

# Portrayals of Climate Change in US History Textbooks

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# Motivation

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- **Anthropogenic climate change** is scientific consensus (Cook 2009, Edwards 2010, Edwards 2020, [climate.nasa.gov/scientific-consensus](https://climate.nasa.gov/scientific-consensus))
- Textbooks are meaningful benchmarks as sites of **'legitimate knowledge'** from the perspective of the state (Apple 1993; Benavot 2005)
- Prior research has found that textbooks may be a **key diffuser** for environmental concerns, as well as a **source for misconceptions** around climate science (Bromley, Meyer, and Ramirez 2011; Choi, Niyogi, Shepardson, and Charusombat 2010).

# Motivation

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- ***SDG Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*
  - **Target 4.7:** By 2030, ensure that all learners acquire the **knowledge and skills** needed to promote **sustainable development**, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development
  - **Indicator 4.7.1:** Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

# Focus on Civics & Soc. Studies

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- In light of the anti-racist movements of the past year, a lot recent attention has been directed towards **revising civic and social studies education**
- However, **climate change and sustainable development** are mostly excluded from these discussions, despite these being long-term problems that affect citizens both in the U.S. and globally
- Rather than focusing on the content of scientific textbooks with respect to climate change, we are interested in **how civics and social studies textbooks portray climate change as a collective problem to be solved through citizen action**

# Focus on Civics & Soc. Studies

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- Problems of climate change and sustainable development are not just technical, they **require solutions with civic and social dimensions**
  - e.g. Coffee Farming in Protected Indonesian Rainforests
  - e.g. Resistance to Tree Planting in Detroit
  - e.g. Community Silence on Poisoned Water from Fracking

# Literature

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- Prior studies relevant to portrayals of environmental and climate change issues can be grouped into the following buckets, which may motivate our analysis:
  - The relationship between humans and the environment
  - Manipulations of the scientific norm of skepticism/uncertainty
  - Differential portrayals of causes of/solutions to climate change
  - California and Texas as meaningful cases of climate change discourse

# Human/environment relationship

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- The framing of a **dichotomy between humans and the environment** undermines the ability for students to understand human actions as causing climate change, as well as the potential for students to see how taking action now may help to mitigate climate change in the future (Lakoff 2010).
- The U.S. increasingly treats **organizations as actors**, but does not afford the same to non-human organisms or other features of the **natural environment** (Choi, D'Apice, and Skinner 2021; Kimmerer 2013)



# Skepticism/uncertainty

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- **Organized skepticism** is a core norm of the scientific community (Merton 1973).
- However, when this norm of skepticism is translated to public discourse through other institutions, including education and mass media, it may be **portrayed as uncertainty** that then becomes an **obstacle** to climate change action (Hayden 2011).



# Who are the problem-solvers?

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- In some cross-national studies, environment-oriented textbooks were found to emphasize human rights above national citizenship, and sought to **engage students as agentic actors** (Bromley, Meyer, and Ramirez 2011)
- Studies have also found **technocratic discourses** in education, which suggest that climate change can only be solved by specialized professionals and scientists, with regular individuals having little to no potential for impact (Halliday and Martin 1993).

# Research Questions

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1. What proportion of textbook content mentions terms relevant to climate change?
2. Within sentences that mention terms relevant to climate change, what types of narratives emerge, particularly with respect to climate change as a collective problem for citizens?

As social scientists, we are interested in examining the extent to which climate change is included in civics and social studies textbooks as a problem to be solved collectively.

# **Data & Analytic Strategy**

# Data

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- Textbooks were sampled for wide use in TX and CA, two of the largest textbook markets that influence national textbooks
- Published between 2003-2019.
- 18 U.S. civics & history textbooks from California
  - Used district-level adoptions of the twenty largest districts to sample for the most widely used in the state
- 15 U.S. civics & history textbooks from Texas
  - Texas makes its district-level textbook purchase data available online via the Texas Education Agency. Selected titles which occurred in at least 10 district-level transactions.

# CA & TX as comparison cases

- California and Texas are two of the **largest textbook markets** in the United States, making their content decisions **consequential for students across the country**.
- Their contrasting political leanings as well as **divergent treatment of climate change in state standards** make them ripe sites for comparison.
- Unclear the extent to which actual textbook content will reflect these differences

## National Center for Science Education Report 2020

	It's real: Recent climate change is a genuine phenomenon	It's us: Human activity is responsible for the global change in climate	It's bad: Climate change is affecting and will continue to affect nature and society	There's hope: It is possible to mitigate and adapt to climate change
CA	B	B	B	B+
TX	F	D	F	F

# Analytic Strategy

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Combination of computational and qualitative methods to both (a) measure space, and (b) identify topics

- Measuring space: What is the proportion of sentences in a book that discuss various sustainable development topics?
- Identifying topics: After pulling the above sentences, what types of topics are associated with climate change-relevant terms, as identified through LDA topic modeling?

