

TOHONO O'ODHAM COMMUNITY COLLEGE



Syllabus: **BIO 154N: GLOBAL CHANGE BIOLOGY**

Course Information

Course Prefix/Number: Bio 154N	Credit Hours: 4 (3 lecture & 3 lab periods)
Semester: Fall 2018	Course Title: Global Change Biology
Class Days/Times: MW 9-11:15 plus one	Room: Gewkdag Son Ki Room 5
Friday field trip and online work	

Instructor Information: Name: Teresa Newberry, Ph.D.	Phone/Voice Mail: 520-383-0107 E-mail: tnewberry@tocc.edu Office location: Ed Division Bldg; Room 107 Office hours: MW 3:30-5 or T 3-5 or by appt.
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Course Description:

Global change biology is a new field of biology which explores the consequences of global environmental change on humans and ecosystems. This course focuses on climate change as a key driver of environmental change. Climate change is addressed by exploring causes of past and current climate change while providing a strong contextual setting for Native American students based on their own culture and traditional ecological knowledge. Impacts of climate change on humans and ecosystems are covered from a holistic and interdisciplinary perspective with an emphasis on understanding the interconnectedness of biotic and physical systems. Students will learn about and compare traditional knowledge with western science understanding of climate processes and effects. This course will explore mitigation and adaptation strategies for climate change impacts and will include an opportunity for students to develop ideas on how Native American nations can respond to a future of changing climate.

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Student Learning Outcomes (SLOs) :

After completion of the course students will be able to

1. Apply basic concepts of meteorology, climatology and traditional ecological knowledge to describe and understand their local climate and environment.
2. Summarize how the earth's climate system works, and understand the physical processes and dynamic interactions of the biosphere, atmosphere, oceans, ice and land surface.
3. Describe changes in climate through time and be able to distinguish between long term geologic-scale climate change and recent human-caused climate change.
4. Explain how future climate changes are predicted, both globally and for their own region or tribal lands, and how scientists make predictions about future climate scenarios.
5. Discuss current impacts of climate change on humans and ecosystems as well as future predicted impacts.
6. Describe various approaches to collecting and analyzing data, including field data collection, visual data analysis, and using data to understand trends or discover underlying issues.
7. Apply scientific and traditional ecological knowledge toward positive solutions to the impacts of climate change while respecting tribal values and strengthening community ties.

Course Structure:

This course consists of four parts each consisting of a varying number of modules (see *Himdag* cultural component below). Each module consists of PowerPoint lectures, assigned reading, and a quiz. Each module also contains some combination of, but not all of the following: documentaries, in-class activities, in class and online discussions, laboratory exercises, reflective writing and homework assignments. There are two final projects for this class: an individual written project and a collaborative group project. The individual final project for the course is a Climate Change Controversy Report in which students choose a current controversial topic related to climate change and explore each side of the issue. The objectives of this Controversy Report are 1) to synthesize, apply, and add to course content by critically analyzing a current environmental issue related to climate change 2) to examine multiple perspectives and facets of a climate change issue by gathering information from a variety of sources, assessing the scientific credibility of the information, and determining the special interests (the players) involved and 3) to arrive at a personal opinion based on a well-researched, well-thought-out rationale. The group final project is the development of a Community-based Climate Change Adaptation Plan for our region. The Adaptation will integrate local traditional knowledge with scientific knowledge.

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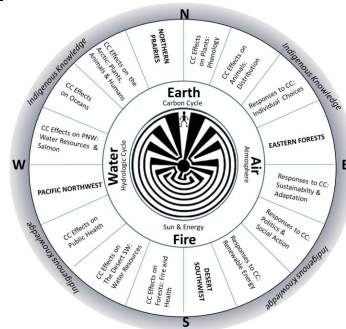
Course Assessment:

Course assessment consists of quizzes, discussions, short written assignments, informal in-class assessments, laboratory reports, a controversy report project which includes a paper and class presentation and a collaborative inquiry-based project. Study guides will be available to help you prepare for quizzes. In accordance with my teaching philosophy in which I believe student learning occurs primarily through hands-on, real world application of course materials, quizzes comprise less than 50% of the final grade (although they are still an important aspect of course assessment and your grade). In order to facilitate on-going faculty-student feedback and provide formative assessment, many class projects are divided into smaller intermediate steps such as topic choice, project proposals, and rough drafts. Student-to-student assessments are also included in this course through peer review of group participation and written assignments. I welcome student feedback about the course anytime. I will also provide students an opportunity to give me feedback on their course experience through an anonymous mid-course and final course evaluation.

