

Date: _____

REQUESTOR CONTACT INFORMATION

Name _____ Campus _____
Title _____ Email _____
Office/Dept _____ Phone _____

PROGRAM CODE FOR ADMISSION STOP-OUT ONLY OR TERMINATION (PLEASE CHECK ONE)

Program Code _____ Program Description _____
Institution _____ Campus _____
College _____ Department _____
Level _____

Are current students "grandfathered" under the program code? Yes No
Should the old program code be available for use in Banner? Yes No

Effective , this program code will no longer be available to admit or recruit students.
Term (ie. Fall 2014)

This will turn off the online application, recruitment (effects Banner forms SRASUMI and SRAQUIK) and admissions (effects Banner forms SAADCRV, SAAADMS, SAASUMI, SAAQUIK, and SAAQUAN) Banner modules.

Effective , this program code will no longer be available to enroll or award degree to students.
Term (ie. Fall 2014)

This will turn off the general student (effects Banner form SGASTDN) and academic history (effects Banner form SHADEGR) Banner modules.

FOR ADMISSION STOP-OUT ONLY REQUEST

Effective , this program code will be reactivated and available to admit or recruit students.
Term (ie. Fall 2014)

This will turn on the online application, recruitment (effects Banner forms SRASUMI and SRAQUIK) and admissions (effects Banner forms SAADCRV, SAAADMS, SAASUMI, SAAQUIK, and SAAQUAN) Banner modules.

Check here to leave ONLINE APPLICATION OFF

ADDITIONAL COMMENTS

IRAO USE ONLY: DATE RECEIVED

ATTACHMENTS

Termination of an Associate, Bachelor and Graduate Degrees, and sole credential certificates.

Memo with President's Approval, with cc to Vice President for Academic Planning and Policy, regarding program action.

Admission stop-outs, termination of a Certificate (eg. Certificate of Achievements, Certificates of Competence, Subject Certificates, Academic Subject Certificates) & Associate in Technical Studies (ATS) Degree.

Memo from Chancellor to Vice President for Academic Planning and Policy regarding program action.

VERIFICATIONS

By signing below, I verify that I have reviewed and confirm the above information that is pertinent to my position.

Registrar
(Print Name)

Financial Aid Officer
(Print Name)

For Community Colleges,
verification of consultation with
OVPCC Academic Affairs:

Tammi Oyadomari-Chun

Signature

Date

Signature

Date

Signature

Date

¹ "Admission stop-out" is defined as a halt to new admissions to a program. (Regent Policy 5.201)



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April 27, 2023

MEMORANDUM

TO: Laura E. Lyons
Interim Vice Provost of Academic Excellence

VIA: Chip Fletcher *CFletcher*
Interim Dean, SOEST

FROM: Margaret McManus *Margaret McManus*
Chair, Department of Oceanography

SUBJECT: APPROVAL OF Update to GES Program Curriculum to Address Accreditation Requirements

SPECIFIC ACTION REQUESTED:

It is requested that the following curricular changes to the GES Program be implemented Fall 2023 to address updates and changes requested by the program's accreditation organization (ABET).

REQUESTED EFFECTIVE TERM:

Fall 2023

ADDITIONAL COST:

There is no cost associated with this change.

RATIONALE/PURPOSE OF PROPOSED CHANGE(S):

The purpose of the proposed curricular changes is to address programmatic updates requested by the Accreditation Board of Engineering and Technology (ABET) as a result of ABET's last programmatic review. ABET requires a subsequent interim report regarding program progress in addressing these requested updates, which is due on July 1st, 2023.

First, the changes address an improved need to provide curricular assessment of student learning outcomes that lend themselves to programming, data science, teamwork, task planning, and meeting deadlines. Additionally, we are hearing from our alumni and external advisory board that data science capabilities continue to grow in importance in the environmental science-related workforce and post-undergraduate education. Finally, many of our majors use data science as part of their required undergraduate thesis experience and thus by strengthening the curriculum



in the proposed manner we are addressing all three of these needs. So while the primary impetus for these changes initially came from the ABET review, these changes also address other areas of improvement need for the GES Program.

DETAILED LIST OF CHANGE(S):

Curriculum changes

1) Addition of the following new GES courses as degree requirements: GES 302 (GES Thesis Proposal), GES 371 (Introductory Environmental Data Science), and GES 471 (Advanced Environmental Data Science)

2) Addition of a basic programming course degree requirement that is satisfied by one of the following three courses: ICS 110P, ICS 110C, EARTH 250

Track, BAM, and Postbaccalaureate Path changes

3) Update of the following program tracks (both plans and sheets): Environmental Planning, General, Sustainability Science, Environmental Health

4) Stop out the following tracks: Sustainability Tourism, Environmental Anthropology, and Risk Management and Insurance

(University Registrar Notes: Concentrations do not exist in Banner, for Sustainability Tourism and Environmental Anthropology, so no action will be taken for these two)

5) Update of the following GES BAMs: MPH, MURP, MSF
BMPH BMGU BMGF

6) Update of the following GES Postbaccalaureate Pathway: Post-Bacc Certificate in Teacher Education

DETAILED LIST OF CONSULTATION WITH IMPACTED PROGRAMS:

1) Consultation with ICS Chair Professor Scott Robertson regarding ICS 110P/110C capacity Discussed if there was a need for additional capacity. Professor Robertson noted that they need to provide additional 110P/110C capacity to all majors with data science needs and would be using our conversation to requested any additional resources, if necessary.

2) Consultation with EARTH 250 instructor Dr. Sloan Coats regarding additional capacity Discussed with the course instructor if there was capacity and they confirmed there was.

3) All the new courses that are part of the curricular requirement updates (GES 302, 371, 471) are being taught by OCN and OCN-affiliated faculty.

ACTION RECOMMENDED:

It is requested that the following curricular changes to the GES Program be implemented Fall 2023 to address updates and changes requested by the program’s accreditation organization (ABET).

ATTACHMENTS (1-5 REQUIRED):

- 1. Current Program Sheet



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2. Proposed Program Sheet (with proposed changes clearly tracked/highlighted in Red)
3. Current 4 Year Plan Template
4. Proposed 4 Year Plan Template (with proposed changes clearly tracked/highlighted in Red)
5. Current Catalog description
6. Proposed Catalog description

APPROVED DISAPPROVED:

A handwritten signature in cursive script, appearing to read 'Laura E. Lyons'.

Laura E. Lyons
Interim Vice Provost for Academic Excellence

7/17/23

Date

University of Hawai'i at Mānoa – Five-Year Academic Plan 2023-2024
School of Ocean & Earth Sciences & Technology/Thompson School of Social Work & Public Health
Bachelor of Science (BS) in Global Environmental Science/Master of Public Health (MPH) GES-BS-BMPH
Epidemiology Emphasis

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

Year 1	Year 2	Year 3	Year 4	Grad Year 2
Fall	Fall	Fall	Fall	Fall
GES/ OCN 102 3	OCN/ERTH 312 3	GES 310L 2	GES/ OCN 401 3	PH 602 3
OEST 100 or OCN/GES 100 1	OCN/ERTH 312 or MATH 307 3	GES 319L, OCN 318, or OCN 481 3	PH 600 N/A	PH 623 3
MATH 241 (FQ) 4	PH 201 (DS) 3	*PH 310 3	*PH 655 3	PH 747 3
CHEM 161 (DP) 3	PHYS 170 4	BIOL 171 (DB) 3	*PH 663 3	PH 791 3
CHEM 161L (DY) 1	PHYS 170L 1	BIOL 171L 1	PH 681 N/A	
FW 3	ATMO 200 3	DA/DH/DL 3	Elective 300+ 3	
	FG (A/B/C) 3	GES 471 3		
		Elective 3		
		Elective 300+ 3		
Credits 15	Credits 17	Credits 16	Credits 12	Credits 12
Spring	Spring	Spring	Spring	Spring
OCN 201 3	ECON 324 (DS) 3	Submit Grad. Application	GES/ OCN 490 2	PH 648 3
OCN 201L 1	ERTH 101 and 101L 4	GES/ OCN 320 3	GES/ OCN 499 3	PH 658 3
OEST 100 or OCN/GES 100 1	or EARTH 170 3	GES/OCN 463 3	PH 656 N/A	PH 669 2
MATH 242 4	PHYS 272 3	BIOL 172 3	*PH 664 3	PH 789 2
CHEM 162 3	PHYS 272L 4	BIOL 172L 1	PH 666 or 748 N/A	
CHEM 162L 1	GES 311 3	DA/DH/DL 3	Elective 300+ 2	
FG (A/B/C) 3	Elective 300+ (OCN 300 req.) 4	Elective 300+ 3	Elective 4	
ICS 110P/110C or EARTH 250 3	GES 302 1	DS 3	Elective 3 3	
	GES 371 3		Elective 3 3	
	FG (A/B/C) 3	Projected Admission to MPH	BS Degree Projected	MPH Degree Projected
Credits 16	Credits 14	Credits 16	Credits 14	Credits 10
Summer	Summer	Summer	Summer	Summer
Credits 0	Credits 0	Credits 0	Credits 0	Credits 0
Total Credits 31	Total Credits 62	Total Credits 94	Total Credits 120	Total Credits 142

UD count
45

Notes:

- Students must take placement exams in order to register for CHEM 161 and MATH 241.
- Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.
- Minimum 45 upper division (300+ course) credits are required. PH 310 is gateway course for MPH+BAM program, PH 445 is recommended undergrad UD elective.
- *Approved Global Environmental Science Required Coupled Systems Courses for 4+1 is PH 310, 655, 663, and 664.
- *Nine double counted credits PH 655, 663, and 664, and 665 used by GES BS and MPH.
- Submit graduate application with Graduate Division for MPH program by Year 3 Spring, and notice of acceptance in Year 3 Spring. Undergraduate commencement with BS in GES Year 4 Spring; start as classified MPH graduate student Year 5 fall. Year 5 students take the remaining 22 credits necessary to complete MPH degree. Projected graduate with MPH Year 5 Spring. The MPH is a Plan B program.
- Advising for GES will be conducted by SOEST; advising for MPH will be conducted by PH.
- Eleven excess credits that are not used for the undergraduate GES degree but are put aside for the MPH are PH 600, 656, 666 or 748, and 681.
- Department of Oceanography: MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES
- GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
- PH Coordinator: Denise Nelson-Hurwitz, PhD; Biomed D-203; (808) 956-3089; denisene@hawaii.edu

University of Hawai'i at Mānoa — Five-Year Academic Plan 2023-2024

School of Ocean and Earth Science and Technology/ Shidler College of Business

GES-BS-BMGF

Bachelor of Science (BS) in Global Environmental Science/Master of Science in Finance (MSF)

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

Year 1	Year 2		Year 3		Year 4		Graduate (Year 5)		
Fall	Fall	Fall	Fall	Fall	Fall	Fall	Fall	Fall	
GES/OCN 100 or OEST 100 GES/OCN 102 ECON 130 (DS) MATH 241 (FQ) CHEM 161 (DP) CHEM 161L (DY) FW	1 4 3 4 3 1 3	OCN/ERTH 312 PHYS 170 PHYS 170L ATMO 200 ECON 131 ACC 200 GES 102	3 4 1 3 3 3 3	GES 310L OCN/ERTH 312 or MATH 307 BIOL 171 (DB) BIOL 171L BUS 314 FG (A/B/C) DA/DH/DL GES 471	2 3 3 1 3 3 3 3	GES/OCN 401 INS 300 ECON 324 FIN 633 DA/DH/DL 300+ DA/DH/DL GES 319L, OCN 318, or OCN 481	3 3 3 3 2 3 3	FIN 634 FIN 655 FIN 660	3 3 3
Credits	15	Credits	17	Credits	16	Credits	15	Credits	9
Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring
OCN 201 OCN 201L MATH 242 CHEM 162 CHEM 162L ECON 130 (DS) OEST 100 or GES/OCN 100 ICS 110P/110C or EARTH 250	3 1 4 3 1 3 1 3	PHYS 272 PHYS 272L ERTH 101 and 101L or EARTH 170 ACC 210 GES 310 GES 311 Elective 300+ (OCN 300 req.) GES 302 GES 371	3 4 4 3 3 4 1 3	Submit Grad. Application FIN 301 BIOL 172 BIOL 172L GES/OCN 320 GES/OCN 463 FG (A/B/C) DA/DH/DL Projected Admission to MSF	3 3 1 3 3 3 3	GES/OCN 490 GES/OCN 499 FIN 450 FIN 625 (or FIN 639) DS BS Degree Projected	2 3 3 3 3	FIN 639 (or FIN 625) FIN 654	3 3
Credits	16	Credits	14	Credits	16	Credits	14	Credits	6
Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer
								FIN 653 FIN 661 MSF Degree Projected	3 3
Total Credits	31	Total Credits	62	Total Credits	94	Total Credits	##	Total Credits	144

UD Count
45

Notes:

Student must take placement exams to be able to register for CHEM 161 and MATH 241; ~~Student must select ECON 321 and OCN 312 math track.~~

Approved Global Environmental Science Coupled Systems Courses for BAM: BUS 314, FIN 301, 450, INS 300

Student must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.