# Climate change dictionary

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We created a high-school level “climate change dictionary” to help identify sentences related to climate change topics.

Steps:

1. Made a list in our research group based on specialized knowledge
  - Expertise: Graduate student in sustainable development; climate activist in U.S.; professor and graduate students that have studied social science education and education for sustainable development
2. Examined terms within ‘ideal’ climate change vocabulary lists and glossaries, especially ones intended for high school & official documents
  - United Nations’ “Sustainable Development Goals” (2015), Boston University’s “Sustainability Glossary of Terms” (2009), and the U.S. Environmental Protection Agency (EPA)’s “Glossary of Climate Change Terms”



# Climate change dictionary

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We created a high-school level “climate change dictionary” to help identify sentences related to climate change topics.

Steps (continued):

3. Look at frequently occurring words in the textbooks themselves (i.e. more than 200 times) to see if we had missed any relevant terms
4. Result: 147 terms used almost exclusively to discuss relevant content

# Climate change dictionary

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- Terms included
  - Obvious Terms: climate change, global warming, greenhouse gas, pollution, overfish, acidification, desertification
  - Key People, Acts, Events: Rachel Carson, Green New Deal, Clean Water Act, EPA, Kyoto Protocol, Bonneville Dam, Greenpeace, Sierra Club, Exxon Valdez, BP Oil Spill
  - Renewable Energy Sources: geothermal, wind power, hydro power, solar power
- Terms excluded
  - Geographic descriptors: forest, ocean, wetland, grassland, river, ice age, nature
  - General terms about development: globalization, arable, grazing, agriculture, livestock, crop, Industrial Revolution
  - Words that appeared with many other uses: lead (as in “leader” rather than the element)