Texts and Materials:

“Red Alert! Saving the Planet with Indigenous Knowledge” Daniel R. Wildcat
“Dire Predictions” by M.E. Mann & L.R. Kump

iPad: Earth the Operators Manual plus climate change apps



Himdag Cultural Component:

This course teaches student about current climate change while providing a strong contextual setting for Tohono O'odham students based on the Himdag and traditional ecological knowledge. Throughout the course, students learn about and compare traditional knowledge with western science understanding of climate processes and effects.

This course was developed in collaboration with six other tribal colleges. The course structure is based on the four directions and the sacred hoop, or medicine wheel. The medicine wheel is used as an analogy for the inter-connectedness of the earth, air, water and the energy that binds them. The course

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uses the images, stories, and values of the medicine wheel to examine the interconnected effects of a changing climate on the four elements of the earth system.

The concept of climate is at the center of the medicine wheel. It is further embodied by the four directions and their representation as the four elements of fire, water, air and earth. The spokes of the medicine wheel radiate from the climate center and depict the many aspects of changing climate and its impacts. The entire medicine wheel is encircled by indigenous knowledge, a connected band of learning that has evolved to contain people's cumulative experience through time about the climate, the four elements, the earth sciences, and how we can adapt to climate change.

The course begins at the center of the medicine wheel by defining climate and by looking to Native American knowledge held in Creation stories. At TOCC, we include the Tohono O'odham Creation story. It then circles the medicine wheel once to provide an overview of the earth's system from the perspective of the four elements. The course then circles again around the medicine wheel, passing through all 16 spokes, and covering earth science topics on climate, climate change, change impacts and possible solutions.

Policies and expectations-

Course Policies Requirements: (1) Attend class regularly; (2) Complete in-class and out-of-class assignments and submit to the instructor; (3) Attend all field trips; (4) Take all exams (5) Complete all class projects & presentations.

Attendance: You are expected to arrive to class on time and actively participate each class period. Quizzes and exams are given out at the beginning of class time. Field trips and class activities begin at the start of class and may be missed if you do not arrive to class on time. Because exams, labwork and/or other assignments potentially occur every class period, points potentially will be lost each class period missed. If you miss all or a portion of a class, then you are solely responsible for obtaining missed class material from fellow students. Complete attendance is mandatory during student project presentations; otherwise presentation points will be forfeited. Four consecutive, unexcused absences may result in withdrawal. You may request to be excused from class for religious observances and practices, for illness, for travel or for personal or family emergency. If you will be absent or have been absent, please notify the instructor as soon as possible.

Make-up policy: Missed exams due to an excused absence can be made up within two days of the exam date. Late assignments that can be made up will be accepted but will be penalized 25%. Laboratories cannot be made up. At the instructor's discretion, extra credit opportunities and optional activities may be provided.

Academic Integrity: Violations of scholastic ethics are considered serious offenses by Tohono O'odham Community College, the Student Services Department, and by your instructor. Students may consult the TOCC Student Handbook sections on student code of conduct, on scholastic ethics and on the grade appeal procedure. Copies are available at Tohono O'odham Community College.

All work done for this class must be your own. While you may discuss assignments with other class members, the final written project must clearly be your own. You may use work from books and other materials if it is properly cited. Copying from a book without proper reference or from a person under any circumstances will result in an "F" for the assignment, and at the instructor's

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discretion, possibly an "F" for the course.

ADA Compliance:

Tohono O'odham Community College strives to comply with the provisions of the Americans with Disabilities Act and Section 504 of the Rehabilitation Act. If you have a learning problem, physical disability, or medical illness that requires you to have any special arrangements, please inform your instructor at the beginning of the semester so your academic performance will not suffer because of the disability or handicap.