Student must take ECON 130, 131, ACC 200, and 210 as prereqs for upper division BUS, FIN, and INS courses.

BUS 314 is the gateway course for BAM and taken Fall of Year 3.

BAM consist of nine credits of double-counted courses (FIN 633, 450, 625, or 639) between GES and MSF degrees.

Undergraduate commencement with BS in GES is Spring of Year 4; Start as classified MSF graduate student is Fall of Year 5.

Once in MSF program, Year 5, student takes remaining 21 credits (FIN 634, 639/625, 653, 654, 655, 660, 661) to complete MSF degree.

Projected graduation with MSF is in Summer of Year 5. The MSF is a Plan B program (course-based and not thesis-based).

Advising for GES will be conducted by SOEST; advising for MSF will be conducted by Shidler OSAS.

Department of Oceanography; MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES/

GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu

MSF Advisor: Shannon Mark; BusAd G-202; (808) 956-9016; skwcmark@hawaii.edu

University of Hawai'i at Mānoa – Five-Year Academic Plan 2023-2024
School of Ocean & Earth Sciences & Technology/College of Social Sciences

GES-BS-BMGU

Bachelor of Science (BS) in Global Environmental Science/Master of Urban and Regional Planning (MURP)

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

Year 1		Year 2		Year 3		Year 4		Year 5	
Fall	CR	Fall	CR	Fall	CR	Fall	CR	Fall	CR
GES/OCN 102 OEST 100 or OCN/GES 100 MATH 241 (FQ) CHEM 161 (DP) CHEM 161L (DY) FW	3 1 4 3 1 3	MATH 243 or OCN/ERTH 312 OCN/ERTH 312 or MATH 307 PHYS 170 PHYS 170L ATMO 200 FG (A/B/C) DA/DH/DL	3 3 4 1 3 3 3	GES 310L GES 319L, OCN 318, or OCN 481 PLAN 310* (DS) BIOL 171 (DB) BIOL 171L DA/DH/DL Elective 300+ Elective 300+ Elective	2 3 3 3 1 3 2 3 3	OCN GES 401 PLAN 600 PLAN 601 Elective 300+ PLAN 473 Elective DS Elective-	3 3 3 3 3 3 4	PLAN 678 PLAN Methods #2 PLAN Methods #3 PLAN Elective #1	3 3 3 3
Credits	15	Credits	17	Credits	16	Credits	12	Credits	12
Spring		Spring		Spring		Spring		Spring	
OEST 100 or OCN/GES 400 OCN 201 OCN 201L MATH 242 CHEM 162 CHEM 162L FG (A/B/C) ICS 110P/110C or EARTH 250	1 3 1 4 3 1 3 3	ERTH 101 and 101L or EARTH 170 PHYS 272 PHYS 272L ECON 324 (DS) GES 311 Elective 300+ (OCN 300 req.) GES 302 GES 371 FG (A/B/C)	4 3 3 4 3 4 1 3 3	Submit Grad. Application OCN 463 OCN/GES 320 BIOL 172 BIOL 172L PLAN 473 Elective 300+ Elective 300+ GES 471 Projected Admission to MURP	3 3 3 1 3 3 3	GES/OCN 490 GES/OCN 499 PLAN 620 PLAN 603 PLAN 640 Elective Elective BS Degree Projected	2 3 3 N/A N/A 3 3 3	PLAN 650 (PLAN B) PLAN 751 PLAN Elective #2 MURP Degree Projected	3 6 3
Credits	16	Credits	14	Credits	16	For BS Degree	14	Credits	12
Total Credits	31	Total Credits	62	Total Credits	94	Total Credits	##	Total Credits	##

UD Count
48

Notes:

Students must take placement exams to be able to register for CHEM 161 and MATH 241.
 Minimum 45 upper division (300+ course) credits are required.
 Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.
 *PLAN 310 is a gateway course for MURP ~~4+4~~ BAM Program.

Approved global environmental coupled system courses for Environmental Planning BS track: PLAN 310, 473, 600, 620.
~~Nine Six~~ excess credits that are not used for the 120 credit undergraduate GES degree, but rather put aside (PLAN 601, 603, 640).
 Nine double-counted credits (PLAN 473, 600, 620) is used by both GES BS and MURP degrees.

Once in MURP program, students take the remaining 27 credits necessary to complete the MURP degree.
 Submit Office of Graduate Division graduate application for MURP program by February 1 of Spring, Year 3 and notice of acceptance in Spring, Year 3.
 Undergraduate commencement with BS in GES Spring, Year 4; Start as classified MURP graduate student Fall, Year 5.
 MURP ~~4+4~~ BAM degree implies completing Plan B option and PLAN 650. However, if students want to pursue Plan A, they must take PLAN 700 (6 credits) in place of PLAN 650. Projected graduation for MURP with PLAN A is Fall, Year 6.
 Advising for GES will be conducted by SOEST; advising for MURP will be conducted by PLAN.
 Department of Oceanography; MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES/
 GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
 MURP Coordinator: Priyam Das, PhD; SAUN 107J; (808) 956-2780; priyam@hawaii.edu

University of Hawai'i at Mānoa – Five-Year Academic Plan 2023-2024
School of Ocean and Earth Science and Technology/College of Education

GES-BS-GPGS

Bachelor of Science (BS) in Global Environmental Science/Post-Baccalaureate Certificate in Teacher Education

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

UD Count
54

Year 1	Year 2	Year 3	Year 4	Grad Year 2
Fall	Fall	Fall	Fall	Fall
OCN/GES 102 3 OEST 100 or OCN/GES 100 1 MATH 241 (FQ) 4 CHEM 161 (DP) 3 CHEM 161L (DY) 1 FW 3	OCN/ERTH 342 3 OCN/ERTH 312 or MATH 307 3 ATMO 200 3 PHYS 170 4 PHYS 170L 1 FG (A/B/C) 3 Elective 4	EDEF 310 (DS) 3 GES 349L 2 <small>GES 319L, OCN 318, or OCN 481</small> 3 Coupled Systems 3 BIOL 171 (DB) 3 BIOL 171L 1 DA/DH/DL 3 GES 471 3	GES/OCN 401 3 EDEP 311 (DS) 3 Coupled Systems 3 DA/DH/DL 3 Elective 2 3	STE 402H 3 STE 404H 3 SPED 445 3
Credits 15	Credits 14	Credits 16	Credits 15	Credits 9
Spring	Spring	Spring	Spring	Spring
OCN 201 3 OCN 201L 1 OEST 100 or OCN/GES 400 1 MATH 242 4 CHEM 162 3 CHEM 162L 1 FG (A/B/C) 3 ICS 110P/110C or ERTH 250 3	GES 311 3 EGON 324 (DS) 3 ERTH 101/101L or ERTH 170 4 PHYS 272 3 PHYS 272L 4 Elective 300+ (OCN 399-fee-) 4 GES 302 1 GES 371 3 FG (A/B/C) 3	Submit Grad. Application GES/OCN 320 3 GES/OCN 463 3 BIOL 172 3 BIOL 172L 1 Coupled Systems 3 Coupled Systems 3 DA/DH/DL 3	GES/OCN 490 2 GES/OCN 499 3 *STE 401 3 *STE 402H 3 *STE 440 3 BS Degree Projected	STE 405H 6 9 STE 406 3
Credits 16	Credits 14	Credits 16	Credits 14	Credits 12
Summer	Summer	Summer	Summer	Summer
Credits 0	Credits 0	Credits 0	Credits 0	Credits 0
Total Credits 31	Total Credits 59	Total Credits 91	Total Credits ##	Total Credits ##

Notes:

- Students must take placement exams to be able to register for CHEM 161 and MATH 241.
- Minimum 45 upper division (300+ course) credits are required.
- Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.
- EDEF 310 (3) and EDEP 311 (3) taken in the GES degree program will be waived in PBCTE Secondary Science program.
- *STE 401, 402H, and 440 double counted to both programs.
- Advising for GES will be conducted by SOEST; advising for PBCTE will be conducted by COE.
- Department of Oceanography: MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES/
- GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
- PBCTE Coordinator: Amelia Jenkins, PhD, Everly 128; (808) 956-7704; amelia@hawaii.edu

University of Hawai'i at Mānoa – Four-Year Academic Plan 2023-2024

School of Ocean and Earth Science and Technology Bachelor of Science (BS) in Global Environmental Science

Environmental Health Sciences Track

Suggested Banner Program
Code: GES-BS-ENHS

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

UD Count
45

Year 1	Year 2		Year 3		Year 4	
Fall	Fall	Fall	Fall	Fall	Fall	Fall
MATH 241 (FQ) 4	MATH 243 or OCN/ERTH 312 3	PH 201 (DS) 3	PH 201 (DS) 3	PH 340 3		
CHEM 161 (DP) 3	OCN/ERTH 312 or MATH 307 3	GES 310L 2	GES 310L 2	OCN/GES 401 3		
CHEM 161L (DY) 1	PHYS 170 4	GES 319L, OCN 318, or OCN 481 3	GES 319L, OCN 318, or OCN 481 3	Elective 300+ 3		
OCN/GES 102 3	PHYS 170L 1	BIOL 171 (DB) 3	BIOL 171 (DB) 3	Elective 300+ 3		
OEST 100 or OCN/GES 100 1	ATMO 200 3	BIOL 171L 1	BIOL 171L 1	Elective 300+ 3		
FW 3	FG (A/B/C) 3	DA/DH/DL 300+ 3	DA/DH/DL 300+ 3			
		DA/DH/DL 3	DA/DH/DL 3			
		GES 471 3	GES 471 3			
Credits 15	Credits 14	Credits 16	Credits 16	Credits 12		
Spring	Spring	Spring	Spring	Spring	Spring	Spring
MATH 242 4	GES 311 3	PH 310 3	PH 310 3	PH 341 3		
CHEM 162 3	MATH 244 or ECON 321 (DS) 3	BIOL 172 3	BIOL 172 3	OCN/GES 490 2		
CHEM 162L 1	PHYS 272 3	BIOL 172L 1	BIOL 172L 1	OCN/GES 499 3		
OCN 201 3	PHYS 272L 4	OCN/GES 320 3	OCN/GES 320 3	Elective 300+ 3		
OCN 201L 1	ERTH 101 and EARTH 101L 4	OCN/GES 463 3	OCN/GES 463 3	Elective 300+ 3		
OEST 100 or OCN/GES 100 1	or EARTH 170 4	DA/DH/DL 3	DA/DH/DL 3			
FG (A/B/C) 3	GES 302 1	DS 3	DS 3			
ICS 110P/110C or EARTH 250 3	GES 371 3					
	FG (A/B/C) 3					
Credits 16	Credits 14	Credits 16	Credits 16	Credits 14		
Summer	Summer	Summer	Summer	Summer	Summer	Summer
Credits 0	Credits 0	Credits 0	Credits 0	Credits 0		
Total Credits 31	Total Credits 59	Total Credits 91	Total Credits 91	Total Credits 117		

Notes:

Students must take placement exams to be able to register for CHEM 161 and MATH 241

~~ECON 321 and OCN 312 may be taken in place of both MATH 243 and 244.~~

~~If MATH 243 is taken, MATH 244 must be taken; if ECON 321 is taken, OCN/ERTH 312 must be taken.~~

Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.

