



# IB 159: The Living Planet: *Impact of the Biosphere on the Earth System*

(3 units)

Course Summary and Syllabus  
Spring Semester, 2024

## Basic contact information

### Instructors

Ivo Duijnstee  
Jenn Wagner

### Email

duijnstee@berkeley.edu  
jenn\_wagner@berkeley.edu

### Office hours

Thursdays, 11am–noon  
Mondays, 1-2pm

## Course description

### *Prerequisites*

Biology 1B or consent of instructor.

### *Overview of the course*

Planet Earth is a complex, dynamic system in which the interplay between its components atmosphere, hydrosphere/cryosphere and lithosphere largely determines the conditions on the planet's outside that we inhabit. The different components exchange matter and energy through global element cycles, volcanism, weathering, evaporation, precipitation, radiation, absorption, etc.; thus continuously changing each other's properties. Also within the components energy and matter are perpetually cycled. Obviously, the changing physicochemical conditions of the abiotic environment have a profound impact on life on earth. Less generally known is what vast influence life continuously asserts on the abiotic components of the Earth System; in fact the biosphere itself is an important Earth System component. Interestingly, life – with its evolving species – forms a complex adaptive system. Therefore, with the addition of an adaptive, evolving component, some argue the earth system itself may have gained adaptive properties. We will discuss pros and cons of such Gaia-like views.

During our course we will briefly touch on General Systems Theory and Cybernetics. However, the focus will be on the ever-changing state of System Earth (especially in terms of global climate) throughout our planet's geologic history; in particular the effect the evolving biosphere has had on the Earth System over the last 3.5 billion years, and vice versa. We will cover a wide range of temporal and spatial scales (from sub-decadal to hundreds of millions of years, and from regional to global and beyond), and discover that variations in the Earth's state are governed by different sets of processes on different spatial and temporal scales. In the last part of the course we will focus on what some consider the recent emergence of yet another Earth System component: the *anthroposphere*. In the current age of human-induced climate change we cannot neglect to explore as to what extent this particular species of bipedal mammal affects the functioning of our planet.

### *Course format*

Two hours of lecture (Mon, 2–4PM) and two-hour discussion sections per week (Tue/Wed, 1–3PM; attendance is compulsory); additionally, there may be assignments.

### *Primary text (required)*

The Earth System, Third Edition (2010),  
by Kump, Kasting & Crane; Prentice Hall/Pearson.  
ISBN10: 0321597796  
ISBN13: 9780321597793

## Exams

There will be two exams, one midterm and one final. These exams may either be closed-book exams, or open-book/open-notes exams (we will discuss pros & cons as a group), with short-answer, as well as multiple-choice questions plus some fill-in-the-blanks. The exams will be based on the things you learned during lecture and the material covered during the discussions. Although the exams are not cumulative, a good understanding of the foundational concepts covered during the first part of this course will still be important for the second part.

Time and location of the **midterm**: Monday, March 11, 2024, in 107 Gen & Plant Bio, 2-4 pm (that's our regular lecture's time & place)

Time of the **final**: Tuesday, May 7, 2024, from 11:30 am to 2:30 pm. The location of the final exam has yet to be determined.

## Policies

### *Grading break-down*

Midterm (material from Part I&II)	37.5%
Final (material from Part III&IV)	37.5%
Class participation (incl. audience feed-back; good citizenship)	5%
<u>Sections (exhibit challenge, quizzes, etc.)</u>	<u>20%</u>
	100%

### *Grades*

The class can be taken for a grade and as pass/no pass. The letter grade **C-** or higher is required to pass this class. See also: <https://registrar.berkeley.edu/academic-records/grades> The grades will NOT be curved. Written grade appeals are accepted in a time window starting three days after the initial grade has been assigned until ten days after. Before or after this period appeals may not be considered. Students who wish to review their exam should email one of the instructors. Be aware that re-grades can result in point deductions as well.

### *Attendance and class participation*

Attendance is highly recommended for lectures and **required** for discussion sections. Additionally, part of your course grade will be based on your participation during section. However, obviously, if you have a legitimate reason for being late or missing a section entirely, like a family emergency or illness, please contact Ivo or Jenn as soon as possible. Written proof of the situation may be required. Typically, a few non-emergency, non-pre-approved absence in sections will likely merely result in point deduction, however frequent non-pre-approved absence is grounds for a failing grade.