Classroom Behavior:

- Because of insurance limitations, non-registered visitors are not allowed at class sessions or on field trips.
- Possession of drugs, alcohol or firearms on college property is illegal.
- Food and beverages are allowed in classrooms.
- Pets, telephones, pagers and other electronic devices that distract students are not allowed in classrooms.
- Students creating disturbances that interfere with the conduct of the class or the learning of others will be asked to leave.

Course Feedback:

All assignments, written papers and quizzes will be graded and returned to the students one week after the assignment is due. E-mail and phone messages will be returned within two days. A student or the instructor may request a student conference at any time during the semester. Students are encouraged to monitor their progress and current grade by logging into Canvas and checking the gradebook.

Instructor Withdrawals:

Students who have missed four consecutive classes, not submitted any assignments nor taken any quizzes by the 45th day census report, due on 10/5/2018 are assumed NOT to be participating in the class and will be withdrawn. Students may withdraw from class at any time during the first 2/3 of the semester without instructor permission and without incurring any grade penalty. Please be sure to withdraw yourself by 11/2/2018 if you do not expect to complete the class, otherwise you may receive an "F" grade.

Incomplete (I) grade:

"I" grades are not awarded automatically. The student must request an "I" from the instructor who will judge the student's ability to complete the course on his or her own. Generally, the student must have completed over 80% of the course requirements with at least a "C" grade. An "I" requires a written contract between the student and the instructor listing work to be completed as well as how and when the work will be done. If the work is not completed within the contract period, the "I" grade automatically reverts to an "F." "I" grades will not be re-evaluated during the final two weeks of the semester when class activities are normally at their most intense.

Special Withdrawal (Y) grade:

The "Y" grade is an administrative withdrawal given at the instructor's option when no other grade is deemed appropriate. Your instructor must file a form stating the specific rationale for awarding this grade. "Y" grades are discouraged since they often affect students negatively. Your instructor will not award a "Y" grade without a strong reason.

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Final Grades: Students will receive a grade transcript from the college mailed to the address given with registration materials at the end of the semester when all grades have been recorded.

SPECIAL NOTE TO STUDENT:

For privacy and security reasons, instructors are advised **NOT** to give grades over the telephone. Grades will only be emailed with written permission from the student.

Your instructor will make every attempt to follow the above procedures and schedules, but they may be changed in the event of extenuating circumstances.

Students submitting assignments through the mail or by email are advised to make copies for their own protection.

If you move during the semester, please file a change of address form with the Student Services Office, and inform your instructor.

GOOD LUCK!

Course Outline:

- I. Introduction to Climate
 - A. Climate Terminology & Fundamentals
 - B. Native American Creation Stories
 - C. Climate and Ecosystems of Native American Tribes

- II. The Earth's Climate System
 - A. Energy
 - B. Atmosphere
 - C. Land – Biomes
 - D. Ocean - Overview
 - E. Hydrologic Cycle
 - F. Carbon cycle

- III. Intro to Climate Change and Global Warming
 - A. Long-term changes in climate
 - B. Short-term climate cycles
 - C. Greenhouse Effect
 - D. Sources of Greenhouse gasses