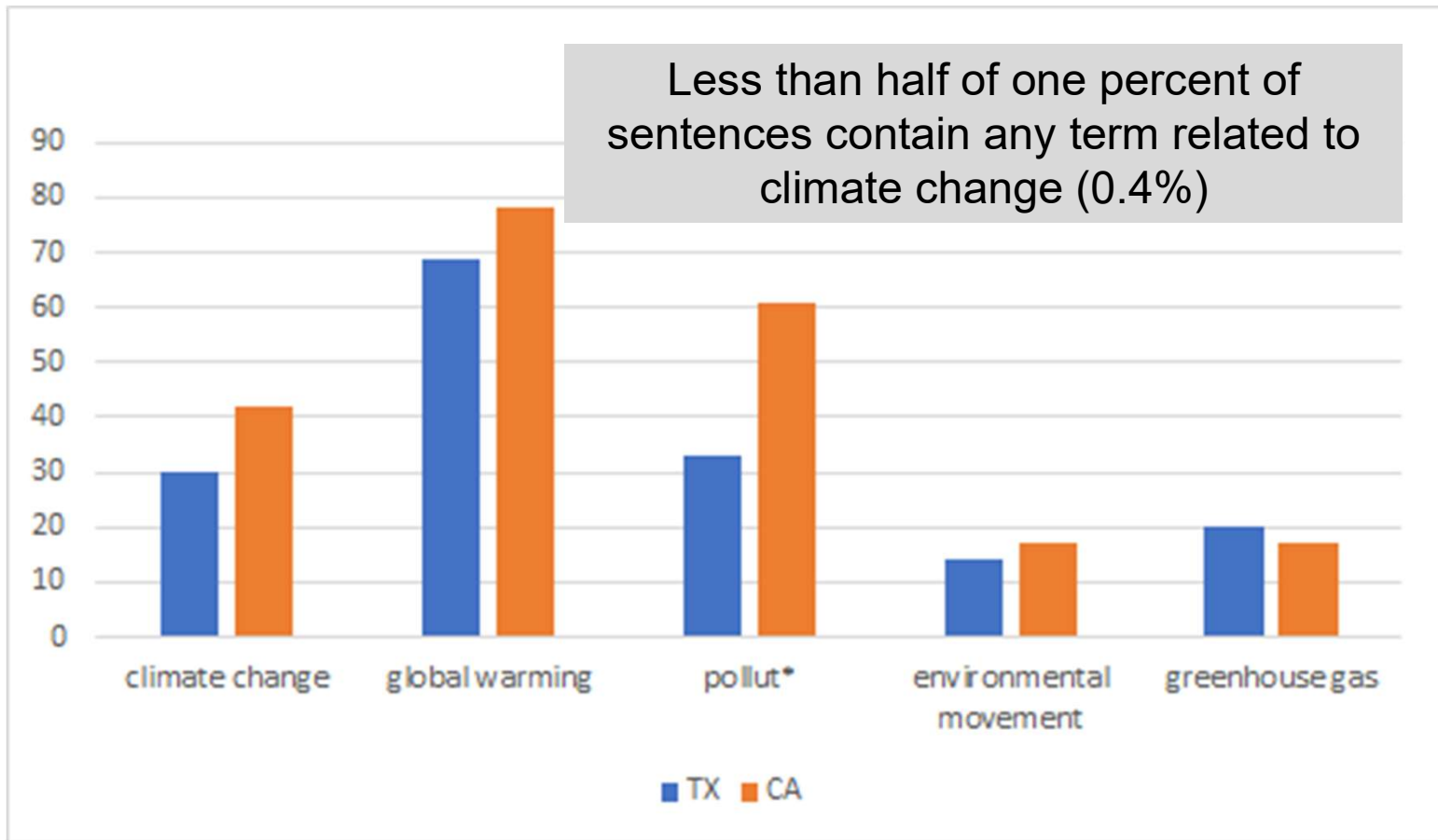
# LDA Topic Modeling

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- After identifying the sentences that include climate change-related terms, we perform LDA topic modeling to identify narratives within these sentences
- $n = 2365$  sentences identified across all textbooks as incorporating terms relevant to climate change, with an average length of 14 cleaned tokens (excluding stop words)