### *Classroom (& Zoom) etiquette*

Being prepared, attentive listening and completion of in-class work is important. Perhaps needless to say: be courteous and be on time. Most importantly: treat your classmates with compassion and respect your fellow students and their opinions. We would like everyone to feel comfortable in our class. Please, no class-irrelevant laptop, tablet, or cell phone use during class—that is often quite distracting for your classmates.

### *Missed exams and missed or late assignments*

You are expected to take all exams at their scheduled date and time, but we know all too well that the reality of life can ruin our best intentions and plans. How we deal with missed exams and missed/late assignments and scheduling conflicts is something we decide together on an individual basis. If you know you are going to miss an exam, please contact Ivo well in advance. When you have missed an exam or assignment it is **up to you** to reach out about this so we can work something out before it's too late. Please rest assured that we want you to succeed in this class. We're always happy to help with scheduling conflicts and legitimate absence cases, but failure to bring it up can have unintended and consequences that could have been avoidable, so please don't hesitate to talk to us.

### *Reporting illness and family emergencies*

If illness or a family emergency does prevent you from making an exam, written proof of the situation may be required. Don't forget: we are always happy to help if we can, so please communicate so that your hardship can be taken into account, or that simple accommodations to mitigate the situation can be provided.

### *Extra credit opportunities*

Besides some potential bonus questions on exams, no extra credit opportunities are offered for this class.

### *Permissible and impermissible collaboration & academic honesty*

As you know students will be expected to produce their own work product (individually or collectively as a group when allowed) and utilize appropriate references when required. If you are unsure or uncomfortable about your skills in this area, please contact the Student Learning Center for some assistance. Of course, we assume this will not apply to you, but for completeness' sake we would like to state here that academic honesty violations are grounds for an F in this course, and that it will have to be reported to the Center for Student Conduct.

## Discussion and Lab Components

### *Assignments*

Your assignment and duties vary per discussion section, on which you will be briefed during the semester. In summary, this is what you will be doing during sections this semester:

- Make short quizzes – mandatory and (almost) weekly
- Participate in activities and discussions
- Ask questions about current topics in the readings or in class that you are confused about or that need further explanation, or about any tangentially related issue that we haven't covered in class
- Contribute to the UCMP Exhibit Challenge in the 2nd half of the semester (details later in the semester)

### *Short quizzes*

During section a total of about 11 quizzes will be given. These are meant as an incentive to make sure you are on top of your reading assignments. The very short quizzes will cover the readings that are assigned for the two lectures that took place the Monday before the discussion section (or in one instance also from the week before – see 'Schedule' on the next page and see the schedule in *bCourses*).

### *The UCMP Exhibit Challenge*

Together with Cindy Looy and children's book author & illustrator Hannah Bonner, we are in the process of developing a permanent exhibit on behalf of the UC Museum of Paleontology. It will have 11 panels on episodes in the history of our planet relevant to the relation between Earth and the biosphere. If you were to design this exhibit, what would you do? Pick one of the 11 episodes and design your own panel. Specific instructions will follow.

## Schedule

### Calendar of topics and readings

For a READING SCHEDULE from *Kump et al.*'s “THE EARTH SYSTEM, 3<sup>rd</sup> edition”, please see the table below. In our textbook, there is more emphasis on the abiotic than the biotic aspects of the Earth System—both now and in the geologic past. It is intended to provide a more detailed explanation and Earth-Science backbone for the lectures and discussion sections which will add the biotic perspectives. (Additional readings that may be used in the discussion sections and will be provided)

