EARTH 2100—ACT TWO

BOB WOODRUFF
The year is 2015, six short years from now, and the best laid plans are getting underway. A wave farm off Scotland is harnessing the ocean's energy.[1] Vatican City has gone totally solar.[2] And here in America, cars are running cleaner and more efficiently.[3] Still we cling to that old habit…oil. And it's getting harder and more expensive to find.[4]

NEWSCAST
Across the US people are going to extremes to find gas price relief. In California...[5]

THOMAS HOMER DIXON
Professor, Centre for Environment and Business, University of Waterloo
We could see – doubling, or tripling of real oil prices, that's after inflation.

MICHAEL KLARE
Professor, Peace & World Security Studies, Hampshire College
We are running out of oil, and we've created a society, the American way of life is what we call it, based on the assumption that oil will be plentiful forever.

THOMAS HOMER DIXON
The large spread out suburbs that we've grown accustomed to, the strip malls, the big box stores with their enormous parking lots around them all of those have been made possible because we have had cheap gasoline as energy becomes much more expensive, you'll see that those areas become less desirable places to live.

MARCH 2015
Graphic Novel Element:

LUCY
The first time I moved? I was six. Everyone was leaving the suburbs for the city. There were new jobs and you didn't need a car for everything. My dad was going to work on new streetcar system in Miami.[6] And my mother told me we were going to live on the top floor of an apartment building. When we looked out the window, she said, the tops of the palm trees would be below us. I was excited, but I also a little sad to leave.

BOB WOODRUFF
As the price of oil goes up, it will ripple through every part of the global economy.[7]

NEWSCAST
Outrage over skyrocketing food prices...reached the halls of Congress today.[8]

JAMES HOWARD KUNSTLER
Author, *The Long Emergency*
Our agriculture system is almost wholly dependent on cheap oil. Tremendous amounts of diesel fuel that are used in planting, in harvesting. And then moving the stuff all these vast distances

HEIDI CULLEN
Climatologist, Climate Central
So by 2015 in the United States add about 20 million people to the population and then just play out what that does to consumption patterns. I mean, the number of people that we've got to feed. There's just basically the slowing creeping tension for natural resources.

BOB WOODRUFF
As the American life becomes increasingly unsustainable…the rest of the world will be trying to catch up.

ELIZABETH ECONOMY
Director for Asia Studies, Council on Foreign Relations
The Chinese like cars and they like big cars. You have 14,000 cars added to China's roads daily.

ROZ NAYLOR
Professor of Environmental Science, Stanford University
Countries like China, India, many parts of Southeast Asia where incomes are rising really rapidly, they're moving into meat based diets. [9]

MICHAEL POLLAN
Author, *In Defense of Food*
You need ten pounds of grain to get one pound of meat.

GRAPHIC
Americans consume 60 billion pounds of meat each year. [10]

BOB WOODRUFF
If everyone in the world consumed as much as the average American, it would take the resources of four earths to support the planet's population.[11] **Which raises the question: should the rest of the world be consuming less, or should we? American habits, though, are hard to break.**

RICHARD HEINBERG
Senior Fellow, Post Carbon Institute
We in the U.S. have gotten used to the idea that we're somehow immune to natural limits and it's the other people who are going to suffer.

Graphic Novel Element:

NEWSCAST
Good morning Miami. The summer of 2015 is on track to become one of the hottest in history. Temperatures are expected to be in the triple digits...[12]

LUCY
My mother and I were waiting for gas; the line went around the block and then some. Nothing new, but this time the line had stopped moving altogether. A man who worked at the gas station came out holding a sign. People started yelling, and they got out of their cars and started moving towards him. My mother got us out of there fast.[13]

NEWSCAST
In the face of mounting protests over rising gas and food prices, Congress today approved a plan to fund the construction of 40 new coal-fired power plants over the next 5 years.

LUCY
The country took the easy way out.[14] **Coal was once again touted as our so-called salvation. But the more coal we burned, the faster our planet warmed. You get the picture.**

MICHAEL KLARE
Any talk about coal, the current technology means global warming will get worse.

PETER GLEICK
President, Pacific Institute
We're spewing more carbon, more methane, more nitrous oxide into the atmosphere. All the bad things of climate change are coming true.

LUCY
And most people were just going along with their everyday lives.

THOMAS HOMER DIXON
And until we have a crisis of some kind, I don't think we're going to be motivated to wake up and say, "Okay, now we have to change."