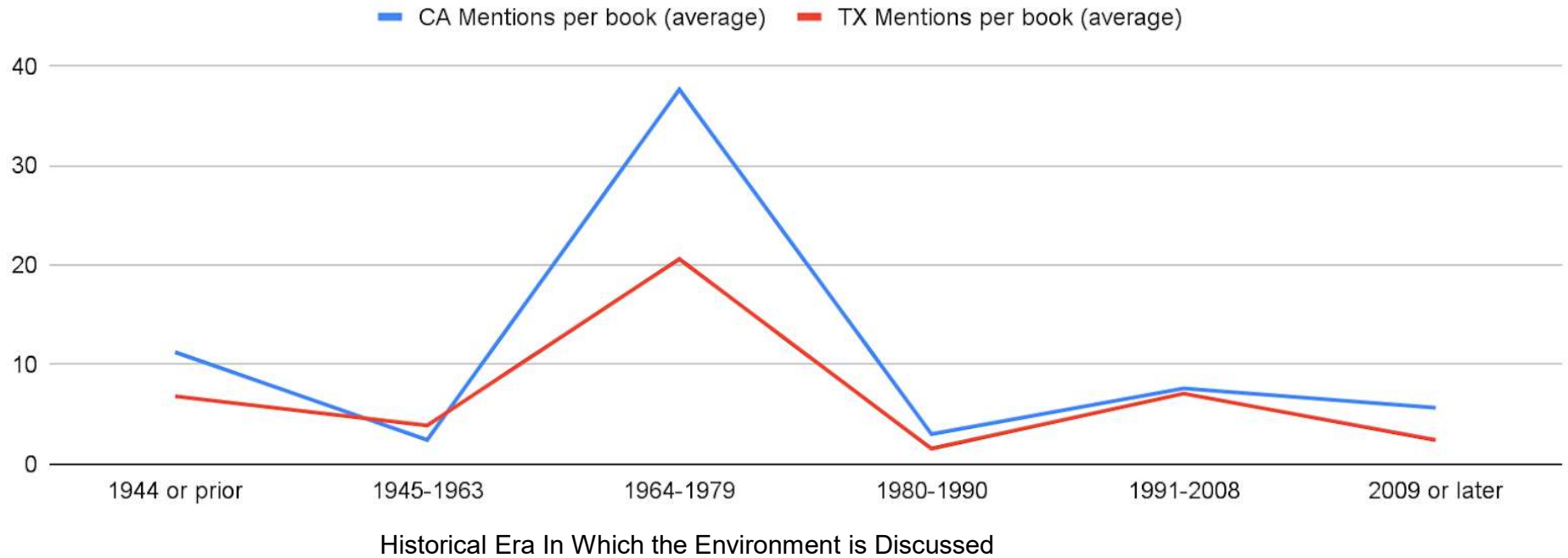
# Findings

# Counts of core terms per state

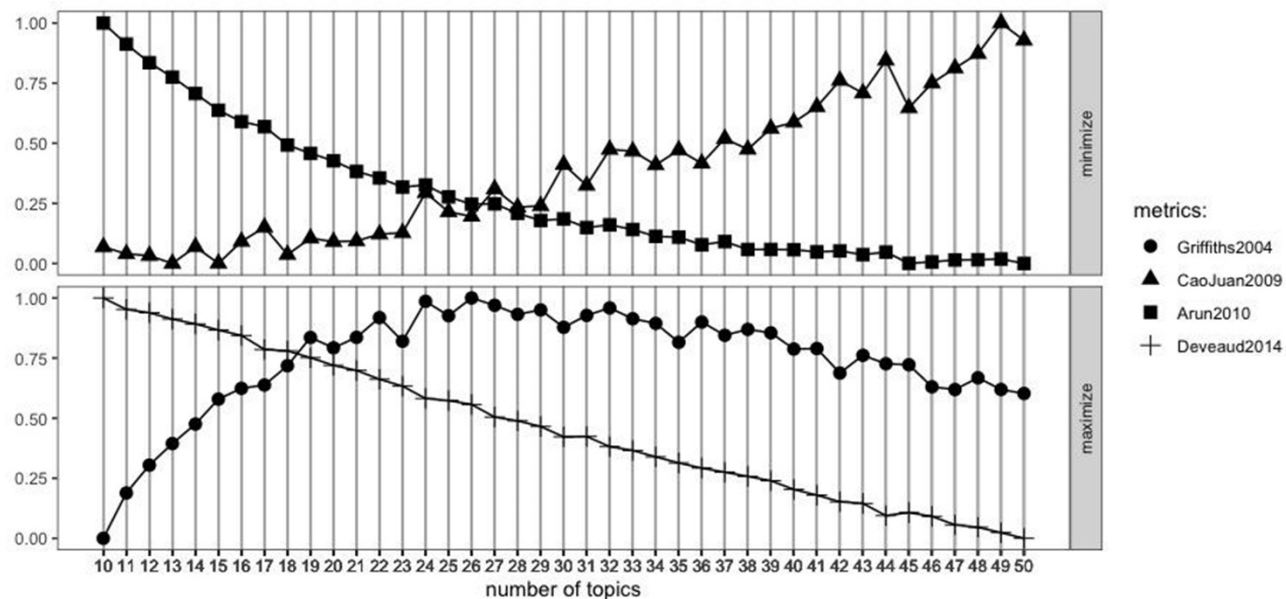


# Environmentalism is depicted mainly in the past

CA vs. TX: Average mentions of "environmental" per book



# LDA Topic Modeling



Selecting between different values of k:

- Examine the values of four performance metrics (Griffiths et al 2004, Cao Juan et al 2009, Arun et al 2010, and Deveaud et al 2014)
- Compare the term exclusivity of topics (Airoldi & Bischof, 2012; Roberts et al., 2014)
- Manually check semantic validity (Quinn et al 2010)

Decided on k=18



# Topic content

#	Topic Title	Top 10 Terms	Exemplar Sentence
1	<b>National Parks</b>	nation, park, establish, yellowston, servic, system, part, includ, creation, acr	"The government set aside about 12 million acres of land for new national parks, including Shenandoah National Park in Virginia, Kings Canyon National Park in California, and Olympic National Park in Washington State."
2	<b>Nuclear Power</b>	nuclear, power, energi, plant, mile, island, sourc, accid, pennsylvania, oppon	"Opponents of nuclear energy contended that nuclear plants, and the wastes opponents of nuclear energy produced, were potentially dangerous to humans and opponents of nuclear energy's environment."
3	<b>Earth Day &amp; Activism</b>	day, earth, peopl, support, million, activ, event, celebr, point, april, commun	"With three major events serving as catalysts, environmentalism became a certifiable mass movement on the first Earth Day, April 22, 1970, when 20 million people gathered in communities across this country to express 20 million people's support for a cleaner, healthier planet."
4	<b>General Public Works (mostly in the form of lists)</b>	valley, tennesse, author, tva, develop, dam, project, electr, program, deal	"Works Progress Administration, Social Security, National Labor Relations Board, farm programs, regional development policies, and energy development projects such as the Tennessee Valley Authority, California Central Valley Project, and Bonneville Dam"
5	<b>Human impact of natural disasters</b>	effect, region, movement, california, natur, econom, agricultur, left, disast, impact	"Discuss the human toll of the Depression, natural disasters, and unwise agricultural practices and their effects on the depopulation of rural regions and on political movements of the left and right, with particular attention to the Dust Bowl refugees"
6	<b>Fossil Fuels</b>	natur, oil, resourc, coal, environ, year, spill, gener, price, mexico	"Supporters of nuclear energy hailed it as a cleaner and less expensive alternative to fossil fuels, such as coal, oil, and natural gas, which are in limited supply."

