population and prioritize and promote equitable, inclusive, and transformative learning.

**Please select the college strategic initiatives with which your program goal aligns.:** Improve Student Completion, Promote a Climate of Inclusivity

## Goal Description: Scheduling of face-to-face offerings

With the understanding that student success is greater in our face-to-face offerings, we want to work to ensure that all of our disciplines have face-to-face offerings. We want to rebuild ftf GEOG offerings and also ensure that we retain ftf GEOL and OCEN offerings post-COVID.

**Goal Status:** 1 - New (PR)

**Relevant Program Review Cycle:**

**Estimated Start Date:**

**Estimated Completion Date:**

**Who's Responsible for this Goal?:** Susan Mahoney and Sci Tech Dean

**Please select the college goals with which your program goal aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success.

**Please select the college strategic initiatives with which your program goal aligns.:** Improve Student Completion