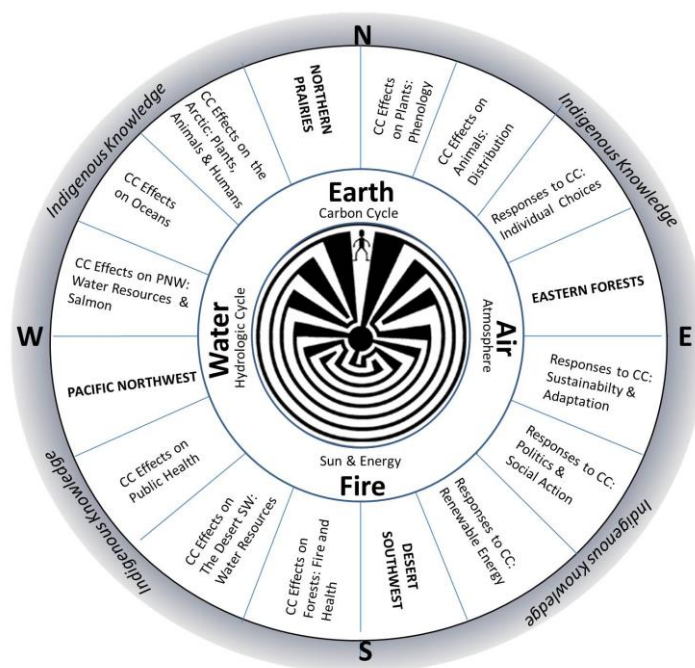
- IV. Impacts on Humans and Terrestrial Ecosystems
 - A. Loss of Biodiversity
 - B. Changes in Seasons and Phenology
 - C. Changes in animal diversity and distribution
 - D. Impacts on Western Forests
 - E. Impacts on the Arctic
 - F. Impacts to Human Health

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- V. Impacts on Water Resources and Aquatic Ecosystems)
 - A. Water in the Arid Southwest
 - B. Snow, ice and glaciers
 - C. Oceans and rising sea level
 - D. Ocean, streams and salmon

- VI. Sustainability, Mitigation and Adaptation
 - A. Renewable Energy
 - B. Climate Change Legislation
 - C. Social Change and Transformation

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This course combines the Man in the Maze (a symbol for life's journey and O'odham Himdag), the four directions, and the medicine wheel concept from Native Americans in central North America, as an analogy for the inter-connectedness of the Earth, air, water and the energy that binds them. It draws from the images, stories, and values of O'odham and other Indigenous knowledge sources to examine the interconnected effects of a changing climate on the four elements of the Earth system.

The climate, especially the climate of the Sonoran desert and Tohono O'odham lands, is presumed to be at the center and is driven by the four elements of Earth (Carbon Cycle), air (Atmosphere), water (Hydrologic Cycle), and fire (Sun & Energy). It is further embodied by the four directions and each direction is associated with one of these four elements. The spokes of the medicine wheel radiate from the center and depict the many aspects of changing climate and its impacts. The entire image is encircled by indigenous knowledge, a connected band of learning that has evolved to contain people's cumulative experience through time about the climate, the four elements, the Earth sciences, and how we can adapt to climate change. Following the spokes of the circle illustrates the interconnectedness of all aspects of climate and Earth's system.

The course begins at the center by defining climate and starting from O'odham traditional knowledge of the Sonoran desert and climate. In addition, we will explore the knowledge of other Indigenous people from different parts of North America to begin to learn how they understand their traditional lands and the climate. We then will follow the medicine wheel once around to provide an overview of the Earth's system from the perspective of the four elements. The course then circles again around the medicine wheel, passing through all 16 spokes, and covering Earth science topics on climate, climate change, change impacts and possible solutions.

Thus the analogy (the Man in the Maze and the medicine wheel) for this class has four concentric circles: the center (O'odham Himdag and climate), the four directions (holistic overview of earth's climate and interconnectedness), 16 spokes of the medicine wheel (more in depth view of all climate-related topics), and the outer circle of humans and culture (Indigenous knowledge).

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PART ONE

The Center: O'odham and Indigenous Knowledge of local Environments and Climate

This section is an introduction to the environment and the climate from Indigenous perspectives

- Include creation stories (O'odham and those of other tribes that can be shared) as an Indigenous knowledge framework
- Provide students with basic concepts of weather and climate and a place-based introduction to their local climate
- Begin building student awareness on 'ways of knowing' and comparing and contrasting traditional knowledge with Western science approaches.