*\*Note: In these versions of sentences, pronouns were replaced with the nouns to which they referred during text processing*

# Topic content

#	Topic Title	Top 10 Terms	Exemplar Sentence
7	<b>Students Analyze Impacts</b>	human, polici, issu, analyz, environ, result, modif, student, impact, physic,	"Analyze the impact of physical and human geographic factors on the settlement of the Great Plains, the Klondike Gold Rush, the Panama Canal, the Dust Bowl, and the levee failure in New Orleans after Hurricane Katrina."
8	<b>Conservationists</b>	john, muir, roosevelt, club, sierra, pinchot, gifford, forest, yosemit, naturalist,	"Through naturalist John Muir (1838-1914)'s friendship with President Theodore Roosevelt, naturalist John Muir (1838-1914) persuaded President Theodore Roosevelt to greatly increase the amount of protected public land."
9	<b>Dust Bowl</b>	dust, bowl, great, plain, farmer, famili, drought, oki, depress, farm,	"Write two to three paragraphs: describing the Dust Bowl, the Dust Bowl's causes, the Dust Bowl's effect on people, and how the Dust Bowl made the Great Depression worse for those living on the Great Plains."
10	<b>Henry David Thoreau</b>	thoreau, david, henri, civil, live, emerson, walden, disobedi, tax, life, ralph, refus, societi,	"In Henry David Thoreau's 1849 essay "Resistance to Civil Government," Henry David Thoreau extended Henry David Thoreau's critique of artificial constraints in society to government, arguing that when government required an individual to violate Henry David Thoreau's or her own morality, it had no legitimate authority."
11	<b>Land Projects and Funding</b>	govern, conserv, feder, industri, land, public, creat, establish, work, administr,	"Private groups, such as the Nature Conservancy and local land trusts, have raised money to purchase forest and watershed lands and keep forest and watershed lands pristine."

# Topic content

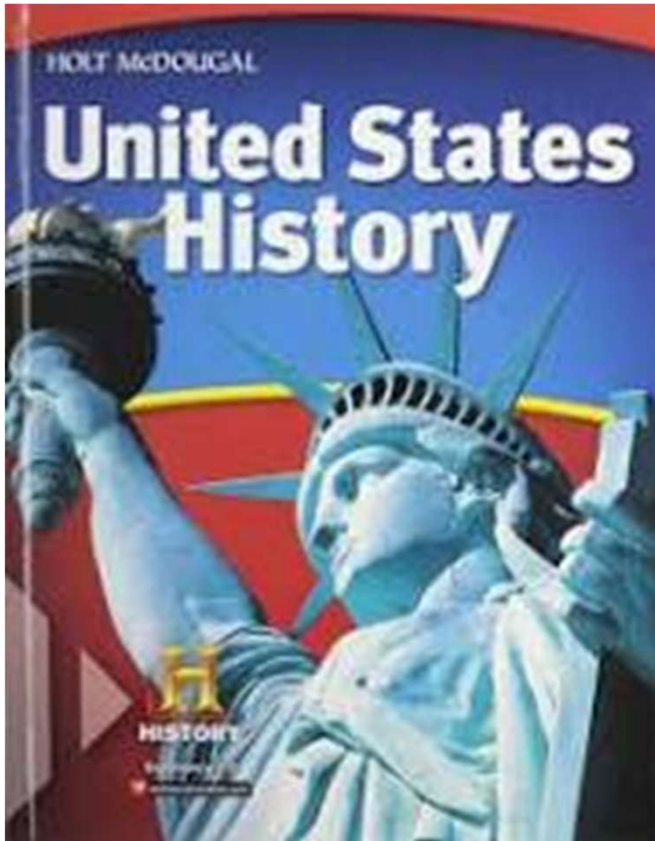
#	Topic Title	Top 10 Terms	Exemplar Sentence
12	<b>Kyoto Protocol</b>	presid, kyoto, climat, protocol, emiss, reduc, sign, call, countri, treati,	"In 1997, representatives of the major industrial nations met in Kyoto, Japan, and agreed to a broad treaty to reduce carbon emissions to slow or reverse global warming."
13	<b>Science of Global Warming</b>	global, warm, carbon, fuel, increas, dioxid, fossil, time, greenhous, scientist,	"During this time, another environmental issue emerged when some scientists warned that global warming could lead to more droughts and global warming an increase in average world temperatures over time." // "Former vice president Al Gore, whose 2006 film, An Inconvenient Truth, may have done more to raise awareness of the threat of global warming than any other recent event won an Academy Award as Best Documentary Feature, and Gore won the 2007 Nobel Peace Prize for Gore's efforts on behalf of the movement Gore has championed."
14	<b>Clean Air Act</b>	act, air, clean, water, pollut, congress, standard, qualiti, pass, set,	"Following a new Clean Air Act that added several amendments to the Clean Air Act of 1963, Congress also passed a new Clean Air Act that added several amendments to the Clean Air Act of 1963, in addition to laws that limited pesticide use and curbed strip mining the practice of mining for ore and coal by digging gaping holes in the land."
15	<b>Environmental Controversies</b>	environment, protect, agenc, epa, law, advoc, controversi, nixon, creat, safeti,	"Trace the impact of, need for, and controversies associated with environmental conservation, expansion of the national park system, and the development of environmental protection laws, with particular attention to the interaction between environmental protection advocates and property rights advocates"
16	<b>Rachel Carson</b>	carson, rachel, silent, spring, book, pesticid, publish, marin, biologist, chemic,	"In 1962, marine biologist Rachel Carson published marine biologist Rachel Carson's book Silent Spring, which warned of the destructive effects of pesticides."
17	<b>Public Structures</b>	american, area, build, earli, west, home, import, citi, worker, question, today	"The PWA was responsible for building many important structures that are still in use today, such as New York City's Triborough Bridge, the Overseas Highway linking Miami and Key West, Florida, and the Bonneville Dam on the Columbia River in the Pacific Northwest."