Minimum 45 upper division (300+ course) credits are required.

Approved global environmental coupled systems for Environmental Health Sciences track: PH 201, 310, 340, 341.

University of Hawai'i at Mānoa
School of Ocean and Earth Science and Technology Program Sheet 2023-2024
Bachelor of Science (BS) in Global Environmental Science
Environmental Health Sciences Track
Admissions: Open Process: Declaration
Min. Total Credits: 120 (104⁵ in core & major + 16⁵ in electives)

UHM General Education Core Requirements	
Foundations	
<input type="checkbox"/>	FW ENG 100, 100A, 190, ESL 100, or AMST 111
<input type="checkbox"/>	FQ* MATH 241
<input type="checkbox"/>	FG (A / B / C)
<input type="checkbox"/>	FG (A / B / C)
*Note: This requirement changed in Fall 2018. If you entered the UH System prior to that, please see your college/school advisor.	
Diversification	
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DB BIOL 171
<input type="checkbox"/>	DP CHEM 161
<input type="checkbox"/>	DY CHEM 161L
<input type="checkbox"/>	DS PH 201
<input type="checkbox"/>	DS
* See degree, college and major requirements for courses that can also fulfill these.	
UHM Graduation Requirements	
Focus	
<input type="checkbox"/>	H
<input type="checkbox"/>	E (300+)
<input type="checkbox"/>	O (300+)
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W (300+)
<input type="checkbox"/>	W (300+)
Hawaiian / Second Language	
The Hawaiian or Second Language requirement is not required for students admitted to the School of Ocean and Earth Science and Technology.	
Credit Minimums	
•	120 total applicable
•	30 in residence at UHM
•	45 upper division (300+ level) credits
Grade Point Average	
•	2.0 cumulative or higher
•	Good academic standing

Degree Requirements	
Bachelor of Science Requirements	
<input type="checkbox"/>	MATH 241*FQ
<input type="checkbox"/>	MATH 242
<input type="checkbox"/>	MATH 243 307 or OCN/ERTH 312
<input type="checkbox"/>	MATH 244 or ECON 321*BS
<input type="checkbox"/>	BIOL 171*DB / <input type="checkbox"/> 171L*DY
<input type="checkbox"/>	BIOL 172/ <input type="checkbox"/> 172L
<input type="checkbox"/>	CHEM 161*DP / <input type="checkbox"/> 161L*DY
<input type="checkbox"/>	CHEM 162 / <input type="checkbox"/> 162L
<input type="checkbox"/>	PHYS 170 / <input type="checkbox"/> 170L
<input type="checkbox"/>	PHYS 272/ <input type="checkbox"/> 272L
•	MATH 244 must be taken if MATH 243 is taken.
•	ECON 321 must be taken if OCN/ERTH 312 is taken.
College Requirements	
Exit Requirements	
•	Submit the Graduation Worksheet to the Student Academic Services Office at least two semesters preceding the award of the degree.
•	Exit interview by SOEST Student Academic Services Office.

*This program sheet was prepared to provide information and does not constitute a contract. See back for major requirements.
Meet regularly with your major advisor.*

Major Requirements for BS in Global Environmental Science Environmental Health Sciences Track

Admission: First-year: Open; Transfer: Completion of CHEM 161/161L and MATH 241 with a C or better.

Application: NA

Min. major credits: **46 50-51** (86-87 with basic science required courses)

Min. C grade (not C-) in all courses

Requirements

Global Environmental Science Basic Science Required Courses (**40 36** credits)

BIOL 171*^{DB} / 171L

BIOL 172 / 172L

CHEM 161*^{DP} / 161L*^{DY}

CHEM 162 / 162L

MATH 241*^{FQ}

MATH 242

MATH ~~243~~ 307 or OCN/ERTH 312

~~MATH 244~~ or ~~ECON 321~~*^{DS}

OEST 100

PHYS 170 / 170L

~~PHYS 272~~ / ~~272L~~ ICS 110P or ICS 110C or EARTH 250

**MATH 244 must be taken if MATH 243 is taken. ECON 321 must be taken if OCN/ERTH 312 is taken.*

Global Environmental Science Core Courses (11 credits)

ATMO 200

EARTH 101 / 101L or EARTH 170

OCN 201 / 201L

Global Environmental Science Foundation Courses (**18 21-22** credits)

~~OCN~~/GES 100

~~OCN~~/GES 102

GES 311

GES 319L or ~~OCN~~ 318 or ~~OCN~~ 481

~~OCN~~/GES 320

~~GES~~ 371

~~OCN~~/GES 401

~~OCN~~/GES ~~463~~ 471

Global Environmental Coupled Systems Courses (4 approved courses)

PH 201*^{DS}

PH 310

PH 340

PH 341

Approved coupled systems courses for Environmental Health Sciences track: PH 201, 310, 340, 341.

Global Environmental Senior Research Courses (**5 6** credits)

~~GES~~ 302

~~OCN~~/GES 490

~~OCN~~/GES 499

Notes

School of Ocean and Earth Science and Technology: Student Academic Services, Director of Student Services: Heather Saito; HIG 131B; (808) 956-8763; hsaito2@hawaii.edu; [http:// https://www.soest.hawaii.edu/soestwp/education/undergraduate/advising/](http://https://www.soest.hawaii.edu/soestwp/education/undergraduate/advising/)
Department of Oceanography: MSB 205; (808) 956-2913; ges@soest.hawaii.edu; <https://www.soest.hawaii.edu/oceanography/GES/>
GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
Track Coordinator: Denise Nelson-Hurwitz, PhD; Biomed D-203; (808) 956-3089; denisene@hawaii.edu

University of Hawai'i at Mānoa – Four-Year Academic Plan 2023-2024

School of Ocean and Earth Science and Technology Bachelor of Science (BS) in Global Environmental Science Environmental Planning Track

Suggested Banner Program Code:
GES-BS-ENPL

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

Year 1		Year 2		Year 3		Year 4	
Fall		Fall		Fall		Fall	
MATH 241 (FQ)	4	MATH 243 or OCN/ERTH 312	3	GES 310L	2	PLAN 473	3
CHEM 161 (DP)	3	OCN/ERTH 312 or MATH 307	3	GES 319L, OCN 318, or OCN 481	3	PLAN 620	3
CHEM 161L (DY)	1	PHYS 170	4	BIOL 171 (DB)	3	OCN/GES 401	3
OCN/GES 102	3	PHYS 170L	1	BIOL 171L	1	Elective 300+	3
OEST 100 or OCN/GES 100	1	ATMO 200	3	Elective 300+	3	Elective	3
FW	3	FG (A/B/C)	3	DA/DH/DL 300+	3	Elective 300+	3
				DA/DH/DL	3	Elective	3
				DS*	3		
				GES 471	3		
Credits	15	Credits	14	Credits	16	Credits	15
Spring		Spring		Spring		Spring	
MATH 242	4	GES 311	3	PLAN 310 (DS)	3	PLAN 414	3
CHEM 162	3	MATH 244 or ECON 321 (DS)	3	BIOL 172	3	OCN/GES 490	2
CHEM 162L	1	PHYS 272	3	BIOL 172L	1	OCN/GES 499	3
OCN 201	3	PHYS 272L	4	OCN/GES 320	3	Elective 300+	3
OCN 201L	1	ERTH 101 and EARTH 101L	4	OCN/GES 463	3	Elective 300+	3
OEST 100 or OCN/GES 100	1	or EARTH 170		DA/DH/DL	3	Elective	3
FG (A/B/C)	3	GES 302	1	DS	3	Elective	4
ICS 110P/110C or EARTH 250	3	GES 371	3				
		FG (A/B/C)	3				
Credits	16	Credits	14	Credits	16	Credits	14
Summer		Summer		Summer		Summer	
Credits	0	Credits	0	Credits	0	Credits	0
Total Credits	31	Total Credits	59	Total Credits	91	Total Credits	120

UD Count
45

Notes:

Students must take placement exams to be able to register for CHEM 161 and MATH 241; ~~ECON 321 and OCN 312 may be taken in place of both MATH 243 and 244. If MATH 243 is taken, MATH 244 must be taken; if ECON 321 is taken, OCN/ERTH 312 must be taken.~~

Minimum 45 upper division (300+ course) credits are required.

Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.

Approved global environmental coupled systems for Environmental Planning track: PLAN 310, 414, 473, and 620.

University of Hawai'i at Mānoa
School of Ocean and Earth Science and Technology Program Sheet 2023-2024
Bachelor of Science (BS) in Global Environmental Science
Environmental Planning Track
Admissions: Open Process: Declaration
Min. Total Credits: 120 (10-45 in core & major + 165 in electives)

UHM General Education Core Requirements	
Foundations	
<input type="checkbox"/>	FW ENG 100, 100A, 190, ESL 100, or AMST 111
<input type="checkbox"/>	FQ* MATH 241
<input type="checkbox"/>	FG (A / B / C)
<input type="checkbox"/>	FG (A / B / C)
*Note: This requirement changed in Fall 2018. If you entered the UH System prior to that, please see your college/school advisor.	
Diversification	
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DB BIOL 171
<input type="checkbox"/>	DP CHEM 161
<input type="checkbox"/>	DY CHEM 161L
<input type="checkbox"/>	DS PLAN 310
<input type="checkbox"/>	DS
* See degree, college and major requirements for courses that can also fulfill these.	
UHM Graduation Requirements	
Focus	
<input type="checkbox"/>	H
<input type="checkbox"/>	E (300+)
<input type="checkbox"/>	O (300+)
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W (300+)
<input type="checkbox"/>	W (300+)
Hawaiian / Second Language	
The Hawaiian or Second Language requirement is not required for students admitted to the School of Ocean and Earth Science and Technology.	
Credit Minimums	
•	120 total applicable
•	30 in residence at UHM
•	45 upper division (300+ level) credits
Grade Point Average	
•	2.0 cumulative or higher
•	Good academic standing

Degree Requirements	
Bachelor of Science Requirements	
<input type="checkbox"/>	MATH 241*FQ
<input type="checkbox"/>	MATH 242
<input type="checkbox"/>	MATH 243 307 or OCN/ERTH 312
<input type="checkbox"/>	MATH 244 or ECON 321*DS
<input type="checkbox"/>	BIOL 171*DB / <input type="checkbox"/> 171L*DY
<input type="checkbox"/>	BIOL 172/ <input type="checkbox"/> 172L
<input type="checkbox"/>	CHEM 161*DP / <input type="checkbox"/> 161L*DY
<input type="checkbox"/>	CHEM 162 / <input type="checkbox"/> 162L
<input type="checkbox"/>	PHYS 170 / <input type="checkbox"/> 170L
<input type="checkbox"/>	PHYS 272/ <input type="checkbox"/> 272L
•	MATH 244 must be taken if MATH 243 is taken.
•	ECON 321 must be taken if OCN/ERTH 312 is taken.
College Requirements	
Exit Requirements	
•	Submit the Graduation Worksheet to the Student Academic Services Office at least two semesters preceding the award of the degree.
•	Exit interview by SOEST Student Academic Services Office.

