

Interdisciplinary Indexing

Professor Elizabeth Trobaugh, English
Professor Steve Winters, Earth Science
Holyoke Community College
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Integration is a vital critical thinking skill worth teaching our students.

- Integrative learning does not just happen.
- Students learn from seeing models and from practicing.
- “Indexing” is a tool that teaches Integration.
- Link
<https://washingtoncenter.evergreen.edu/cgi/viewcontent.cgi?article=1173&context=lcrpjournal>

Indexing as scaffolding

Barber (2012) identifies three distinct developmental stages of integration that emerged from his interviews with undergraduate students from liberal arts colleges:

- **Connection**, the discovery of a similarity between ideas that themselves remain distinctive;
- **Application**, the use of knowledge from one context in another; and
- **Synthesis**, the creation of new knowledge by combining insights.

Based on Barber's framework, we used *interdisciplinary* indexing as a scaffolding strategy to integrate science and literature in our Learning Community (LC) classrooms at Holyoke Community College (HCC) and in the process uncovered how students developed integrative habits of mind over the course of a semester.

Indexing for Interdisciplinary Learning and Thinking

- Our experience: Learning Communities at HCC
 - 7-credit course combining freshman composition and a lab science
 - Cli-Fi and geology/Earth science

What is Cli-Fi, or climate change fiction?

Also known as climate fiction, eco-fiction, and eco-literature.

According to Wikipedia, “Climate fiction, popularly abbreviated as cli-fi (modelled after the assonance of “[sci-fi](#)”), is literature that deals with [climate change](#) and [global warming](#). Not necessarily speculative in nature, works of cli-fi may take place in [the world as we know it](#) or in the near future.”

https://en.wikipedia.org/wiki/Climate_fiction

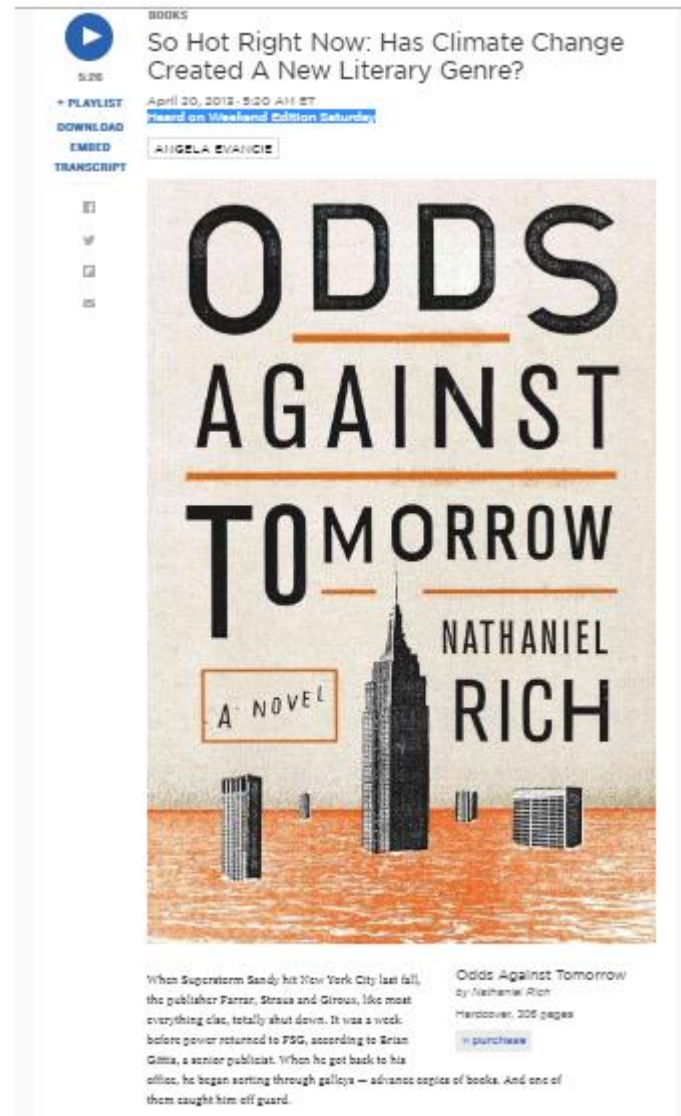
NPR: “So Hot Right Now: Has Climate Change Created a New Literary Genre?”