Date	Topic Module	Readings	Red Alert Readings & On-line Discussions	Labs & Assignments
8/20 & 8/22	Introduction to the syllabus, texts, course goals	Dire Alert Pgs. 120-121	"Where Words Touch the Earth" Canvas Discussion	Overview to Impacts of Climate Change Facebook Assignment— Current Article on Climate Change Impacts
8/27 & 8/29	Native Science & Western Science	Reading & Discussion due V. Deloria: "Traditional Technology," <i>Spirit & Reason</i> , pgs. 129-136 Reading & Discussion due L. Little Bear: "Forward" and G. Cajete: "Introduction" in <i>Native Science</i> , pgs. ix-xii & 2-9.		8/27 Reflection & In-class discussion on "Traditional Technology" reading 8/29 Reflection & Discussion on Native Science Readings
9/5	Creation's Original Instructions/Inuit Perspectives on Climate Change	J. Bruchac: "Origins" in <i>Our Stories Remember</i> , Dire Alert pgs. 58-70; "The geographical pattern of future warming" (Pages 92-93) and "The Polar Meltdown" (Pages 138-139)	Red Alert: Introduction pgs. 1-12 (RA Discussion #1)	9/5 Reflection and In-class Discussion on Creation Stories & Climate 9/5 Inuit and Climate Change
9/10 & 9/12	Introduction to Weather & Climate		Gaia Hypothesis Discussion in Canvas	Lab 1: Variables of Weather and Climate

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PART TWO

The Four Directions: A Holistic View of the Earth's Climate System

This section presents a holistic view of the earth's climate using the four directions of the medicine wheel to teach the basic earth system physical components that control climate.

- Introduce the Earth's Climate System. Help students to move from the local scale of previous section to the global scale.
- Provide students with the fundamental earth science concepts they will need to understand climate change topics by using the four elements: fire, air, water, earth.
- Introduce the sun and global energy budget, atmosphere, hydrologic cycle, and carbon cycle
- Emphasize the similarity of the earth system approach of western science and the interconnectedness between the four elements from the perspective of native knowledge
- Introduce students to climate change and what is causing the climate to change. Explain the greenhouse effect, rising global temperature and climate change projections for the future

Date	Topic Module	Readings	Red Alert Readings & On-line Discussions	Labs & Assignments
9/17	Introduction to Energy and the Sun	"What's up with the weather (and the climate!)" (Pgs 10-15)	"Red Alert" pgs 13-21 (RA Discussion #2)	Homework: Temperature in Sells
9/19	Character of the Earth's Atmosphere		"The Truth is Not Inconvenient it is Deadly" Pgs 23-38 (Discussion #3)	
9/24 & 9/26	The Hydrologic Cycle	"Ice Kingdoms" (Page 15)	"Indigenous Knowledges: Where We Touch the Earth" pgs 73-86 (Discussion #4)	Lab #2: Unique Properties of Water
****FALL BREAK 10/1-10/5****				
10/8-10/17	The Carbon Cycle & Greenhouse Effect	<ul style="list-style-type: none"> • "What are the important greenhouse gases, and where do they come from?" (Pages 26-27) and "Carbon-cycle feedbacks: Nature's response to CO₂" (Pages 94-97) • "Feedback loops compound the greenhouse effect" (Pages 24-25), "Greenhouse gases on the rise" (Pages 32-33) "Couldn't the increase in atmospheric CO₂ be the result of natural cycles?" (Pages 34-35), and "It's getting hotter down here" (Pages 36-37) 	"Future: Wind Power on the Plains," pgs. 92-97 "Indigenous Dwellings versus Spec Houses" (Pages 115-120) Discussion #5	Controversy Question: 9/26 Water in my Land Due Lab #3: Temperature trends at Organ Pipe National Monument Guest Lecture on "Deep Time" by Daniel Aiken

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PART THREE

Spokes of the Medicine Wheel: Climate Change and Its Impacts

This section explores the impacts of climate change and introduces responses and solutions.