*This program sheet was prepared to provide information and does not constitute a contract. See back for major requirements.
 Meet regularly with your major advisor.*

Major Requirements for BS in Global Environmental Science Environmental Planning Track

Admission: First-year: Open; Transfer: Completion of CHEM 161/161L and MATH 241 with a C or better.

Application: NA

Min. major credits: **46 50-51** (86-87 with basic science required courses)

Min. C grade (not C-) in all courses

Requirements

Global Environmental Science Basic Science Required Courses (**40 36** credits)

BIOL 171*^{DB} / 171L

BIOL 172 / 172L

CHEM 161*^{DP} / 161L*^{DY}

CHEM 162 / 162L

MATH 241*^{FQ}

MATH 242

MATH **243 307** or OCN/ERTH 312

~~MATH 244~~ or ~~ECON 321~~*^{DS}

OEST 100

PHYS 170 / 170L

~~PHYS 272~~ / ~~272L~~ ICS 110P or ICS 110C or EARTH 250

**MATH 244 must be taken if MATH 243 is taken. ECON 321 must be taken if OCN/ERTH 312 is taken.*

Global Environmental Science Core Courses (11 credits)

ATMO 200

EARTH 101 / 101L or EARTH 170

OCN 201 / 201L

Global Environmental Science Foundation Courses (**18 21-22** credits)

~~OCN~~/GES 100

~~OCN~~/GES 102

GES 311

GES 319L or ~~OCN 318~~ or ~~OCN 481~~

~~OCN~~/GES 320

~~GES 371~~

~~OCN~~/GES 401

~~OCN~~/GES **463 471**

Global Environmental Coupled Systems Courses (4 approved courses)

PLAN 310*^{DS}

PLAN 414

PLAN 473

PLAN 620

Approved coupled systems courses for Environmental Planning track: PLAN 310, 414, 473, and 620.

Global Environmental Senior Research Courses (**5- 6** credits)

~~GES 302~~

~~OCN~~/GES 490

~~OCN~~/GES 499

Notes

School of Ocean and Earth Science and Technology: Student Academic Services, Director of Student Services: Heather Saito; HIG 131B; (808) 956-8763; hsaito2@hawaii.edu; www.soest.hawaii.edu/soestwp/education/undergraduate/advising/
Department of Oceanography; MSB 205; (808) 956-2913; ges@soest.hawaii.edu; <https://www.soest.hawaii.edu/oceanography/GES/>
GES Undergraduate Chair : Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
Track Coordinator: Priyam Das, PhD; SAUN 107J; (808) 956-2780; priyam@hawaii.edu

University of Hawai'i at Mānoa – Four-Year Academic Plan 2023-2024

School of Ocean and Earth Science and Technology

Bachelor of Science (BS) in Global Environmental Science

Sustainability Science Track

Suggested Banner Program Code:
GES-BS-SSCI

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

UD Count
45

Year 1		Year 2		Year 3		Year 4		
Fall		Fall		Fall		Fall		
MATH 241 (FQ)	4	MATH 243 or OCN/ERTH 312	3	GES 310L	2	OCN/GES 401	3	
CHEM 161 (DP)	3	OCN/ERTH 312 or MATH 307	3	<small>GES 319L, OCN 318, or OCN 481</small>	3	SUST 300+	3	
CHEM 161L (DY)	1	PHYS 170	4	OCN 441	3	Elective 300+	3	
OCN/GES 102	3	PHYS 170L	1	BIOL 171 (DB)	3	Elective 300+	3	
OEST 100 or OCN/GES 100	1	ATMO 200	3	BIOL 171L	1	DS	3	
FW	3	FG (A/B/C)	3	DA/DH/DL 300+	3			
				GES 471	3			
				DS*	3			
Credits		15	Credits		14	Credits		12
Spring		Spring		Spring		Spring		
MATH 242	4	GES 311	3	OCN/GES 320	3	OCN/GES 490	2	
CHEM 162	3	MATH 244 or ECON 321 (DS)	3	OCN/GES 463	3	OCN/GES 499	3	
CHEM 162L	1	PHYS 272	3	OCN 442	3	SUST 300+	3	
OCN 201	3	PHYS 272L	4	BIOL 172	3	Elective 300+	3	
OCN 201L	1	ERTH 101 and EARTH 101L	4	BIOL 172L	1	Elective 300+	3	
OEST 100 or OCN/GES 100	1	or EARTH 170		DA/DH/DL	3	Elective	3	
FG (A/B/C)	3	GES 302	1	DS	3	Elective	4	
ICS 110P/110C or EARTH 250	3	GES 371	3					
		FG (A/B/C)	3					
Credits		16	Credits		14	Credits		14
Summer		Summer		Summer		Summer		
Credits		0	Credits		0	Credits		0
Total Credits		31	Total Credits		59	Total Credits		88
								114

Notes:

Students must take placement exams to be able to register for CHEM 161 and MATH 241.

~~ECON 321 and OCN 312 may be taken in place of both MATH 243 and 244.~~

~~If MATH 243 is taken, MATH 244 must be taken; if ECON 321 is taken, OCN/ERTH 312 must be taken.~~

~~*DS needed if not fulfilled with ECON 321 or any of the Coupled Systems courses.~~

Minimum 45 upper division (300+ course) credits are required.

Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.

Approved global environmental coupled systems for Sustainability Science track: OCN 441, 442, and 2 SUST 300+ courses.

University of Hawai'i at Mānoa
School of Ocean and Earth Science and Technology Program Sheet 2023-2024
Bachelor of Science (BS) in Global Environmental Science
Sustainability Science Track

Admissions: Open Process: Declaration
 Min. Total Credits: 120 (10~~7~~8 in core & major + 1~~3~~2 in electives)

UHM General Education Core Requirements	
Foundations	
<input type="checkbox"/>	FW ENG 100, 100A, 190, ESL 100, or AMST 111
<input type="checkbox"/>	FQ* MATH 241
<input type="checkbox"/>	FG (A / B / C)
<input type="checkbox"/>	FG (A / B / C)
*Note: This requirement changed in Fall 2018. If you entered the UH System prior to that, please see your college/school advisor.	
Diversification	
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DB BIOL 171
<input type="checkbox"/>	DP CHEM 161
<input type="checkbox"/>	DY CHEM 161L
<input type="checkbox"/>	DS
<input type="checkbox"/>	DS
* See degree, college and major requirements for courses that can also fulfill these.	
UHM Graduation Requirements	
Focus	
<input type="checkbox"/>	H
<input type="checkbox"/>	E (300+)
<input type="checkbox"/>	O (300+)
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W (300+)
<input type="checkbox"/>	W (300+)
Hawaiian / Second Language	
The Hawaiian or Second Language requirement is not required for students admitted to the School of Ocean and Earth Science and Technology.	
Credit Minimums	
●	120 total applicable
●	30 in residence at UHM
●	45 upper division (300+ level) credits
Grade Point Average	
●	2.0 cumulative or higher
●	Good academic standing

Degree Requirements	
Bachelor of Science Requirements	
<input type="checkbox"/>	MATH 241*FQ
<input type="checkbox"/>	MATH 242
<input type="checkbox"/>	MATH 243 307 or OCN/ERTH 312
<input type="checkbox"/>	MATH 244 or ECON 321*BS
<input type="checkbox"/>	BIOL 171*DB / <input type="checkbox"/> 171L*DY
<input type="checkbox"/>	BIOL 172/ <input type="checkbox"/> 172L
<input type="checkbox"/>	CHEM 161*DP / <input type="checkbox"/> 161L*DY
<input type="checkbox"/>	CHEM 162 / <input type="checkbox"/> 162L
<input type="checkbox"/>	PHYS 170 / <input type="checkbox"/> 170L
<input type="checkbox"/>	PHYS 272/ <input type="checkbox"/> 272L
●	MATH 244 must be taken if MATH 243 is taken.
●	ECON 321 must be taken if OCN/ERTH 312 is taken.
College Requirements	
Exit Requirements	
●	Submit the Graduation Worksheet to the Student Academic Services Office at least two semesters preceding the award of the degree.
●	Exit interview by SOEST Student Academic Services Office.

*This program sheet was prepared to provide information and does not constitute a contract. See back for major requirements.
 Meet regularly with your major advisor.*

Major Requirements for BS in Global Environmental Science Sustainability Science Track

Admission: First-year: Open; Transfer: Completion of CHEM 161/161L and MATH 241 with a C or better.

Application: NA

Min. major credits: ~~46~~ **50-51** (86-87 with basic science required courses)

Min. C grade (not C-) in all courses

Requirements

Global Environmental Science Basic Science Required Courses (~~40~~ **36** credits)

BIOL 171*^{DB} / 171L

BIOL 172 / 172L

CHEM 161*^{DP} / 161L*^{DY}

CHEM 162 / 162L

MATH 241*^{FQ}

MATH 242

MATH ~~243~~ **307** or OCN/ERTH 312

~~MATH 244~~ or ~~ECON 321~~*^{DS}

OEST 100

PHYS 170 / 170L

~~PHYS 272~~ / ~~272L~~ ICS 110P or ICS 110C or EARTH 250

**MATH 244 must be taken if MATH 243 is taken. ECON 321 must be taken if OCN/ERTH 312 is taken.*

Global Environmental Science Core Courses (11 credits)

ATMO 200

EARTH 101/ 101L or EARTH 170

OCN 201 / 201L

Global Environmental Science Foundation Courses (~~18~~ **21-22** credits)

~~OCN~~/GES 100

~~OCN~~/GES 102

GES 311

GES 319L or OCN 318 or OCN 481

~~OCN~~/GES 320

GES 371

~~OCN~~/GES 401

~~OCN~~/GES ~~463~~ **471**

Global Environmental Coupled Systems Courses (4 approved courses)

OCN 441

OCN 442

SUST 300+

SUST 300+

Approved coupled systems courses for Sustainability Science track: OCN 441, OEST 442, and 2 SUST 300+ courses.

Global Environmental Senior Research Courses (~~5~~ **6** credits)

GES 302

~~OCN~~/GES 490

~~OCN~~/GES 499

Notes

University of Hawai'i at Mānoa
School of Ocean and Earth Science and Technology Program Sheet 2023-2024
Bachelor of Science (BS) in Global Environmental Science
Sustainability Science Track
Admissions: Open Process: Declaration
Min. Total Credits: 120 (10~~7~~8 in core & major + 1~~3~~2 in electives)

School of Ocean and Earth Science and Technology: Student Academic Services, Director of Student Services: Heather Saito; HIG 131B; (808) 956-8763; hsaito2@hawaii.edu; www.soest.hawaii.edu/soestwp/education/undergraduate/advising/
Department of Oceanography: MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES
GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu
Track Coordinator: ~~Daniel Spencer, PhD; George 207; (808) 956-8124; dan.spencer@hawaii.edu~~ Michael Cooney, PhD; POST 104B; (808) 956-7337; mcooney@hawaii.edu

Rev LV 6/2023

University of Hawai‘i at Mānoa – Four-Year Academic Plan 2023-2024
School of Ocean and Earth Science and Technology
Bachelor of Science (BS) in Global Environmental Science
General Pathway

This is a sample academic plan. Students should meet with an academic advisor prior to registration to formulate their own plan.