“Over the past decade, more and more writers have begun to set their novels and short stories in worlds, not unlike our own, where the Earth's systems are noticeably off-kilter. The genre has come to be called climate fiction — ‘cli-fi,’ for short.”

“I think we need a new type of novel to address a new type of reality, which is that we're headed toward something terrifying and large and transformative. And it's the novelist's job to try to understand, what is that doing to us?”

Nathaniel Rich, author of *Odds Against Tomorrow*, interviewed by Angela Evancie, *National Public Radio*, 20 April 2013.

<https://www.npr.org/2013/04/20/176713022/so-hot-right-now-has-climate-change-created-a-new-literary-genre>



HCC's Cli-Fi course in the news



REUTERS

Business

Markets

World

Politics

Tech

Commentary

Breakingviews

Money

LIFESTYLE | Fri Apr 10, 2015 | 1:35pm EDT

Move over sci-fi: 'Climate fiction' finds way into classrooms



By Kyle Plantz

LONDON (Thomson Reuters Foundation) - Students at a Massachusetts college have just read "The Windup Girl", the tale of a dystopian future Bangkok where climate change has pushed up temperatures and sea levels, and viruses acquired from genetically modified food are killing people.

The book, by debut novelist Paolo Bacigalupi, is the product of a new class at Holyoke Community College on "climate fiction" or "cli-fi", a relatively new variant of science fiction.

Around the world, from the United States to Britain to India, cli-fi classes are creeping into timetables as academics try to bring a growing international concern into the classroom in a lively way that combines science and emotion.

Interdisciplinary learning at HCC

"Cli-fi is capturing what is in the air now, the human impact on the environment, and I think literature is a great tool to raise awareness for this," said **Elizabeth Trobaugh** who teaches the class at Holyoke and earlier taught a class looking at real-life science in science fiction.

The class led by Trobaugh and fellow professor **Steven Winters**, called "Cli-Fi: Stories and Science of the Coming Climate Apocalypse", includes a two-hour science lab each week.

"We take some scientific topic introduced in the literature that can work as a lab and explore some of the themes discussed using an experiment," Winters said.

["Move Over Sci-Fi: 'Climate Fiction' Finds Way Into Classrooms,"](#) 10 April 2015

The New York Times

Spring 2018 LC 108: Cli-Fi: Stories and Science



Cli-Fi: Stories and Science of the Coming Climate Apocalypse is a Learning Community combining English 102 and Earth Science 120 (3-hour English credit *plus* an “E” 4-hour credit science lab course). Cli-Fi is a new sub-genre of science fiction that deals explicitly with climate change and imagines its impact on our world. We’ll be reading brand-new short stories and, of course, learn the geologic and environmental sciences behind climate change – ***and what we can do about it.***

MWF 9:00-9:50; MWF 10:00-10:50;