JOHN PODESTA
President, Center for American Progress
Sometimes it takes a big shock to get people, you know, out of the inertia that's built into the system.

Graphic Novel Element:

NEWSCAST

They are calling it the storm of the century. Hurricane Linda, packing category 5 winds...

LUCY
Big storms weren't unusual, but this one was bigger than the others. And it was headed for Miami.

NEWSCAST
All coastal regions are being evacuated. When this storm makes landfall we're going to see a tremendous storm surge.

LUCY
My mother was a nurse, and she wouldn't leave until all the sick were evacuated from the hospital that she worked at. My father was afraid we wouldn't get out in time. I was afraid too.

NEWSCAST
Those who make the decision not to evacuate face life-threatening danger. Between the howling winds and these giant, surging waves, Miami is a very scary place to be right now.

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[1] http://www.scotland.gov.uk/News/Releases/2009/01/22121716 One of the world's largest wave stations will be constructed off the Isle of Lewis in the Western Isles, creating up to 70 jobs and advancing Scotland's lead in renewable energy. Ministers have granted consent for npower renewables application to operate a wave farm with a 4MW capacity at Siadar, Isle of Lewis, Western Isles. It is one of the first marine renewable energy projects to be approved in the UK and follows the recent launch of the £10 million Saltire Prize. First Minister Alex Salmond said: "Today's announcement is a significant step in Scotland's journey to become a world leader in renewables. The Siadar wave farm will be one of the largest consented wave electricity generating station in the world. It is the first commercial wave farm in Scotland and is starting with a capacity to power around 1,800 homes." (Source: Scottish Government Press Release, Jan. 22, 2009.)

[2] The world's smallest state now intends to build the biggest solar plant in Europe…project engineer Mauro Villarini said in an interview. Advised by German solar-panel maker Solarworld AG, the Holy See is running counter to many governments that say harnessing sunlight on a grand scale is too costly to help curb global warming, especially in the deepest recession since World War II.

"Now is the time to strike," Cardinal Giovanni Lajolo, the Vatican City's governor, said in an interview from his study overlooking the Michelangelo-designed Basilica of St. Peter's. "One should take advantage of the crisis to try and develop these renewable-energy sources to the maximum, which in the long run will reap incomparable rewards."

The Vatican, advantaged by its small size, will count on revenue and solar aid from Italy after 2014. That's when the new plant is scheduled to turn the enclave into an electricity exporter to the nation that surrounds it…The 100 megawatts unleashed by the station will supply about 40,000 households. That will far outstrip demand by Pope Benedict XVI and the 900 inhabitants of the 0.2 square-mile country nestled across Rome's Tiber River. (Source: "Pope Pursues Heavenly Power With Plant Harnessing Sun," Bloomberg News, April 17 2009)

[3] **President Obama Announces National Fuel Efficiency Policy** WASHINGTON, DC – President Obama today – for the first time in history – set in motion a new national policy aimed at both increasing fuel economy and reducing

greenhouse gas pollution for all new cars and trucks sold in the United States. The new standards, covering model years 2012-2016, and ultimately requiring an average fuel economy standard of 35.5 mpg in 2016, are projected to save 1.8 billion barrels of oil over the life of the program with a fuel economy gain averaging more than 5 percent per year and a reduction of approximately 900 million metric tons in greenhouse gas emissions. This would surpass the CAFE law passed by Congress in 2007 required an average fuel economy of 35 mpg in 2020. (Source: The White House, Office of the Press Secretary, May 19 2009)

[4] "We're probably never gonna run out of oil in the sense that there will always be some oil underneath the surface of the earth. But, you know, it won't be economical to try to get it out. We will get to the point where it will take more than a barrel of oil's worth of energy to retrieve a barrel of oil. And that's the point where, you know, it's pointless." (James Howard Kunstler, Author, *The Long Emergency*, in conversation with Michael Bicks for ABC News)

"That doesn't mean that there isn't oil left on the planet, but what's left on the planet is gonna be increasingly difficult to obtain —more costly and more remote areas, in areas that are at risk for hurricanes or other environmental dangers or political dangers." (Michael Klare, Professor of Peace & World Security Studies, Hampshire College, in conversation with Michael Bicks for ABC News)