UD Count
45

Year 1	Year 2	Year 3	Year 4
Fall	Fall	Fall	Fall
MATH 241 (FQ) 4 CHEM 161 (DP) 3 CHEM 161L (DY) 1 OCN/GES 102 3 OEST 100 or OCN/GES 100 1 FW 3	MATH 243 or OCN/ERTH 312 3 OCN/ERTH 312 or MATH 307 3 PHYS 170 4 PHYS 170L 1 ATMO 200 3 FG (A/B/C) 3	GES 319L 2 GES 319L, OCN 318, or OCN 481 3 BIOL 171 (DB) 3 BIOL 171L 1 Coupled Systems 3 DA/DH/DL 300+ 3 DA/DH/DL 3 DS* 3 GES 471 3	OCN/GES 401 3 Coupled Systems 3 Elective 300+ 3 Elective 300+ 3 Elective 3 DS 3
Credits 15	Credits 14	Credits 16	Credits 15
Spring	Spring	Spring	Spring
MATH 242 4 CHEM 162 3 CHEM 162L 1 OCN 201 3 OCN 201L 1 OEST 100 or OCN/GES 100 1 FG (A/B/C) 3 ICS 110P/110C or EARTH 250 3	GES 311 3 MATH 244 or ECON 321 (DS) 3 PHYS 272 3 PHYS 272L 4 ERTH 101 and EARTH 101L 4 or EARTH 170 GES 302 1 GES 371 3 FG (A/B/C) 3	BIOL 172 3 BIOL 172L 1 OCN/GES 320 3 OCN/GES 463 3 Coupled Systems 3 DA/DH/DL 3 DS 3	OCN/GES 490 2 OCN/GES 499 3 Coupled Systems 3 Elective 300+ 3 Elective 300+ 3 Elective 3 Elective 4
Credits 16	Credits 14	Credits 16	Credits 14
Summer	Summer	Summer	Summer
Credits 0	Credits 0	Credits 0	Credits 0
Total Credits 31	Total Credits 59	Total Credits 91	Total Credits 120

Notes:

Students must take placement exams to be able to register for CHEM 161 and MATH 241.

~~ECON 321 and OCN 312 may be taken in place of both MATH 243 and 244.~~

~~If MATH 243 is taken, MATH 244 must be taken; if ECON 321 is taken, OCN/GG/ERTH 312 must be taken.~~

~~*DS needed if not fulfilled with ECON 321 or any of the Coupled Systems courses.~~

Minimum 45 upper division (300+ course) credits are required.

Students must incorporate all focus requirements into this plan. Focus designations (i.e., W, E, O, H) are CRN specific & semester specific.

List of approved GES Coupled Systems courses available on www.soest.hawaii.edu/oceanography/ges/curriculum.html

University of Hawai'i at Mānoa
School of Ocean and Earth Science and Technology Program Sheet 2023-2024
Bachelor of Science (BS) in Global Environmental Science

General Pathway Track

Admissions: Open Process: Declaration

Min. Total Credits: 120 (10~~7~~8 in core & major + 1~~3~~2 in electives)

UHM General Education Core Requirements	
Foundations	
<input type="checkbox"/>	FW ENG 100, 100A, 190, ESL 100, or AMST 111
<input type="checkbox"/>	FQ* MATH 241
<input type="checkbox"/>	FG (A / B / C)
<input type="checkbox"/>	FG (A / B / C)
*Note: This requirement changed in Fall 2018. If you entered the UH System prior to that, please see your college/school advisor.	
Diversification	
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DA / DH / DL
<input type="checkbox"/>	DB BIOL 171
<input type="checkbox"/>	DP CHEM 161
<input type="checkbox"/>	DY CHEM 161L
<input type="checkbox"/>	DS
<input type="checkbox"/>	DS
* See degree, college and major requirements for courses that can also fulfill these.	
UHM Graduation Requirements	
Focus	
<input type="checkbox"/>	H
<input type="checkbox"/>	E (300+)
<input type="checkbox"/>	O (300+)
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W
<input type="checkbox"/>	W (300+)
<input type="checkbox"/>	W (300+)
Hawaiian / Second Language	
The Hawaiian or Second Language requirement is not required for students admitted to the School of Ocean and Earth Science and Technology.	
Credit Minimums	
●	120 total applicable
●	30 in residence at UHM
●	45 upper division (300+ level) credits
Grade Point Average	
●	2.0 cumulative or higher
●	Good academic standing

Degree Requirements	
Bachelor of Science Requirements	
<input type="checkbox"/>	MATH 241*FQ
<input type="checkbox"/>	MATH 242
<input type="checkbox"/>	MATH 243 307 or OCN/ERTH 312
<input type="checkbox"/>	MATH 244 or ECON 321*DS
<input type="checkbox"/>	BIOL 171*DB / <input type="checkbox"/> 171L*DY
<input type="checkbox"/>	BIOL 172/ <input type="checkbox"/> 172L
<input type="checkbox"/>	CHEM 161*DP / <input type="checkbox"/> 161L*DY
<input type="checkbox"/>	CHEM 162 / <input type="checkbox"/> 162L
<input type="checkbox"/>	PHYS 170 / <input type="checkbox"/> 170L
<input type="checkbox"/>	PHYS 272/ <input type="checkbox"/> 272L
●	MATH 244 must be taken if MATH 243 is taken.
●	ECON 321 must be taken if OCN/ERTH 312 is taken.
College Requirements	
Exit Requirements	
●	Submit the Graduation Worksheet to the Student Academic Services Office at least two semesters preceding the award of the degree.
●	Exit interview by SOEST Student Academic Services Office.

*This program sheet was prepared to provide information and does not constitute a contract. See back for major requirements.
Meet regularly with your major advisor.*

Major Requirements for BS in Global Environmental Science General Pathway Track

Admission: First-year: Open; Transfer: Completion of CHEM 161/161L and MATH 241 with a C or better.

Application: NA

Min. major credits: **46 50-51** (86-87 with basic science required courses)

Min. C grade (not C-) in all courses

Requirements

Global Environmental Science Basic Science Required Courses (**40 36** credits)

BIOL 171*^{DB} / 171L

BIOL 172 / 172L

CHEM 161*^{DP} / 161L*^{DY}

CHEM 162 / 162L

MATH 241*^{FQ}

MATH 242

MATH ~~243~~ 307 or OCN/ERTH 312

~~MATH 244~~ or ~~ECON 321~~*^{DS}

OEST 100

PHYS 170 / 170L

~~PHYS 272~~ / ~~272L~~ / ICS 110P or ICS 110C or EARTH 250

**MATH 244 must be taken if MATH 243 is taken. ECON 321 must be taken if OCN/ERTH 312 is taken.*

Global Environmental Science Core Courses (11 credits)

ATMO 200

EARTH 101 / 101L or EARTH 170

OCN 201 / 201L

Global Environmental Science Foundation Courses (~~18~~ 21-22 credits)

~~OCN~~/GES 100

~~OCN~~/GES 102

GES 311

GES 319L or ~~OCN~~ 318 or ~~OCN~~ 481

~~OCN~~/GES 320

GES 371

~~OCN~~/GES 401

~~OCN~~/GES ~~463~~ 471

Global Environmental Coupled Systems Courses (4 approved courses)

Examples of approved coupled systems courses: ATMO 302, 303; BIOC 141; BIOL 265, 301, 360, 404; BOT 480; ECON 358, 458, 638; GEO 300, 401, 402, 405; EARTH 301, 309, 420, 425, 455, 466; MICR 401; NREM 301, 301L 302, 304, 461; OCN 318, 330, 331, 340, 403, 418, 457, 480, 481, 620, 621, 622, 623, 633, 638; PHIL 316; POLS 316; SOC 412; Refer to the GES website for the complete list.

Global Environmental Senior Research Courses (~~5~~ 6 credits)

GES 302

~~OCN~~/GES 490

~~OCN~~/GES 499

Notes

School of Ocean and Earth Science and Technology: Student Academic Services, Director of Student Services: Heather Saito; HIG 131B; (808) 956-8763; hsaito2@hawaii.edu; www.soest.hawaii.edu/soestwp/education/undergraduate/advising/
Department of Oceanography: MSB 205; (808) 956-2913; ges@soest.hawaii.edu; www.soest.hawaii.edu/oceanography/GES/
GES Undergraduate Chair: Michael Guidry, PhD; MSB 205E; (808) 956-9935; guidry@hawaii.edu

combination of geology, geophysics, geochemistry, planetary science, spectroscopy, radar science, or remote sensing is appropriate for optimum development in the field and to satisfy requirements in the Department of Earth Sciences.

Global Environmental Science

Marine Science Building 205E, 205F
1000 Pope Road
Honolulu, HI 96822
Tel: (808) 956-2913
Fax: (808) 956-9225
Email: ges@soest.hawaii.edu
Web: soest.hawaii.edu/oceanography/ges/