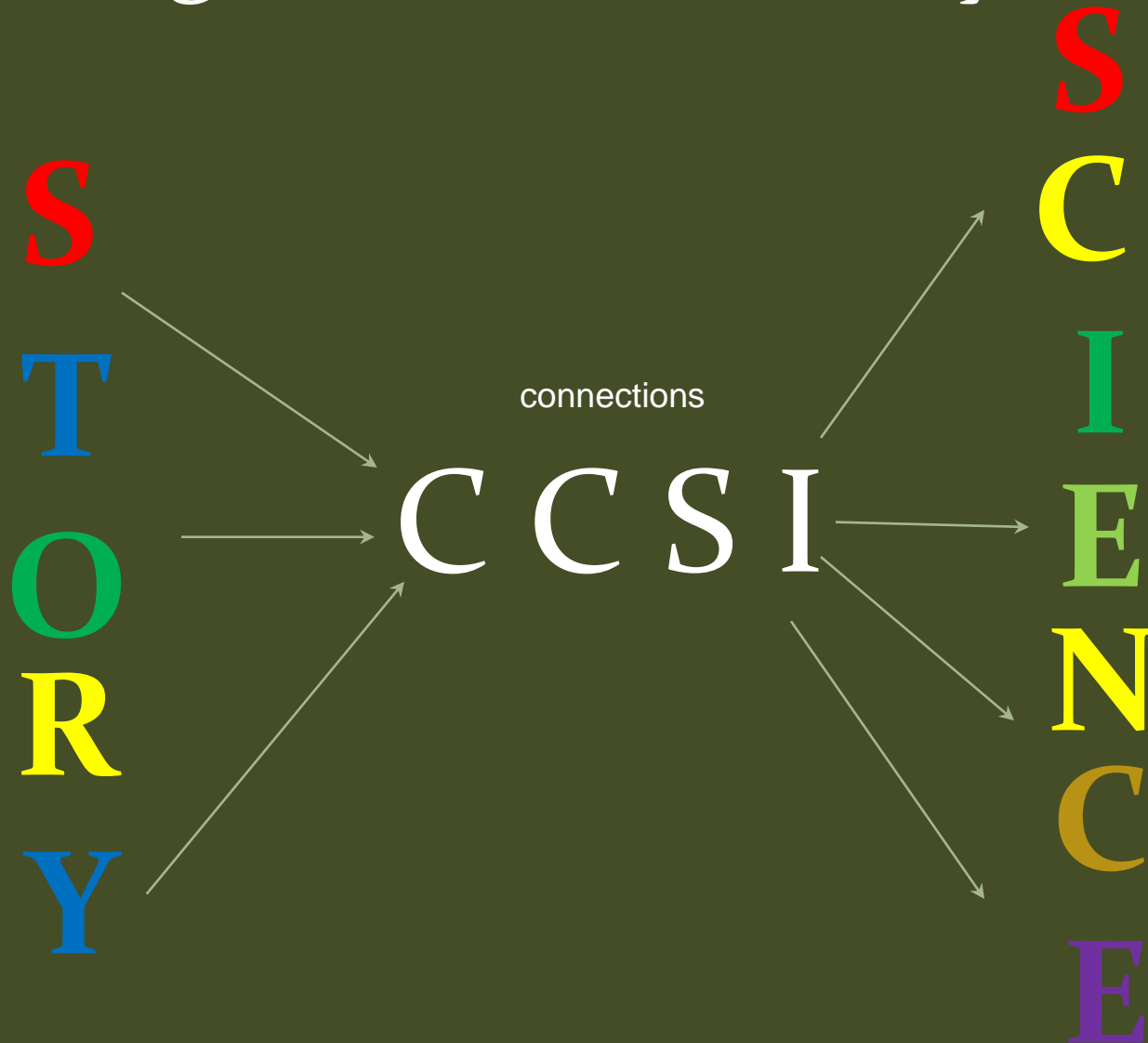
F 11:00-1:30 (lab)

Professor Elizabeth Trobaugh, English
Professor Steven Winters, Earth Science

The Climate Change Stress Index (CCSI), a chart that *invites* connections!

- Stress factors: climate change science
- Literary text: short stories

It all begins with the story ...



The Climate Change Stress Index (CCSI)

Climate change stresses the environment and human society in a variety of ways. In life and in literature, climate change stress manifests as:

- **Climate and weather imbalance and disorder** – extreme weather and geological events
- **Ecological imbalance** – animals, vegetation, water excess and/or drought
- **Resource scarcity**
- **Disease/illness/contamination**
- **Breakdown in infrastructure**
- **Breakdown in civilization, social order, government; political and economic instability**
- **Regression** – social, technological, civic

Our original form ...