<b>I. INTRODUCTION &amp; THE EARTH SYSTEM COMPONENTS</b>		<b>READING</b>	
01/22	<b>L1</b> <i>Feedbacks &amp; Forcings</i> <b>L2</b> <i>Mother Earth</i>	CH2 p21–33 CH1 p18–19	[quizzed in D1] [quizzed in D1]
01/29	<b>L3</b> <i>Here comes the Sun</i> <b>L4</b> <i>Air</i>	CH3 p36–55 CH4 p57–70, CH10 p197–199	[quizzed in D2] [quizzed in D2]
02/05	<b>L5</b> <i>Water</i> <b>L6</b> <i>Ice</i>	CH5 p84–91, p96–106 CH6 p108–120	[quizzed in D3] [quizzed in D3]
02/12	<b>L7</b> <i>Rock</i> <b>L8</b> <i>Life</i>	CH7 p122–144 CH10 p199–208, if necessary: CH9 p176–188, CH13 p255–269	[quizzed in D4] [quizzed in D4]
02/19	PRESIDENTS' DAY		
<b>II. COMPONENT INTERACTIONS, GLOBAL CYCLES AND THEIR IMPACT ON LIFE</b>			
02/26	<b>L9</b> <i>Recycling Earth's exterior</i> <b>L10</b> <i>Recycling of the elements I</i>	CH7 p144–146 CH4 p70–82, CH8 p170–173	[quizzed in D6] [quizzed in D6]
03/04	<b>L11</b> <i>Recycling of the elements II</i> <b>L12</b> <i>Recycling of the elements III</i>	CH8 p149–162 CH8 p162–169	[quizzed in D7] [quizzed in D7]
	03/05&06: MIDTERM Q & A (during the Tue & Wed Discussion Sections)		
03/11	<b>MIDTERM</b> (during the Monday lecture) covering lectures L1–L12		
<b>III. IMPACT OF LIFE ON THE EARTH SYSTEM &amp; VICE VERSA: EXAMPLES</b>			
03/18	<b>L13</b> <i>Biogenic heating &amp; cooling</i> <b>L14</b> <i>Snowball Earth</i>	CH11 p210–224, CH12 p233–239 CH12 p240–252	[quizzed in D8] [quizzed in D8]
03/25-29	Yay! SPRING BREAK		
04/01	<b>L15</b> <i>Conquering continents</i> <b>L16</b> <i>Mother of all mass extinctions</i>	CH8 p158, p169 (A CLOSER LOOK), CH11 p224–231 CH13 p258–268	[quizzed in D9] [quizzed in D9]
04/08	<b>L17</b> <i>Cenozoic cooling &amp; ice ages</i> <b>L18</b> <i>Small-scale climate variations</i>	CH14 p272–293 CH5 p92–96, CH15 p295–301	[quizzed in D10] [quizzed in D10]
<b>IV. THE NEW EARTH SYSTEM COMPONENT: THE ANTHROSPHERE</b>			
04/15	<b>L19</b> <i>Dawn of the Anthroposphere</i> <b>L20</b> <i>Human footprint</i>	CH18 p361–376 browse CH17	[quizzed in D11] [quizzed in D11]
04/22	<b>L21/22</b> <i>Human-made climate/Public debate</i>	CH15 p300–318, CH16 p321–338	
04/23&24	<b>L23</b> <i>Our problem. our solutions; The future &amp; wrap-up</i>	CH19 p379–381	
	04/30&05/01: FINAL EXAM Q & A (during the Tue & Wed Discussion Sections)		
Tue 05/07	<b>FINAL EXAM</b> (11:30 am–2:30 pm)		

*Last day to withdraw from the course (with and without penalties)*

For Add/Drop Deadlines, see:

<https://registrar.berkeley.edu/registration/enrollment/>

and <https://registrar.berkeley.edu/calendar/>

## **Statement on accommodation**

Students who require accommodation for medical, religious or other reasons should contact the instructor at the start of the lecture series. We will be happy to accommodate students with disabilities, but we do require a letter from the Disabled Students' Program.

We would like everyone to get the most out of this course. If there is anything that prevents you from doing well in this class, please come and talk to us, so we can find out if there is something we can do to help.

As we have just emerged from an ongoing pandemic, our path forward could in theory still be characterized by last-minute, ad hoc changes and disruptions. This may be annoying, frustrating and can have a great impact on ourselves or those around us. Please be patient and considerate and try to treat each other with compassion and respect.

## **Disclaimer**

This syllabus may be subject to change. Please, check *bCourses* regularly for updates.

This syllabus is your handbook for the course. You are responsible for knowing and understanding all the information in it. Not knowing the requirements does not excuse you from fulfilling them.