Faculty

- M. Guidry, PhD (Undergraduate Chair)—biogeochemical modeling, mineral precipitation/dissolution kinetics, K-12/university curriculum development assessment, geoscience education
- R. Alegado, PhD—marine microbial ecology, influence of bacteria on animal evolution, Hawaiian fishponds
- H. Annamalai, PhD—diagnostic and modeling aspects of the Asian Summer Monsoon system, prediction and predictability of the Asian Summer Monsoon system, dynamical and physical link between Monsoon-ENSO
- D. Beilman, PhD—long-term terrestrial ecology, paleoscience approaches to global change science, carbon cycling
- ~~R. R. Bidigare, PhD—bio-optical oceanography, pigment biochemistry, plankton metabolism~~
- S. M. Bushinsky, PhD—biogeochemical cycles, interpretation of data from autonomous vehicles to understand the biological carbon cycle, air-sea gas exchange, Southern Ocean processes controlling air-sea oxygen and carbon fluxes and nutrient export
- S. Businger, PhD—evolution and structure of destructive atmospheric storms including: frontal cyclones, hurricanes, and severe thunderstorm
- B. C. Bruno, PhD—planetary geosciences, geoscience education
- G. S. Carter, PhD—physical oceanography, ocean mixing, tides, internal waves, underwater ocean gliders
- Q. Chen—environmental changes and use of multiple tools to address these issues
- M. J. Cooney, PhD—high rate anaerobic digestion, bio-oil extraction from biomass, and the analytical characterization of chemical microenvironments surrounding immobilized enzymes
- J. I. Decnik, PhD—soil fertility and soil quality, nitrogen and carbon cycling in agroecosystems, traditional agroecosystems, biochar and sustainable agriculture
- E. F. DeLong, PhD—application of contemporary genomic technologies to understand the ecology, evolution and biochemistry of complete microbial assemblages
- ~~S. Dollar, PhD—biogeochemistry, nearshore processes and effects of human activity on the coastal zone~~
- J. C. Drazen, PhD—physiological ecology of marine fishes, energetics and tropodynamics, deep-sea biology, adaptations of fishes to the deep-sea
- K. Edwards—phytoplankton ecology, community ecology, ecological theory and statistics, benthic communities
- M. Edwards, PhD—marine geology and geophysics, remote sensing of the seafloor, Mid-Ocean Ridges, Arctic Basin
- A. El-Kadi, PhD—hydrogeology; modeling groundwater systems
- R. C. Ertekin, PhD—hydrodynamics, computational methods, offshore and coastal engineering, oil-spill spreading, fishpond circulation, ocean renewable energy
- P. J. Flament, PhD—dynamics of surface ocean layer, mesoscale structures, remote sensing
- C. H. Fletcher, PhD—quaternary and coastal marine geology, sea-level history, coastal sedimentary processes
- O. Francis—strom-generated ocean waves, meteorological and ocean processes on coastal infrastructure, water, and wastewater systems affected by climate change and water shortage
- K. Frank—identifying environmental drivers of microbial dynamics and to characterize the impact of the microorganisms on biogeochemical cycling in mineral-hosted ecosystems from mountain ridge to mid-ocean ridges
- ~~P. Fryer, PhD—marine geology, petrology, tectonics~~
- E. Gaidos, PhD—molecular evolution; microbiology of extreme environments; biosphere-climate feedbacks; critical intervals in Earth history; exobiology; biological networks
- T. W. Giambelluca, PhD—interactions between the atmosphere and the land surface, including influences of land use and land cover change on climate and surface hydrology and effects of global climate change on hydrologic processes and terrestrial ecology
- B. T. Glazer, PhD—biogeochemical processes in marine environments; use of molecular methods to characterize and understand synergy of geomicrobiology
- C. R. Glenn, PhD—paleoceanography, marine geology, sedimentology, sediment diagenesis
- E. Goetze, PhD—marine zooplankton ecology; dispersal and gene flow in marine plankton populations; evolution, behavioral ecology and systematics of marine calanoid copepods
- E. G. Grau, PhD—environmental physiology and comparative endocrinology of fish
- M. P. Hamnet, PhD—coastal zone management; fisheries economics; disaster preparedness and mitigation
- N. Hawco, PhD—impacts of micronutrient scarcity on phytoplankton growth and the carbon cycle, sources, sinks, and transformations of iron, cobalt and other metals in the ocean, elemental and isotopic tracers of environmental change
- D. T. Ho, PhD—air-water gas exchange, tracer oceanography, carbon cycle, and environmental geochemistry
- S. Howell, PhD—environmental aerosol research, aerosol chemistry
- A. Jani—ecology of infectious diseases
- C. Karamperidou—ENSO dynamics and predictability, ENSO in past climate, response of mid-latitude atmospheric circulation to climate change and variability.
- D. Karl—microbiological oceanography, oceanic productivity, biogeochemical fluxes
- M. Kirs—environmental microbiology, Microbial source tracking, recreational water quality, quantitative PCR
- D. E. Konan, PhD—international trade, microeconomics, computational economics
- ~~K. Lowry, PhD—design, planning and evaluation of ocean and coastal management programs; experience in Hawaii, Indonesia, Sri Lanka, Philippines and Thailand~~
- D. Luther—tides, internal waves, abyssal mixing, energy flow, wave interaction at the coast, interactive ocean observation
- S. J. Martel, PhD—engineering and structural geology
- M. A. McManus, PhD—descriptive physical oceanography, coupled physical-biological numerical models; development of ocean observing systems
- M. Merlin, PhD—biogeography, natural history of the Pacific
- A. Misra—material science, remote sensing, remote Raman, micro Raman, High T_c Superconductor, stress strain sensors
- T. Miura, PhD—remote sensing of terrestrial vegetation, GIS
- G. F. Moore, PhD—marine geophysics, structural geology
- P. Mouginiis-Mark, PhD—volcanology from space, remote sensing of natural hazards
- ~~P. K. Müller—ocean circulation, waves and turbulence~~
- C. E. Nelson, PhD—structure and function of natural bacterial communities in aquatic habitats such as coral reefs lakes, streams, and open ocean

- A. Nugent—mountain meteorology and cloudy physics, orographic convection and precipitation, shallow cloud dynamics, cloud microphysics
- B. N. Popp, PhD—~~isotope biogeochemistry, organic geochemistry~~
- J. N. Porter, PhD—~~atmospheric science, use of satellites to study aerosol and cloud forcing, ship measurements of aerosol and cloud optical properties~~
- J. Potemra, PhD—~~general ocean circulation and its relationship to climate; oceanic processes in the western equatorial Pacific and eastern Indian Ocean and their connection~~
- B. S. Powell, PhD—~~numerical modeling, variational data assimilation, ocean predictability, ocean circulation, and ecosystem dynamics~~
- B. Qiu—~~large-scale ocean circulation, ocean atmosphere interaction, satellite observations, and numerical modeling of ocean circulation~~
- M. S. Rappe, PhD—~~ecology of marine microorganisms; genomics; coral-associated microorganisms; ecology of microorganisms in the deep subsurface~~
- G. Ravizza, PhD—~~paleoceanography and environmental chemistry; geologic history of chemical weathering; geochemistry of recent and ancient metalliferous sediments; anthropogenic influences on the geochemical cycles of the platinum group elements; chemical signatures of extraterrestrial matter in marine sediments; biogeochemistry of molybdenum in the marine environment~~
- K. J. Richards, PhD—~~observation and modeling of ocean processes, ocean dynamics, ocean-atmosphere interaction, ecosystem dynamics~~
- ~~M. A. Ridgley, PhD—resource management and human-environment system analysis~~
- J. Roumasset, PhD—~~environmental economics and sustainable growth~~
- K. Rubin, PhD—~~isotope geochemistry, chronology~~
- K. Ruttenberg, PhD—~~biogeochemistry of phosphorus and phosphorus cycling in the ocean, rivers, and lakes; nutrient limitation of aquatic primary productivity; effects of redox chemistry on nutrient cycling; early diagenesis in marine sediments with focus on authigenic mineral formation and organic matter mineralization~~
- C. L. Sabine, PhD—~~global carbon cycle, ocean inorganic carbon, ocean acidification, carbonate biogeochemistry, air-sea gas exchange, multitracer relationships, sensor and ocean platform development~~
- N. Schneider, PhD—~~decadal climate variability, tropical air-sea interaction, coupled modeling~~
- K. Selph—~~biological oceanography, microbial ecology, protistan grazer feeding dynamics, phytoplankton distributions, use of flow cytometry in ecological research~~
- S. K. Sharma, PhD—~~atmospheric instrumentation and remote sensing; Lidar, Raman, and infrared spectrometry and fiber-optic environmental sensors~~
- C. R. Smith, PhD—~~benthic and ecology, deep-sea biology, sediment geochemistry, climate-change effects on Antarctic ecosystems, marine conservation~~
- G. F. Steward, PhD—~~aquatic microbial ecology, molecular ecology and diversity of viruses and bacteria~~
- M. F. Stuecker, PhD—~~internal climate variability and forced changes in the past, present, and future; El Niño-Southern Oscillation dynamics; decadal variability, climate connections between the tropics and poles and between different ocean basins~~
- ~~B. Taylor—plate tectonics, geology of ocean margin basins~~
- R. Toonen—~~dispersal and recruitment of invertebrate larvae, population genetics, evolution and ecology of marine invertebrates~~
- B. Wang, PhD—~~atmospheric and climate dynamics~~
- R. Wright, PhD—~~hyperspectral imaging instrument development, remote sensing, infrared radiometry, volcanology~~
- R. E. Zeebe, PhD—~~global biogeochemical cycles, carbon dioxide system in seawater and interrelations with marine plankton, paleoceanography, stable isotope geochemistry~~

Degree Offered: BS in global environmental science

The Academic Program

Global Environmental Science (GES) is a holistic, scientific approach to the study of the Earth system and its physical, chemical, biological, and human processes. This academic program is designed to educate leaders and citizenry to become wise stewards of our planet. GES focuses on the global reservoirs of hydrosphere (water, primarily oceans), biosphere (life and organic matter), atmosphere (air), lithosphere (land, sediments, and rocks), and cryosphere (ice); their interfaces; and the processes acting upon and within this interactive system, including human activities. In the course of their scientific studies, GES students are able to investigate natural as well as economic, policy, and social systems and their response and interaction with the Earth system. GES has important ties to the more classical sciences of geology and geophysics, meteorology and climatology, oceanography, and ecology as well as to the social sciences. Thus, the scope of GES is extremely broad. This breadth is reflected in the interdisciplinary nature of the faculty, which is primarily drawn from numerous departments and research institutions within the School of Ocean and Earth Science and Technology.

GES has much to offer the student who is interested in the environment and the effect of humans on the environment. The skills developed in GES can be brought to bear on local, regional, and global environmental issues. Many of the critical environmental problems confronting humankind involve large-scale processes and interactions among the atmosphere, oceans, biosphere, cryosphere, shallow lithosphere, and people. Some of the problems derive from natural causes; others are a result of human activities. Some of the issues that GES students deal with are: climatic changes from anthropogenic inputs to the atmosphere of CO₂ and other greenhouse gases; human interventions and disruptions in the biogeochemical cycles of carbon, nitrogen, phosphorus, sulfur, trace metals, and other substances; emissions of nitrogen and sulfur oxide gases and volatile organic compounds to the atmosphere and the issues of acid deposition and photochemical smog; depletion of the stratospheric ozone layer and associated increase in the flux of ultraviolet radiation to Earth's surface; increasing rates of tropical deforestation and other large-scale destruction of habitat, with potential effects on climate and the hydrologic cycle; disappearance of biotic diversity through explosive rates of species extinction; global consequences of the distribution and application of potentially toxic chemicals in the environment and biotechnology; interannual and interdecadal climate variability, e.g., El Niño/Southern Oscillation; eutrophication; water and air quality; exploitation of natural resources with consequent problems of waste disposal; earthquakes, tsunamis, and other natural hazards and prediction; and waste disposal: municipal, toxic chemical, and radioactive. In all cases, the student is encouraged to understand and appreciate the social, economic, and ultimately the policy decisions associated with these and other environmental issues.

Specifically with respect to learning objectives, the students develop competency in understanding how the physical, biological, and chemical worlds are interconnected in the Earth system. They obtain skills in basic mathematics, chemistry, physics, and biology that enable them to deal with courses in the derivative geological, oceanographic, and atmospheric sciences at a level higher than that of qualitative description. In turn, these skills enable the students to learn the subject matter of GES within a rigorous context. The students

develop an awareness of the complexity of the Earth system and how it has changed during geologic time and how human activities have modified the system and led to a number of local, regional, and global environmental issues. They become competent in using computers and dealing with environmental databases and with more standard sources of information in the field. They are exposed to experimental, observational, and theoretical methodologies of research and complete an environmentally focused senior research thesis in environmental study using one or more of these methodologies. Project field work is encouraged for the senior thesis and, depending on the topic chosen by the student, can be carried out at the Hawai'i Institute of Marine Biology's Coconut Island facility, E. W. Pauley Laboratory, associated He'eia ahupua'a, Ka Papa I.o'i O Kanewai, or elsewhere.

The ultimate objective of the GES program is to produce a student informed in the environmental sciences at a rigorous level who is able to go on to graduate or professional school; enter the work force in environmental science positions in industry, business, or government; enter or return to teaching with knowledge of how the Earth system works; or enter the work force in another field as an educated person with the knowledge required to become a wise environmental steward of the planet. The GES program is accredited by the Applied and Natural Science Commission of ABET.

Mission Statement

1. Educate students in creating, developing, and disseminating knowledge through high-quality and innovative faculty-mentored research experiences;
2. Train environmental scientists able to apply a rich diversity of knowledge systems that are committed to sustain and transform our islands and the world.
3. Cultivate creative and innovative leaders in environmental science impacting local to global communities.

Program Educational Objectives

There are four GES Program Educational Objectives, which are broad statements that describe what graduates are expected to attain within a few years after graduation.

1. Apply knowledge and critical thinking skills to attain advanced disciplinary, interdisciplinary, and professional degrees.
2. Apply knowledge and critical thinking skills to the practice of environmental science to become leaders in public and private sector professional careers impacting local to global communities.
3. Apply principles of environmental justice and ethics, sustainability, and Indigenous practices and knowledge in their careers.
4. Demonstrate the ability to conduct independent basic or applied research.