LC 202

Trobaugh Winters



Climate Change Stress Index
For " _____," by _____

Instructions: Please contribute one factor (an example and a brief quote with page #) to this shared document. Write directly into this shared document.

Find passages that illustrate the following themes and features of the climate-changed world:

Stress factor/impact	Example from the text -- record a brief quote, with page #, and bullet point observation(s).	Contributor (put your name here)
Breakdown in infrastructure		
Breakdown in civilization/social order		
Climate imbalance/disorder		
Ecosystem imbalance-flora and fauna		

Example excerpts/activities

1. CCSI for “[People of Sand and Slag](#)” by Paolo Bacigalupi
2. Science narrative/textural editing, “[Ancient armored fish revises early history of jaws](#),” *ScienceNews*, November 26, 2016.

Excerpt 1 from “[The People of Sand and Slag](#)” by Paolo Bacigalupi

We ate sand for dinner. Outside the security bunker, the mining robots tumbled back and forth, ripping deeper into the earth, turning it into a mush of tailings and acid rock that they left in exposed ponds when they hit the water table, or piled into thousand-foot mountains of waste soil. It was comforting to hear those machines cruising back and forth all day. Just you and the bots and the profits, and if nothing got bombed while you were on duty, there was always a nice bonus. After dinner we sat around and sharpened Lisa’s skin, implanting blades along her limbs so that she was a like a razor in all directions (5).

Excerpt 2 from “The People of Sand and Slag”

Lisa laughed and took a spoonful of tailings. “We can eat anything. We’re the top of the food chain.”

“Weird how it can’t eat us.”

“You’ve probably got more mercury and lead running through your blood than any pre-weeviltech animal ever could have had.”

“That’s bad?”

“Used to be poison.”

“Weird” (6).

CCSI for “People of Sand and Slag”

- ❑ *Adaptation/mitigation*
- ❑ *Breakdown in civilization/social order*
- ❑ *Climate imbalance/disorder*
- ❑ *Positive and negative feedback loops*
- ❑ *Extinction*
- ❑ *Illness/disease*
- ❑ *Regression (psychosocial or biological)*
- ❑ *Resource scarcity*

ACTIVITY

Identify an index or factor expressed in the [excerpt](#).

Science concepts index – instructions

fa_19 ESC 115 indexing 'Ancient armored fish' DRAFT 1.docx

ESC 120 "Dinosaurs of New England" Narrative/Textual Indexing



Eotriplaris woodii TRASK, 1938, Devonian, Northwest Russia, Novaya Zemlya

By User:Staplebone, Self-photographed, CC BY-SA 3.0, <https://commons.wikimedia.org/wiki/File:Eotriplaris.jpg>

Discover your inner fish! Read the *ScienceNews* article "Armored fish revises early history of jaws," and in groups of two or three, find examples of the science concepts listed.

Row 2 has been done to get you started.

	Science concept, term, or phrase	Find an example from the text; record a brief quote and include a page number(s).	Contributor(s) (put your initials here)
1	Adaptation		
2	Binomial classification	In 2013, scientists found a fossil placoderm called <i>Eotriplaris woodii</i> with the three-part jaw of a bony fish (2).	SW
3	Evolution		
4	Fossil record		
5	Geologic period or date		
6	Jaw anatomy		
7			
8			
9			
10			

Science concepts index – an [ACTIVITY](#)



Theme Charting – instructions

ENG 101.33

Trobaugh F19



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The Sixth Extinction Theme Chart
-an exercise in recognizing and selecting textual evidence-
Chapter 3

Instructions: As you read the assigned chapters, look for passages that illustrate the themes listed below. For each chapter, select and record one passage to illustrate the theme of your choice. Write your contribution directly into this shared document.