[5] "In the '70s, the shortages that we faced were temporary. And this had to do both with food prices and, especially, with energy. We had the oil embargo of 1973. That was all political. In 1979, the beginning of the Iran/Iraq war, that caused oil prices to rise dramatically. Now we're in a situation where, for the past few years, demand for oil globally has been rising. China, the oil exporting nations. Demand is growing rapidly, but supply has leveled off. Supply of crude oil globally has not grown at all over the past three years. In that kind of situation, there's only one place for prices to go, and that's up. (Richard Heinberg, Author, *Peak Everything*, in conversation with Michael Bicks for ABC News)

It would be all too easy to respond with complacency to a short-term easing back of energy-demand growth. Once the global economy begins to recover, energy demand will bounce back too, imposing costs on consumers and businesses and on the climate in the form of CO2 emissions. There is even the potential for oil market demand to grow more quickly than supply, risking another oil market shock. (McKinsey Global Institute, "Averting the Next Energy Crisis: The Demand Challenge," March 2009).

[6] The City of Miami, in coordination with the Florida Department of Transportation, is proposing to build the Miami Streetcar Project from Government Center in Downtown Miami through the Entertainment District, Wynwood/Edgewater, Midtown Miami, the Miami Design District, Overtown and the Civic Center/Health District complex. The streetcar is an urban transit circulator that will operate in existing roadways, and provide connectivity among major activity centers, commercial and retail establishments, as well as residential communities throughout the project corridor. (Source: http://www.miamigov.com/miamistreetcar/pages/)

[7] "We have a global food system that's fundamentally unsustainable. It's based on the use of petrochemical inputs for fertilizers, pesticides, herbicides, and also for the use of petrochemicals for transporting food in ever larger quantities ever further distances. We've built enormous cities in places where there's in many cases no good agricultural land close by. The only way these cities can subsist is by continual importation of enormous amounts of food from long distances away. And, of course, those imports come by way of trucks, by rail, but ship and in some cases by airplane, all of those relying on diesel fuel or gasoline. As those fuels become more expensive, the whole system becomes more brittle." (Richard Heinberg, Author, *Peak Everything*, in conversation with Michael Bicks for ABC News)

[8] "Our global distribution of food is built, really, on cheap fuel, cheap shipping, very high tech information systems right now. As fuel goes up, obviously the transportation costs are going to rise very steeply for shipping food around. One of the other effects when food prices go up, is that governments start getting very worried. We've

seen, you know, half a dozen really severe riots in different countries in the past month, and at least 30 or so countries that are having sort of political unrest as a result of food prices right now." (Roz Naylor, Professor of Environmental Earth System Science, Stanford University, in conversation with Michael Bicks for ABC News)

[9] http://www.sow.vu.nl/pdf/Brief%20Feed%20for%20China.pdf "China's is among the fastest growing economies in the world. Over the period 1990-2003 the economy has been growing at an average growth rate of 8.5 %, and also in coming years China's overall growth rate is expected to be in the 5-10% range. The rate of economic growth is even more impressive when considering the fact that China comprises about one fifth of the global population. An important characteristic of the increasing levels of incomes and expenditures is a changing food consumption pattern, and in particular, an increasing consumption of meat. While, according to FAO statistics, in 1985 meat consumption in China was approximately 20 kg per person per year, by 2000 it had increased to 50 kg per person per year, and for the next decades further increases in per capita meat consumption are projected." (Centre for World Food Studies, SOW-VU Brief no.3, December 2005)

"The world's appetite for meat will jump enormously. Worldwide, demand for meat is forecast to rise by more than 55 percent (Figure 5) between 1997 and 2020, with most of the increase occurring in developing countries. China alone will account for more than 40 percent of this increase, compared with India's 4 percent." (2020 Global Food Outlook: Trends, Alternatives, and Choices, International Food Policy Research Institute, Washington, D.C, 2001)

[10] "Americans are downing close to 200 pounds of meat, poultry and fish per capita per year (dairy and eggs are separate, and hardly insignificant), an increase of 50 pounds per person from 50 years ago. We each consume something like 110 grams of protein a day, about twice the federal government's recommended allowance; of that, about 75 grams come from animal protein. (The recommended level is itself considered by many dietary experts to be higher than it needs to be.) It's likely that most of us would do just fine on around 30 grams of protein a day, virtually all of it from plant sources." (Source: Mark Bittman, "Rethinking the Meat-Guzzler," New York Times, January 27 2008)

"Well, Americans today are eating on average about two hundred pounds of meat, per person, per year. It's an immense amount. If you think about it, that's ten ounces a day. That's a lot of meat. No one else on this planet eats quite that much meat." (Michael Pollan, in conversation with Michael Bicks for ABC News)

[11] Globally, we are using 1.4 Earths' worth of biocapacity every year. Some nations, however, use a lot less than this, and some use a lot more. Here is how many Earths we would need if everyone lived like a resident of the following countries, according to Global Footprint Network's 2008 National Accounts.