Student Outcomes

All graduates of the Global Environmental Science program are expected to have demonstrated an ability to:

1. Identify, formulate, explain, and solve broadly defined technical or scientific problems relevant to local communities and/or global contexts by applying knowledge of mathematics, science, and Indigenous practices and knowledge in environmentally-related disciplines.
2. Design a system, process, procedure or program to meet desired needs.

3. Develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. Communicate effectively with a range of audiences in both written and oral communication.
5. Understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in economic, environmental, and societal contexts; both locally and globally.
6. Function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

Advising

Students contemplating a major in Global Environmental Science should contact the Student Academic Services in HIGH 131B (808) 956-8763. The GES Program Chair can be contacted via ges@soest.hawaii.edu and phone (808) 956-2913.

BS in Global Environmental Science

University Core and Graduation Requirements

^{of the 31} credits of General Education Core Requirements, 10 are in math and science and are fulfilled through the GES degree. Graduation Requirements include 8 Focus courses, 7 of which can currently be taken through the GES program requirements [Contemporary Ethical Issues (GES 311), Oral Communications (GES/OCN 490), and 5 Writing Intensive courses (BIOL 171L, GES 311, 320, 401, and 499)].

Global Environmental Science Requirements

Aside from General Education Core and Graduation requirements, the global environmental science program has core requirements of two basic types: basic sciences and derivative sciences. The former provides the foundation to understand and appreciate the latter in the context of basic skills and mathematics, biology, chemistry, and physics. Both global environmental science core requirements provide the necessary cognitive skills to deal with the higher academic level courses within the global environmental science curriculum. These include ⁷ required foundation courses in global environmental science and a minimum of 4 coupled systems courses. It is within this latter category of course work that the formal course program will be tailored to the individual student's needs. For example, we anticipate that most students will follow closely a natural science track of study, perhaps concentrating on the terrestrial, marine, or atmospheric environment. However, because of the human dimensions issues involved in the subject matter of environmental change, some students may wish to expand their academic program into the social sciences that bear on the issues of global change.

A minimum grade of C must be obtained in all GES required courses.

Core Basic Sciences Requirement (40 credits)

- BIOL 171/171L, 172/172L
- CHEM 161/161L, 162/162L
- MATH 241, 242
- MATH 243 ³⁰⁷ or OCN/ERTH 312
- ~~MATH 244 or ECON 321~~ ^{ICS 110P or 110C or EARTH 251}
- PHYS 170/170L, ~~272/272L~~
- OEST 100

Core Derivative Sciences Requirement (11 credits)

- ATMO 200
- EARTH 101/101L or EARTH 170
- OCN 201/201L

Foundation Course Requirements (18 credits) - 21-22 credits

- GES/OCN 100 Global Environmental Science Seminar
- GES/OCN 102 Introduction to the Environment, Climate Change, & Sustainability
- GES 311 The Changing Earth and Climate System
- ~~OCN 318 or 319L or 481~~
- GES/OCN 320 Aquatic Pollution
- ~~GES/OCN 401 Biogeochemical Systems~~ **GES371**
- ~~GES/OCN 463~~ **471**

Coupled Systems Courses (4 minimum - Examples)

- ANTH 328 Food Origins, Food Culture
- ANTH 335 Society and Environment
- ANTH 459 Extinctions
- ANTH 482 Anthropology and the Environment: Culture, Power, and Politics
- ASTR 210 Foundations of Astronomy
- ATMO 302 Atmospheric Physics
- ATMO 303 Introduction to Atmospheric Dynamics
- **BIOC241** ~~BIOL 441~~ Fundamentals of Biochemistry
- BIOL 265 Ecology and Evolutionary Biology
- BIOL 301 Marine Ecology and Evolution
- BIOL 310 Environmental Issues
- BIOL 340/CMB 351 Genetics, Evolutions and Society
- BIOL 360 Island Ecosystems
- BIOL 404 Advanced Topics in Marine Biology
- BIOL 410/GEO 410 Human Role in Environmental Change
- BIOL 411 Corals and Coral Reefs
- BOT 350 Resource Management & Conservation in Hawaii
- BOT/HWST/SUST 457 'Āina Mauliōla: Hawaiian Ecosystems
- BOT/HWST/SUST 458 Natural Resource Issues and Ethics
- BOT/HWST/SUST 459 Strategies in Hawaiian Resource Use
- BOT 480 Algal Diversity and Evolution
- CHEM 272 Organic Chemistry I
- CHEM 273 Organic Chemistry II
- CHEM 445 Synthesis & Analysis of Organic Compounds
- CMB 351/BIOI. 340 Genetics, Evolutions and Society
- ~~ECON 321 Introduction to Statistics~~
- ECON 358 Environmental Economics
- ECON 458 Project Evaluation and Resource Management
- ~~ECON 638 Environmental Resource Economics~~
- GEO 300 Introduction to Climatology
- GEO 310 Introduction to Planning
- GEO/SUST 322 Globalization and Environment
- ~~GEO/TIM 324 Geography of Global Tourism~~
- GEO/SUST 330 Culture and Environment
- GEO 388 Introduction to GIS
- GEO 401 Climate Change
- GEO 402 Agricultural Climatology
- GEO 404 Climate, Air Quality, & Policy
- GEO 405 Water in the Environment
- GEO 410 Human Role in Environmental Change

- GEO 411/SUST 413 Past Global Change and the Human Era
- GEO 412 Environmental Impact Assessment
- GEO 413 Resource Management in Southeast Asia
- GEO 414 Environmental Hazards and Community Resilience
- ~~GEO/TIM/SUST 415 Nature-Based Tourism Management~~
- EARTH 301 Mineralogy
- EARTH 309 Sedimentology aProcesses and Environments
- EARTH 325 Geochemistry
- EARTH 413 Introduction to Statistics and Data Analysis
- EARTH 420 Beaches, Reefs, and Climate Change
- EARTH 425 Environmental Geochemistry
- EARTH/OCN 444 Plate Tectonics
- EARTH 455 Hydrogeology
- EARTH 466 Planetary Geology
- ~~HWST 457 'Āina Mauliōla: Hawaiian Ecosystems~~
- ~~HWST 458 Natural Resources Issues and Ethics~~
- ~~HWST 459 Strategies in Hawaiian Resource Use~~
- ~~HWST 460 Hui Kōnōhiki Practicum~~
- MICR 401 Marine Microbiology
- MBBE 412 Environmental Biochemistry
- NREM 301/301L Natural Resources Management/Lab
- NREM 302 Natural Resource and Environmental Policy
- NREM 304 Fundamentals of Soil Science
- NREM 461 Soil and Water Conservation
- OCN 318 Introduction to Environmental Monitoring Systems and Measurements
- OCN 321/PPC 340/SUST 323 Applied Principles of Environmental & Energy Policy
- OCN/ORE 330 Mineral and Energy Resources of the Sea
- OCN 331 Living Resources of the Sea
- OCN 340 Ecology of Infectious Diseases and Symbioses
- OCN 403 Marine Functional Ecology and Biotechnology
- OCN 411 The Ethics of Climate Change and Geoengineering
- OCN 418 Advanced Environmental Monitoring Systems
- OCN 430 Introduction to Deep-Sea Biology
- OCN 435 Climate Change and Urbanization
- OCN/CEE/SUST 441 Principles of Sustainability Analysis
- OCN/SUST 442/TIM 462 Environmental Management Systems
- OCN/GES 454 Earth's Microbiome
- OCN 457 Ridge to Reef: Coastal Ecosystem Ecology and Connectivity
- OCN 480 Dynamics of Marine Ecosystems: Biological-Physical Interactions in the Oceans
- OCN 481 Introduction to Ocean Ecosystem Modeling
- ~~OCN 620 Physical Oceanography~~
- ~~OCN 621 Biological Oceanography~~
- ~~OCN 622 Geological Oceanography~~
- ~~OCN 623 Chemical Oceanography~~
- ~~OCN 633 Biogeochemical Methods in Oceanography~~
- ~~OCN/ERTH 638 Earth System Science and Global Change~~
- PEPS 310/SUST 320 Environment and Agriculture
- PEPS 451 Environmental Law
- PH 201 Introduction to Public Health
- PH 310 Introduction to Epidemiology
- PH 340 Public Health and the Environment

- PH 341 Public Health Biology and Pathophysiology
- PH 655 Biostatistics I
- PH 663 Principles of Epidemiology I
- PH 664 Principles of Epidemiology II
- PHIL 316 Science, Technology, and Society
- PLAN 310 Introduction to Planning
- PLAN 414 Environmental Hazards and Community Resilience
- PLAN 473 GIS for Community Planning
- PLAN 600 Public Policy and Planning Theory
- PLAN/SUST 620 Environmental Planning and Policy
- POLS 315 Global Politics/International Relations
- POLS 316 International Relations
- POLS 380 Environmental Law and Politics
- POLS/SUST 387 Politics of the Ocean
- SOC 412 Analysis in Population and Society
- ~~TIM 321 Sociocultural Issues in Tourism~~
- ~~TIM/ GEO 324 Geography of Global Tourism~~
- ~~TIM/GEO/SUST 415 Nature-Based Tourism Management~~
- ~~TIM 420/SUST 421 Sustainable Tourism Policies and Practices~~

The student may also wish to take additional courses in fundamental physics, chemistry, biology, or mathematics.

In addition to students being able to choose their own coupled systems courses to customize their degree per their interests and goals, the Global Environmental Science program has six tracks (with defined coupled system courses) in the cross-disciplinary environmental science areas of (1) environmental anthropology, (2) environmental health, (3) environmental planning, (4) risk management and insurance (5) sustainable tourism, and (6) sustainability science. For each of these tracks, the collaborating department and their faculty have agreed to support the major required research thesis project so that GES students are able to focus both their curricular and research experience in track's subject material.

1. **Environmental Anthropology (cross-disciplinary with the Department of Anthropology):** Environmental anthropology is distinct from approaches to the environment in other social sciences. While all the social sciences share a common commitment to understanding environmental problems and issues of sustainability as, in essence, social problems, amenable to the tools of the social sciences, anthropology brings a number of distinct emphases and approaches to the problem. Anthropologists have long been committed to understanding the environment from others' points of view, engaging in the kinds of deeply committed, extended and engaged research that forms the basis of ethnographic inquiry. As a holistic science, anthropologists learn new languages, immerse themselves in other cultures, and strive to understand perceptions of the environment from wholly distinct ideological, linguistic, and cosmological perspectives. As part of their holistic approach, anthropologists have also developed models for understanding human interactions with the environment that draw on evolutionary ecology and ecosystem science, studying such things as energy and nutrient flows through systems that include humans as components of broader networks of interaction. Finally, anthropologists have worked to test the assumptions built in to various models of environmental behavior, empirically testing models from political economy or common property theory, but doing so

in ways that dig deeper and overcome more social distance than can the survey-based methodologies of sociology or the econometric, sampling and statistical approaches used by social sciences focused on aggregate social action.

This program builds on the Department of Anthropology's focus on applied anthropology, at both the undergraduate and graduate level. The Environmental Anthropology track will challenge students to question their assumptions about the human relationship to the environment and the practice of environmental management. Students will be trained in methods and approaches that will allow them to understand the linkages between human cultural systems and the environment, and will be trained to contextualize human behavior within broader social, political and economic contexts. Course work, mentoring, and independent research will address such issues as the social dimensions of sustainability, resiliency, and will emphasize anthropological approaches to environmental problems. GES EA track graduates will be prepared to undertake applied graduate studies and to work professionally in such fields as natural resource management, applied environmental archeology, or advocacy and policymaking for environmental sustainability.