- Introduce quotations with an effective signal phrase, identifying the speaker (person speaking), if there is one, and put the page number and the author's last name in a parenthetical reference. *Example:* Kolbert writes, "If you know how to look, you can probably find signs of the current extinction event in your own backyard" (18).
- If you are quoting someone who Kolbert is quoting, use this format: Edgardo Griffith, the director of a Panamanian Amphibian conservation center says, "We are losing all these amphibians before we even know that they exist" (qtd. in Kolbert 10). Notice that the signal phrase provides the speaker's credentials.
- After the quote, write at least one sentence explaining what theme the quote illustrates.
- Identify yourself in the contributor column.

Theme Charting – the chart

ENG-101.33

Tinbaugh-F19



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- Identify yourself in the contributor column.

Theme	Textual Evidence (quote and explanation)	Contributor
Biodiversity		
Natural selection		
Species extinction		
Humanity's environmental impact		
Environmental degradation		
Paradigm shifts/challenges		
Conservation		
Ecosystem services (be specific)		
Ecological interdependence or interconnectedness		
Use of Pathos		
Laugh/Chuckle		
Your choice		

Theme Charting – biodiversity

Theme	Textual Evidence (quote and explanation)	Contributor
Biodiversity	<p><u>Kolbert</u> states “Toward the end of the Beagle’s voyage, Darwin encountered coral reefs. These provided him with his first major breakthrough a startling idea that would ease his entree into London’s scientific circles. Darwin saw that the key to understanding coral reefs was the interplay between biology and geology. If a reef formed around an island or along a <u>continental</u> margin that was slowly sinking, the corals, by growing slowly upward, could maintain their position relative to the water. Gradually as the land subsided the corals would form a barrier reef. If, eventually, the land sank away entirely, the reef would form an <u>atoll</u>”(Kolbert 52). Depending on where the coral reef initially formed, <u>it could</u> adapt itself to be able to survive and thrive better.</p>	Jillian

Theme Charting – environmental degradation

Environmental degradation	<p>Kolbert writes, “Once the Funk Island birds had been salted, plucked, and deep-fried into oblivion, there was only one sizable colony of great auks left in the world, on an island called the Gierfuglasker or great auk skerry, which lay about thirty miles off southwestern Iceland’s Reykjanes Peninsula. Much to the auks’ misfortune, a volcanic eruption destroyed the Gierfuglasker in 1830. This left the birds one solitary refuge, a speck of an island known as <u>te Eldey</u>. By this point the great auk was facing a new threat: its own rarity. Skins and eggs were avidly sought by gentlemen, like Count Rabe, who wanted to fill out their collections. It was in the service of such enthusiasts that the very last known pair of auks was killed on <u>Eldey</u> in 1844.” The quote shows the pattern of humanity degrading the environment and species for the sake of our collections and prizes.</p>	
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Theme Charting – conservation

Conservation	Kolbert explains how Alfred Newton, Cambridge's first professor of zoology, fought for the protection of mating seabirds: "The bird that is shot is a parent," he observed in an address to the British Association for the Advancement of Science. "We take advantage of its most sacred instincts to waylay it, and in depriving the parent of life, we doom the helpless offspring to the most miserable of deaths, that by hunger. If this is not cruelty, what is?" Newton argued for a ban on hunting during breeding season, and his lobbying resulted in one of the first laws aimed at what today would be called wildlife protection: the Act for the Preservation of Sea Birds. (67)" When Newton discovered that the Auk was extinct	Katrina
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Fiction-to-Nonfiction Connections

ENG 102

F19

Group Work: Using any and all of the stories we have read so far, find two literary examples of the symptoms described in Henson.

1. In the Symptom column, introduce the symptom with a signal phrase.
2. In the Fiction column, record the literary passage, using a signal phrase.
3. In the Analysis column, write two analytical sentences explaining the connection between the fiction and the science, the short story and Henson's chapter.