- United States 4.5 Earths
- United Kingdom 3.1 Earths
- Germany 2.5 Earths
- Argentina 1.2 Earths
- Costa Rica 1.1 Earths
- South Africa 1.0 Earth
- India 0.4 Earths

(Source: Global Footprint Network, Media Backgrounder, 2008)

[12] Recent climate model simulations (Ruosteenoja et al., 2003) indicate that by the 2010 to 2039 time slice, year-round temperatures across North America will be outside the range of present-day natural variability, based on 1000 year Atmosphere-Ocean General Circulation Model (AOGCM) simulations with either the CGCM2 or HadCM3 climate models. For most combinations of model, scenario, season and region, warming in the 2010 to 2039 time

slice will be in the range of 1 to 3ºC. (Source: IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Page 626)

Miami Area Extremes: Highest Daily Maximum (degrees Fahrenheit) 1850-2009
Rank Value Ending Date
1 100.0 7/21/1942
2 98.0 7/ 3/1998, 8/ 1/1990, 8/ 9/1987, 6/ 4/1985, 7/24/1983, 7/19/1981, 8/ 6/1954, 6/24/1944
(Source: NOAA, Scott Stephens, in email to Lynn Levy for ABC News, May 1 2009)

[13] "Now, we'll be competing with countries like China, whose demand for oil is growing again at about seven percent per year for those available exports. So, we could see shortages of fuel in this country within just a few years. We're not just talking about high prices at the gas pump. We're actually talking about the gas pumps running dry." (Richard Heinberg, Author, *Peak Everything*, in conversation with Michael Bicks for ABC News)

[14] For the first time in 16 years of forecasting worldwide energy use, the 2006 International Energy Outlook projects that the rate of growth in coal consumption will exceed that of natural gas. Although there is only one-tenth of a percent difference between their projected rates, this signals an alarming trend given the enormous environmental threat posed by carbon emissions from coal-fired power plants. In the absence of international carbon emission restraints, climate change will likely reinforce this trend by increasing the price of natural gas and oil relative to coal. (CNAS, *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change,* November 2007, Page 68)

EARTH 2100—ACT THREE—2015

BOB WOODRUFF
2015 is only six years away, but many experts say that if the world has not reached an agreement to massively reduce greenhouse gasses by then, we could pass a point of no return.

JOHN HOLDREN
Professor, Harvard University
If we're still dragging our feet in 2015, it really becomes at that point almost impossible for the world to avert a degree of climate change that we simply will not be able to manage.

THOMAS HOMER DIXON
The longer we wait without addressing these challenges in an aggressive way, the more likely it is we're going to end up with really bad outcomes.

NEWS REPORT
This morning – in the aftermath of Hurricane Linda – we are seeing the first images of what remains of Miami.

NEWS REPORT
Neighboring communities have been overwhelmed by hundreds of thousands of evacuees seeking refuge…

GRAPHIC NOVEL ELEMENT:

LUCY
The evacuation center was as big as an airplane hangar—maybe it was an airplane hangar—and so jammed with people it was hard to move. It was hot. It was noisy. We were there three weeks. There was nowhere for us to go. Nowhere for anybody to go.

We watched the news on TV. I was only 6 but it looked to me like the whole world was in trouble.

NEWSCAST
Some 250 thousand Bangladeshi refugees fleeing from last month's devastating cyclone are massing on the Indian border…

NEWSCAST
Thousands riot as China faces its worst wheat shortages, the result of seemingly endless drought.

NEWSCAST

World leaders are gathering in Washington DC to attend to an emergency global summit meeting. Hopes are high that world leaders might finally reach an historic climate agreement.

E.O. WILSON
Biologist & Entomologist, Harvard University
This is the first time the whole planet is in that kind of a crisis, and the whole planet has to join in meeting a crisis of epical proportions.

BOB WOODRUFF
Last summer, the Center for the New American Security, a Washington think tank, staged an elaborate game.[15] The goal was to simulate a global summit on climate.

The year is 2015. The context for the game is Lucy's context – Miami has just been devastated by a hurricane and Bangladesh ravaged by a cyclone.[16]

The people who are playing the roles of global leaders are in fact high-level policy makers from around the world.

JOHN PODESTA
Let me be very clear, our time is running out.