Date	Topic Module	Readings	Red Alert Readings & On-line Discussions	Class Activities & Assignments
10/22 & 10/24	Biome/Climate Regions of North America		"Realizing Our Human Selves in the Nature-Culture Nexus" (Pages 99-111) Discussion #6	Lab #4 Climate and Biomes
FIELD TRIP TO IOLKAM (Kitt Peak)—Biodiversity, Cultural History & Environmental —October 26th				
10/29 & 10/31	SW Climate change impacts and solutions: Climate Change, Water and TEK		Sovereignty: Self-Determination or Self Termination" (Pages 39-54) Discussion #7	Group Assignments: A Call to Action Project Introduction to the Man in Maze
11/5 & 11/7	Climate change impacts on Western Forests	Read "Back to the future: Deep time holds clues to climate change" (Pages 40-43), "Ecosystems: Worth saving?" (Pages 112-113), "Profile: James Lovelock..." (Pages 120-121), "Earth, Wind, and Fire," (Pages 134-135) and "Forests: Source or Sink" (Pages 174-175)	"Indigenous Knowledges: Where We Touch the Earth" (Pages 73-97) Discussion #8	Lab #5: Dendrochronology Rough Draft Controversy Paper for Peer Review Due : 11/7
11/14	Climate Change Impacts on Animals: habitat, species distribution, biodiversity	"The highway to extinction" (Page 118-119)	"The Truth is Not Inconvenient it is Deadly" (Pages 23-38) Discussion #9	Lab #6: Animal Biodiversity Controversy Paper due 11/14
11/19 & 11/21	Climate Change Impacts on Oceans: chemistry, global circulation, rising sea levels	Read "What can a decade of western North American drought tell us about the future?" (Pages 48-51), "What can the European Heat Wave of 2003 tell us about the future?" (Pages 52-55), "A Tempest in the Greenhouse: Have Hurricanes become more Frequent or Intense?" (Pages 56-57), "The Day After Tomorrow" (Pages 60-61), "The Last Interglacial: A Glimpse of the Future" (Pages 62-63), and "How Sensitive is the Climate?" (78-83)		Lab #7: Thermohaline Lab CR Presentations 11/19 Video : A Sea Change 11/21

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PART FOUR

Indigenous Knowledge: Solutions to Climate Change and its Impacts

This section focuses on human responsibility and the responses to climate change emphasizing the role of indigenous knowledge. This section uses the Air/East spoke of the wheel.

- Ecology/geography orientation to the Eastern Forests, culture of the Native peoples of the region and students at College of the Menominee Nation
- Tribal community sustainability and adaptation planning. Menominee Nation sustainable forestry program and climate change mitigation.
- Political and social responses to climate change. Understanding Kyoto and Copenhagen and the international agenda.
- Personal responses to climate change. Understanding an individual's carbon footprint, sustainable lifestyles, and responsible behavior towards our planet.

Dates	Topic Module	Dire Predictions Readings	Red Alert Readings & Online Discussions	Class Activities & Assignments
11/26	Indigenous Frameworks for Assessing and Responding to Climate Change		But what can I do about it?" (Pages 180-183) 7 "After Progress: A Reexamination of Traditional Technologies." (Pages 113-134) Discussion #10	Review of Tribal Climate Change Adaptation Plans
11/28	Responses to Climate Change: Politics and Social Action	"Global problems require international cooperation; Can we achieve sustainable development?; The ethics of climate change; The known unknowns and the unknown unknowns; The urgency of climate change" and "Where does that leave us?" (Pages 184-197)	"A Modest Conclusion: We Cannot Save Ourselves without Some Human Homeland Maturity" (Pages 135-139) Discussion #11	
12/3	Sustainability and Adaptation: Renewable Energy & Agriculture	"Famine: More people, less water, less food; A hard row to hoe," and "Greener Acres" (Pages 130-131, 152-153, & 170-173) "It's the economy, stupid!; Solving Global Warming; Where do all those emissions come from?; Keeping the power turned on; On the road again" and "Industrial CO2 pollution	Earth the Operator's Manual Synopsis and Discussion	
12/5	Responses to Climate Change: Human Health	"Global problems require international cooperation; Can we achieve sustainable development?; The ethics of climate change; The known unknowns and the unknown unknowns; The urgency of climate change" and "Where does that leave us?" (Pages 184-197)		Student Presentations on Adaptation Plans for Human Health Impacts
A Call to Action: Group Community-based Adaptation Plan and Presentations due: 12/10				

DISCLAIMER: This syllabus is designed to evolve and change throughout the semester based on class progress and interests. You will be notified of any changes as they occur.

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