Symptom/nonfiction	Fiction passage	Analysis	ID
Henson writes, "The last few years have seen Greenland's largest, speediest glaciers flowing seaward more quickly, yet more erratically. It's now apparent that these highly dynamic systems can move seaward in pulse that strengthen and weaken from year to year on top of longer-term depletion induced by climate change" (119).	Robert Silverberg writes, "The dry-dock kind of berg, it was, two high sides with a valley in between, and it was maybe 200 meters long, sitting far up above the water. Steaming curtains of fog shrouded its edges and the ship's ear was able to pick up the sizzling sound of the melt effervescence that was generated as small chunks of ice went slipping off its sides into the sea" (Henson 205).	The chapter in Henson describes the effect that global warming has on the ice sheets and sea levels in different parts of the world, and in turn Silverberg discusses the same idea in "Hot Sky", as opposing factions try to capture a melting iceberg.	AD CA DJ
Hurricanes and Other Storms	Jeffrey Ford writes, "Super storms, increasingly scorching temperatures, tornadoes that leveled cities, floods that redrew coastlines and snow in March were blamed by those in charge at the Oklahoma State House and by other oil company shills across the country on the sins of homosexuals, the result of god's wrath toward abortions and a turning away from the church" (Ford 2).	In Henson's chapter Hurricanes and Other Storms, he discusses how climate change has increased hurricanes and other storm activity. These storms can be the reason for floods, droughts, and extreme damages to cities all over the globe.	Gilbert Destiny Elisha

Fiction-to-Nonfiction Connections

ENG.102

F19

Extreme Heat	<p>In 2016 22 nations reached all time highs in temperature, highest being 129.0°F.(62)</p> <p>Heat waves aren't always dangerous to humans because of the heat itself, but rather the air pollution it creates.(63)</p>	<p>The temperature began to rise from the 90 degrees of the previous night toward the 120 it would no doubt reach that coming afternoon. An infernal breeze stirred, lifting the pervasive dust and swirling it over and around the pallet. In no time the atmosphere at ground level was thick with powdered dirt, decreasing visibility with each minute that passed.</p>	<p>Jalil Robbie Henry</p>
Oceans	<p>In "Hot Sky" Silverberg begins, "Out there in the chilly zone of the southern Pacific, somewhere between San Francisco and Hawaii, the sea was a weird goulash of currents, streams of cold stuff coming up from the Antarctic and coolish upwelling spirals out of the ocean floor and little hot rivers rolling off the sun-blasted continental shelf far to the east. Sometimes, you could see steam rising in places where cold water met warm" (203).</p>	<p>In Hansons chapter Oceans, he writes about rising sea levels, temperatures, acidification that is caused by human activities. To add on, excessive burning of fossil fuels that melt glaciers. In the passage we choose is shows that cold and warm water chillides together because the oceans level broke down caused by greenhouses.</p>	<p>Anthony Sam Willow</p>
Floods/ Droughts	<p>In "Hot Sky", Silverberg writes, "This berg was due to go to San Francisco, which was in a bad way for water just now.... There hadn't been any rain along the Pacific seaboard in ten months"(205).</p>		<p>Man Matt Katrina Axel</p>

Conclusions

- Indexing gives students a map, or checklist, to integrate their thinking.
- With an index, students can read one discipline or another and pair passages and examples from their reading.
- Indexing can be both a teaching strategy for faculty and a hands-on learning strategy for students.
- Students learn from each other by seeing their classmates' contributions to the chart.
- Indexing serves as scaffolding for student learning and may also serve as a multi-purpose tool for assessing how students integrate their learning.

References

Barber, J, (2012, June). Integration of learning: A grounded theory analysis of college students' learning. *American Educational Research Journal*, 49(3), 590–617. doi: 0.3102/0002831212437854