BOB WOODRUFF
John Podesta, President Obama's transition chief, is playing the role of UN Secretary General.

JOHN PODESTA
Indeed today, in October of 2015, no country, no city is exempt from the ravages of climate change as we saw so tragically with a category five hurricane that hit Miami.

BOB WOODRUFF
In the game, the Secretary General has asked for a thirty percent reduction in emissions by 2025. The US team holds a closed doors strategy session.

TOM DASCHLE
Former Majority Leader, US Senate (D)
It's very important for us to strike that very positive leadership tone right out of the box.

EILEEN CLAUSSEN
President, Pew Center on Global Climate Change
We have to be much faster and more serious about emission reductions.

REID DETCHON
Executive Director for Energy and Climate
We need to do thirty percent –

EILEEN CLAUSSEN
By 2025.

REID DETCHON
By 2025.

BOB WOODRUFF
But here is strong disagreement about whether the American public would be willing to make that kind of sacrifice.

DAVID ERICKSON
Oak Ridge National Laboratory
Basically, the odds of a 30% reduction in the United States in 10 years is zero.

REID DETCHON
The world is going to hell in a hand basket and we're saying, gee, can we stretch this out a little.

BOB WOODRUFF
Even if the United States were willing to make these reductions, this is a global crisis that needs global action. The US calls a meeting with China.

LIANHONG GU
We have an inherent responsibility to our people to take actions.

BOB WOODRUFF
In 2015, China and India are in fact projected to account for more than 30 percent of the world's carbon emissions. [17] **But in the simulation, they are unwilling to agree to a treaty they feel limits their economic growth. For both countries, the issue is fairness.**

BRAHMA CHELLANEY
Center for Policy Research
The western countries went through a very energy intensive development process, became rich by burning coal and burning oil , can countries like India and china, do it without burning as much fossil fuel as the west.

We have to grow greener, you have the technology and you have the capital, and you are prepared to help us grow on a greener path.

BOB WOODRUFF
China and India will agree to the cuts in greenhouse gas emissions, only if the West hands over the technology needed to do so.

JUNHUA ZHANG
Zhejiang University

China would wish to get the technology for the third generation of nuclear power plants.

BOB WOODRUFF
But Europe and the US refuse. The technology belongs to private companies. Instead, they offer to help pay the costs of switching to cleaner energy.

REINHARD BUETIKOFER
Leader, The German Green Party
You do the emissions reduction and we give the money for the emissions reduction that you've done.

JIAHUA PAN
Chinese Academy of Social Sciences
Because see, if simply, you know, you have the money but you do not have the technology, and then you cannot reduce the emissions.

BOB WOODRUFF
The whole summit hinges on whether they can come to an understanding.

REINHARD BUETIKOFER
We're not putting any pressures, we're just offering, and I think it's a good offer.

JIAHUA PAN
We do not accept the offer.

NEWSCAST
The Planet Summit broke down today when China and India refused to agree to cut greenhouse gas emissions.

MICHAEL A. LEVI
Council on Foreign Relations
Ultimately, all the teams fell short.

JOHN PODESTA
That perhaps is the saddest element coming out of this, which is the pace of change just doesn't seem to be in keeping with the magnitude of the challenge.

BOB WOODRUFF
Scientists say that if this is how our leaders respond in 2015, the entire planet will be at risk.

JOHN HOLDREN
If we continue on the business as usual trajectory, there will be a tipping point that we cannot avert. We will indeed drive the car over the cliff.

[15] CNAS Climate Change Wargame Date**:** July 28, 2008 - July 30, 2008. About the Wargame**:** The Center for a New American Security (CNAS) and a consortium of ten partner organizations hosted an international "war game" from July 28, 2008 through July 30, 2008. (Source: CNAS, http://www.cnas.org/node/149)

[16] The participant briefing book for the Clout and Climate Change War Game can be found on the CNAS website at http://www.cnas.org/node/959

[17] "In the latest World Energy Outlook we estimated China and India will account for 31% of global energy related CO2 emissions in 2015." (Source: Laura Cozzi, International Energy Agency, in email to Lynn Levy for ABC News, May 20 2009)

EARTH 2100—ACT FOUR—2030

Graphic Novel Element:

LUCY
There was a story my mother once told me I'll never forget. You put a frog in a pot of cold water and turn the heat on. The water warms so gradually that the frog doesn't notice. It never realizes the precise moment it is cooked.