# “Parent codes” for topics

Parent code	Topics
<b>Government environmental actions</b>	(1) National Parks, (3) Land projects and funding, (4) Public Works, (12) Kyoto Protocol, (14) Clean Air Act, (17) Public Structures,
<b>Development and dangers of human activity</b>	(2) Nuclear Power, (5) Human impacts of natural disasters, (7) Students analyze impacts, (6) Fossil fuels, (9) Dust Bowl
<b>Environmental Activism</b>	(8) Conservationists, (10) Henry David Thoreau, (16) Rachel Carson, (3) Earth Day & Activism
<b>Climate Science</b>	(13) Science of global warming
<b>Environmental controversies</b>	(17) Environmental controversies

# Discussion

# Skepticism/uncertainty



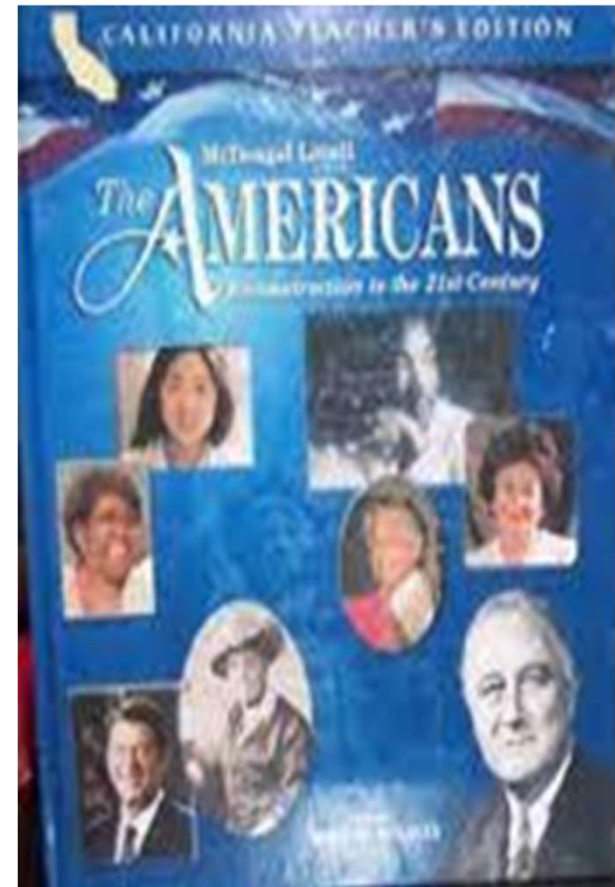
Textbooks present science as uncertain and undecided with respect to climate change. Moreover, students are explicitly prompted to take on positions of skepticism.

- “Scientists also speculated that global warming affected rainfall patterns and storms, increasing droughts, wildfires, and hurricanes.”
- “What are the competing views on global warming?”
- “What core arguments support and question the theory of global warming?”
- “What controversies are associated with the concept of climate change and with environmental conservation?”
- “Trace the impact of, need for, and controversies associated with environmental conservation...”