2. **Environmental Health Sciences (cross-disciplinary with Office of Public Health Studies):** This track enables a student in the Global Environmental Sciences Program to concentrate his/her academic studies in areas of significant importance in the relationship between environmental issues and public health. The inter-relationship between the environment and its impact on human health is vast and constantly changing. Issues such as food security, emerging zoonotic diseases, water scarcity, air and water pollution, over population, waste disposal, pesticide use, depletion of resources on land and in the sea are just a few of the pressing environmental issues that affect the health and well-being of millions of people worldwide. In this track students will gain the basic scientific knowledge necessary to understand the underlying science of the environment while simultaneously being exposed to public health principles that are essential for establishing cause and effect relationships between environmental conditions and human health, as well as understanding the compromises that sometimes must be made to accommodate economic, health, and environmental preservation goals. Graduates of this track will be uniquely positioned for careers in the environmental health field ranging from laboratory workers to regulatory policy and enforcement officers with environmental agencies.
3. **Environmental Planning (cross-disciplinary with Department of Urban and Regional Planning):** Global environmental problems like human-induced climate change challenge local strategies to manage natural resources, protect sensitive species' habitats, and ensure the long-term health of ecosystems. With over fifty-percent of the world's population now living in urban areas and consuming most of the Earth's resources, the way we plan, design, and regulate our cities exacerbates local conditions. At the same time, urban areas are also important locations for solutions. Environmental planners adopt solutions-oriented approaches to address environmental problems, such as supporting local food production, building disaster risk reduction, deploying clean sources of energy, conserving biodiversity and natural habitats, managing urban waste, adapting to sea-level rise, and preserving freshwater resources. Planning as a discipline

has a long tradition in problem solving across different scales from neighborhoods to entire regions with extensive community involvement. Graduates will be uniquely positioned for careers as environmental planners, specialists, and consultants employed by government agencies or private firms required to review planning permits, develop master plans, prepare environmental impact studies, or develop mitigation strategies to minimize development impacts.

4. **Risk Management and Insurance** are an integral part of the decision making processes of corporations and individuals. According to the U.S. Bureau of Labor & Statistics, geoscience finance and insurance-related jobs are projected to grow by over 37% in the next eight years. The projected growth is the response of the finance and insurance industry to “pricing in” current and future impacts of climate and environmental change into all aspects of their provided services. As such, geoscientists with finance and insurance expertise are needed to bridge the two disciplines in the finance and insurance industry. The Risk Management and Insurance track in the Global Environmental Science program will provide students the knowledge and the toolkit of managing risk exposures for corporations and/or individuals. Students will be introduced to personal financial decision making, insurance industry and operations, different insurance policies and their applications in personal and business planning, corporate risk management techniques, and other related financial decision making techniques. In short, this track is designed to prepare students for the dire need of risk professionals and/or the fast growing insurance industries.
5. **Sustainability Science:** In collaboration with Hawai'i Natural Energy Institute, Sustainability Science probes interactions between global, social, and human systems, the complex mechanisms that lead to degradation of these systems, and concomitant risks to human well-being. As Sustainability Science has emerged in the 21st century as a new academic discipline, it brings together scholarship and practice, global and local perspectives, and disciplines across the natural and social sciences, engineering, and medicine—facilitating the design, implementation, and evaluation of practical interventions that promote sustainability in particular places and contexts. The GES graduate from the sustainability track is prepared for opportunities in all fields that would hire environmental scientists, and to be especially competitive for those opportunities that target the design, analysis, implementation, maintenance, and/or monitoring of processes or systems that target increased sustainability.
6. **Sustainable Tourism (cross-disciplinary with the School of Travel Industry Management):** The relationship between tourism and the natural environment is intimate and complex. The desire for contact with nature drives enormous volumes of tourism, yielding not only tourist spending and associated jobs and tax revenues, but also pollution, waste, and overdevelopment resulting from the transportation of masses of people and the construction and operation of tourism-related facilities. Indeed, such pollution, waste, and overdevelopment diminish the quality of the very environments that impel nature-based tourism to begin with. In addition, issues such as food security, water scarcity, overpopulation, urban sprawl, pesticide use, global warming, rising sea levels, and depletion of

resources on land and in the sea are just a few of the pressing environmental issues that affect the attractiveness, competitiveness, and sustainability of destinations throughout the world. Graduates will be uniquely positioned for careers as planners, specialists, and consultants employed by government agencies required to prepare environmental impact studies and/or tourism plans, consulting firms that prepare such studies and/or plans for government agencies, and nonprofit organizations that operate tourism “ecocertification” programs that provide tourism-related businesses with credentials of their “greenness.”

Global Environmental Science Honors Track

The Global Environmental Science Honors track trains students to conduct sustained, supervised research in the fields of environmental science. Honors students work closely with a faculty mentor, take Honors courses, present their finished research at both the Undergraduate Showcase and the GES Symposium, write an Honors/GES thesis based on their research, and submit the thesis to both Honors and GES programs to satisfy each program's requirements.

Students can apply to either the Four Year Honors track or the Upper Division Honors track.

Directed Reading

- GES/OCN 399 Directed Reading

Course offering with an individual faculty member to do a one-on-one study on a topic of particular interest to you.

This could be used to explore a topic before deciding on a senior thesis, or because you are interested in an area in which there isn't a formal course offering. It can be taken for CR/NC or for a grade and you can register for 1-3 credits. This is not considered a CS class.

Senior Research Thesis (5-8 hours) 6 credits a GES 302

- GES/OCN 490 Communication of Research Results
- GES/OCN 499 Undergraduate Thesis

Each student is required to complete a written senior thesis based on research conducted with one or more chosen advisors, and to make a public presentation of their research results.

Combined Bachelor's and Master's Pathways

In collaboration with select departments across the UH Mānoa campus, the Global Environmental Science program offers combined Bachelor's-and-Master's (BAM) degree pathways, which help students earn both their bachelor's and master's degrees in just five years. The pathways allow GES students to double-count relevant credits towards both their undergraduate and graduate degrees and also earn graduate-level credits at the undergraduate tuition rate, essentially saving time and money. The pathway choices available to GES students are BAM with (1) Master of Public Health, Epidemiology Emphasis (MPH) and (2) Master of Urban and Regional Planning (MURP).

1. Combined Bachelor of Science and Master of Public Health, Epidemiology Emphasis (MPH) Pathway

In collaboration with the Office of Public Health Studies, the program offers a combined Bachelor of Science in GES and Master of Public Health, Epidemiology Emphasis (MPH) pathway that helps students earn both degrees in five years. This pathway allows GES students to earn eleven (11) graduate-level credits that apply to the MPH degree, in addition to the nine (9) upper-division credits

that will be double-counted towards both GES and MPH degrees, in their senior year. Once in the MPH program, after graduating with their GES BS degree, students take the remaining 22 credits necessary to complete the MPH degree.

2. Combined Bachelor of Science in Global Environmental Science and Master of Science in Finance

In collaboration with the Shidler College of Business, the Global Environmental Science (GES) program offers a combined Bachelor of Science in Global Environmental Science and Master of Science in Finance pathway that helps students earn both degrees in five years. This pathway allows GES students to earn six (6) graduate-level credits that apply to the MSF degree, in addition to the nine (9) upper-division credits that will be double-counted towards both GES and MSF degrees in their senior year. Once in the MSF program, after graduating with their GES BS degree, students take the remaining 15 credits necessary to complete the MSF degree.

3. Combined Bachelor of Science and Master of Urban and Regional Planning (MURP) Pathway

In collaboration with the Department of Urban and Regional Planning, the program offers a combined Bachelor of Science in GES and Master of Urban and Regional Planning (MURP) pathway that helps students earn both degrees in five years. This pathway allows GES students to earn six (6) graduate-level credits that apply to the MURP degree, in addition to the nine (9) upper-division credits that will be double counted towards both GES and MURP degrees, in their senior year. Once in the MURP program, after graduating with their GES BS degree, students take the remaining 27 credits necessary to complete the MURP degree.

4. Combined Bachelor of Science and Post-Baccalaureate Certificate in Teacher Education (Secondary Science) Pathway

In collaboration with the College of Education, the program offers a combined Bachelor of Science in GES and Post-Baccalaureate Certificate in Teacher Education (PBCTE) in Secondary Science pathway, which allows candidates to earn a degree and complete a teacher licensure program in five years. Candidates complete fifteen (15) credits from the PBCTE program as electives in the bachelor's program, thus saving time and money in the process. With this pathway, GES students would be dual-enrolled in their final spring semester, graduate from the bachelor's program, and complete the PBCTE program the following year. Candidates who successfully complete the PBCTE program will then be eligible to apply for initial teacher licensure in science from the Hawai'i Teacher Standards Board and teach in the State of Hawai'i.

Marine Biology

See the "Interdisciplinary Programs" section of the *Catalog* for more information on the Marine Biology Graduate Program.

Ocean and Resources Engineering

Holmes Hall 402
2540 Dole Street
Honolulu, HI 96822
Tel: (808) 956-7572
Fax: (808) 956-3498
Email: adminore@hawaii.edu
Web: www.soest.hawaii.edu/ore/

Faculty

- *Z. Huang, PhD (Chair)—coastal and ocean engineering, wave-structure interactions, wave energy conversion, natural hazards-tsunamis, coastal sediment transport, coral reef hydrodynamics
- *K. F. Cheung, PhD (Graduate Chair)—coastal and offshore engineering, marine hydrodynamics, computational methods, water wave mechanics, coastal flood hazards
- *E. Briggs, PhD—autonomous instrumentation, chemical sensors, oceanographic monitoring
- *E. D. Gedikli, PhD—marine structures, structural dynamics, hydrodynamics, fluid-structure interaction
- *B. M. Howe, PhD—acoustical and physical oceanography, tomography, sensors and network infrastructure
- *M. Krieger, PhD—marine robotics, autonomous vehicles, unconventional propulsion, biomimicry analysis
- *E. Nosal, PhD—passive acoustic monitoring methods, ocean ambient noise, sediment acoustics, bioacoustics
- *J. Stopa, PhD—marine forecasting/hindcasting, data analysis applications in geophysical datasets, oceanic remote sensing, spectral wave models, wind and wave climate
- *Y. Yamazaki, PhD—computational methods, coastal flood hazards

Cooperating Graduate Faculty

- M. Chyba, PhD—control theory
- P. Cross, PhD—wave energy
- O. P. Francis, PhD—coastal engineering
- R. Ghorbani, PhD—dynamics, controls, design, alternative energy
- B. Glazer, PhD—instrumentation
- Z. Song, PhD—marine robotics, autonomous vehicles, sensor fusion, multi-agent systems
- J. Yu, PhD—marine bioproducts engineering

Affiliate Graduate Faculty

- R. C. Ertekin, PhD—offshore engineering, hydrodynamics
- B. D. Greeson, PhD—offshore engineering, hydrodynamics, ROV/submersible operations
- B. Jones, PhD—oceanography
- E. Pawlak, PhD—coastal mixing processes, fluid dynamics, sediment transport
- D. Rezachek, PhD—ocean energy and engineering design
- D. A. Smith, PhD—near-shore processes and coastal engineering
- J. R. Smith, PhD—marine survey
- L. J. Van Uffenlen, PhD—acoustical oceanography, oceanographic instrumentation
- D. Vithanage, PhD—coastal engineering, nearshore circulation

Degrees Offered: MS in ocean and resources engineering, PhD in ocean and resources engineering

The Academic Program

Ocean and Resources Engineering (ORE) is the application of ocean science and engineering design to the challenging conditions found in the ocean environment and to the synthesis of novel products from marine systems. Waves and currents, turbulence, dynamic loads, mobile sediment, high pressure and