# Who are the problem-solvers?

Climate change is not necessarily portrayed as a problem to be solved by regular students and citizens, but rather by “**Great Men**” through large-scale projects. Only one topic highlights environmental activism by **regular people** through “Earth Day”

- “Later in 1970, **President Nixon** signed the legislation creating the Environmental Protection Agency.”
- “**Bush** supported the Clean Air Act that toughened air quality standards and pollution controls.”
- “Former VP **Al Gore**’s 2006 film, *An Inconvenient Truth*, may have done more to raise awareness of the threat of global warming than any other recent event.”
- “**Obama** said he would use executive authority to institute action on climate change.”





# Human/environment relationship

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- People that impact the environment are Great Men, but the environment affects everyone. **Who the agent is** changes depending on the direction of the change. Less discussed are how **private citizens** can impact the environment, either directly or indirectly.
- An important omission from the content is **private companies** as a **cause** of climate change

# Human/environment relationship

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Discussion of private groups and private action is limited.

## Examples portrayed positively

- “**Private groups**, such as the Nature Conservancy and local land trusts, have raised money to purchase forest and watershed lands and **keep forest and watershed lands pristine.**”
- “Lastly, private groups and voluntary organizations play an increasing role in **promoting public awareness** and protecting the environment, such as the Sierra Club, founded in California by conservationist John Muir in 1892.”
- “**Private citizens** can file **lawsuits against polluters** under the Environmental Protection Agency.”

## Examples portrayed negatively

- “...Forest Bureau in **1887** and the subsequent withdrawal from the public sale of 45 million acres of timberlands for a national forest reserve, the government stood by while **private interests gobbled up** the shrinking wilderness.”
- “The damage the giant tanker **Exxon Valdez** caused to the nearby shoreline and wildlife also greatly increased environmental consciousness.”
- “In 2010, a BP (British Petroleum) offshore well, **Deepwater Horizon**, suffered a crippling explosion that sent approximately 5 million barrels of oil into the Gulf of Mexico.”

# Human/environment relationship

- Only 5 sentences in the sample discussed either Exxon Valdez or Deepwater Horizon, and all 5 were in the Texas textbooks. Other than that, negative portrayals of private interests are relegated to the time periods of early conservationists.
- The portrayals of actions private citizens can take include raising awareness, purchasing land for conservation, and filing lawsuits under the EPA.

# CA/TX state comparisons?

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- While the standards between states are quite different, the actual content of the textbooks tends to be more similar than different – and far more similar than we might expect given divergent political and economic contexts
  - When topics are run by state individually, the vast majority (14 of 18) are directly comparable between the states, e.g...
    - Roosevelt/Pinchot/Gifford, Henry David Thoreau, John Muir, Rachel Carson, EPA/Nixon, Clean Air Act, Kyoto Protocol, Tennessee Valley Authority, National Parks, Earth Day, Dust Bowl, Nuclear Power, Fossil Fuels, Students Analyze...
  - What is unique between the two are which additional political actors might be highlighted (e.g. Bush vs Gore), and some private organizations (e.g. Sierra Club)
  - Will perform STM as robustness check

# Conclusions

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Our findings suggest that textbooks in our sample tend to maintain discourses around climate change that suggest

- (1) There remains controversy and uncertainty around whether climate change is human-driven and/or solvable through human actions
- (2) If solvable, mainly Great Men can address climate change and environmental issues, and only through large-scale projects
- (3) Private organizations, if mentioned, are highlighted as positive contributors to addressing climate change and environmental issues, rather than pointing to other private organizations that are contributors to environmental problems

Taken together, these themes may serve as **obstacles** to both teaching students about **collective climate change action**, as well as providing students with the **knowledge and skills** needed to promote sustainable futures.

# Thank you from our research team!

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and Lucy Li for their advice and input!

Please contact Hannah D'Apice ([hdapice@stanford.edu](mailto:hdapice@stanford.edu)) or Patricia Bromley ([pbromley@stanford.edu](mailto:pbromley@stanford.edu)) for questions or comments.

# **Extra info on textbook approval processes**

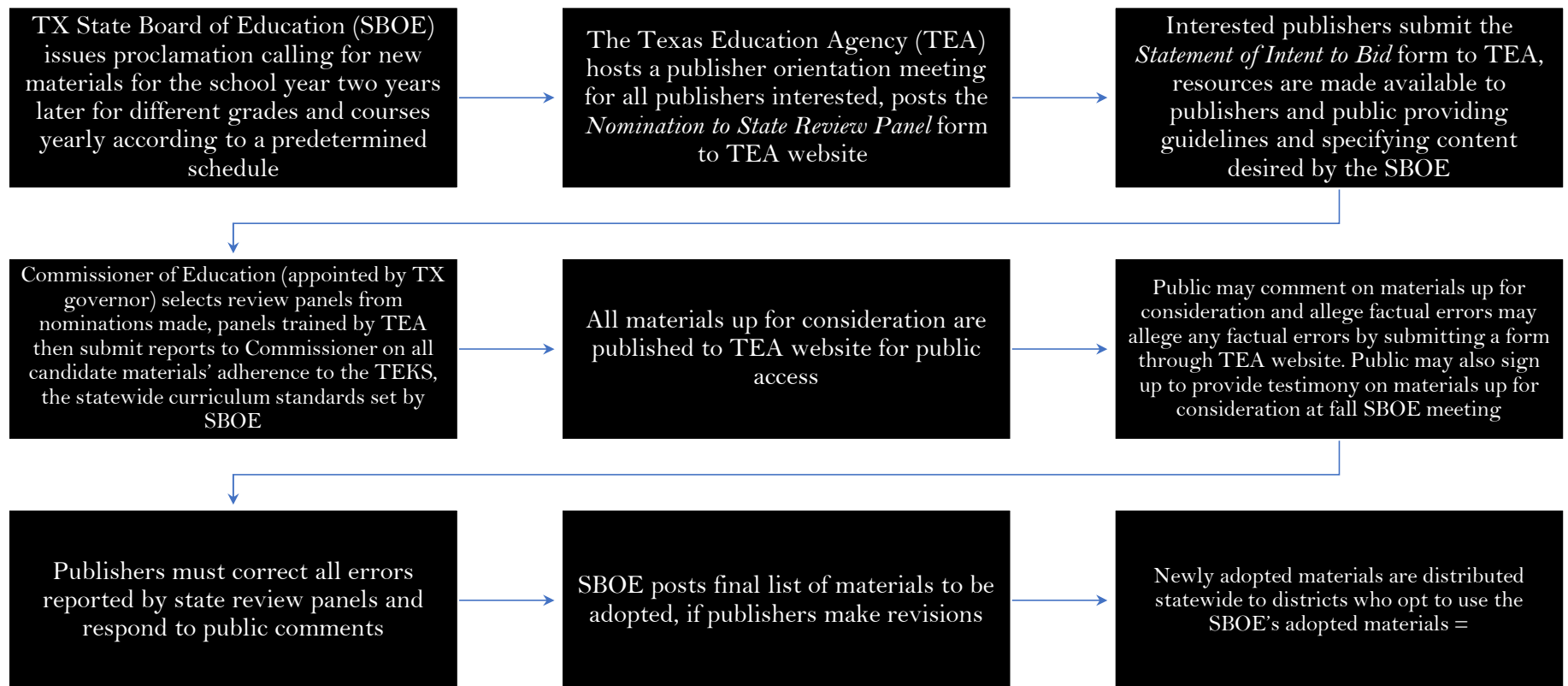
# California's High School Textbook Selection Process

- The governing board of a local district either runs its own adoption process by forming a selection and approval committee as recommended by the California Education Code (EDC), or leaves the adoption process to their high schools (sometimes with guidelines).
- High schools employ develop similar processes.
  - Some districts issue an approved list of publishers.
- Whether the process is organized by a district or its high schools, the process is fairly like state adoption processes: **ask for bids from publishers-->establish selection/review committee-->invite public input-->ask for or require revisions from final candidate-->adopt and distribute materials.**
- The California Department of Education (CDE) maintains that it supports the autonomy of local districts and that its content standards are merely a backbone for curriculum and material adoption, not a suggestion of how curriculum should be delivered or taught.



# Texas's High School Textbook Selection Process

Statewide for grades K-12, local districts not mandated to use adopted textbooks/materials but most do.\* Proclamations are issued yearly asking for material bids for the school year two years later.



\*Districts not required by law to use state-adopted materials as of 2011.

## California History Standards

- ...analyze **human modifications** of landscapes and examine the resulting **environmental policy issues**.
- ...discuss the **human toll** of the Depression, natural disasters, and unwise agricultural practices
- ...discuss the diverse environmental regions of North America, their relationship to local economies, and the **origins and prospects of environmental problems** in those regions and impacts in California.
- ...trace the **impact of, need for, and controversies associated with environmental conservation**, expansion of the national park system, and the development of environmental protection laws, with particular attention to the interaction between environmental protection advocates and property rights advocates.

## Texas History Standards

- ...analyze the **impact of physical and human geographic factors** on the Klondike Gold Rush, the Panama Canal, the Dust Bowl, and the levee failure in New Orleans after Hurricane Katrina.
- ...identify the **roles of governmental entities and private citizens in managing the environment** such as the establishment of the National Park System, the Environmental Protection Agency (EPA), and the Endangered Species Act.