THOMAS HOMER DIXON
The frog will sit there, because it's not able to detect the small changes in temperature that are making its life increasingly dangerous. And we're in the same sort of situation. We're so adaptable in our evolution as a species, an adaptability that'll allow—that has allowed us to really, in a sense, conquer nature, and conquer the world. But at this point that adaptability is actually a real threat to our existence.

LUCY
As I grew up, it became increasingly clear that we were the frog.

After our home was destroyed by the hurricane my family moved to San Diego. Maybe because it was as far away from Miami as we could get.

NEWS REPORT
Finally this evening, saving our seas: the federal government has released a major assessment of the oceans. The news is not good.[18]

NEWS REPORT
It's going to be tough to drive this summer. Gas prices are expected to soar even higher, making travel impossible for many families.[19]

NEWS REPORT
Increased heat speeds up evaporation cycles…

NEWS REPORT
The United Nations announced today that there are now eight billion people living on earth…[20]

2030 - San Diego, California
Graphic Novel Element—THE NEW NORMAL

LUCY
It's amazing what you can come to take for normal. By the time I was in my twenties, shortages and higher prices were just a fact of everyday life.

After high school I decided to train as an EMT. I wanted to be useful, and this seemed the perfect kind of work.

BOB WOODRUFF
So what else will normal be in 2030? For one thing, it will be warmer – about one and a half degrees Fahrenheit warmer.[21] Enough to dramatically alter the planet's weather and rainfall.

Canada and Siberia, for example, will be wetter and hotter.[22] But for much of the world rain will be scarce, and so will its most basic need…water.[23]

JANINE BENYUS
President & Founder, Biomimicry Institute
By 2030, 2/3rds of the world's population will be under water stress.[24]

BOB WOODRUFF
In Asia, for example, glaciers on the Tibetan Plateau act as a giant reservoir for billions of people.[25]

DAN SCHRAG
Professor of Geology, Harvard University
All over the world, as the climate warms, mountain glaciers are melting at faster and faster rates.

BOB WOODRUFF
By 2030, 80% of those glaciers may be gone.[26] **If the glaciers disappear, much of the food supply will disappear as well.**

HEIDI CULLEN
These glaciers provide stream flow in the summer, during the dry months that you can use to irrigate your crops. When those glaciers are gone, you've got no stream flow in the summer. And so you've got a massive drought situation.

BOB WOODRUFF
In 2030, Africa could be facing extreme and widespread drought.

EDWARD MIGUEL
Associate Professor of Economics, UC Berkeley
Rainfall levels are gonna continue to drop over time in Africa, especially in these fragile regions like the Sahel.[27] *When the rains fail and people don't have enough to eat, they often turn to desperate means to survive.*

BOB WOODRUFF
And in the US, in 2030, many of the massive reservoirs fed by the Colorado River will be drying up.[28]

HEIDI CULLEN
We talk about the Southwest moving into drought as a way to describe what's going to happen, but technically, the Southwest, it's not going to be in drought, it's going to become a desert.[29]

Graphic Novel Element—IN DEEP WATER

LUCY
In San Diego, they were ahead of the game. In 2009 they had started building huge desalination plants.[30] **It took 20 years and cost billions of dollars but it worked. The massive plants on the ocean turned salt water into fresh and the city's water supply was restored.**

400 miles inland though, they were running out—and no one had enough money to build a pipe that long.

WEB VIDEO
So now we're here rationing water.

WEB VIDEO
And people in Las Vegas are starting to totally panic…people in Phoenix are starting to panic too.

WEB VIDEO
When I turned on my tap this morning, this is what I got out of my tap.

THOMAS HOMER-DIXON
Something that will catch people's attention is the first city, rich city in the world that just runs out of water.

NEWS BULLETIN
Three days after Tucson declared a water emergency, its parched residents finally got relief.[31] **A convoy of National Guard tanker trucks arrived today, bearing gallons of water for the anxious crowds.**

Graphic Novel Element:

LUCY
What happened there scared the whole country. In San Diego, the private companies who desalinated our water used Tucson as an excuse and jacked up our water prices. I decided enough was enough. I went to a protest rally, my first.

I must have been yelling my head off, because a man standing next to me said, "I'm glad you're on our side." To make a short story shorter, we fell in love on the spot. Two months later we were married. A year later our daughter Molly was born – with a head full of red hair.

And the desalination companies? They backed down. We had won.

LUCY
Josh and I had friends who, like us, were determined to re-imagine the future. We were all of us optimists. Some worked on solar plants in the desert, others tinkered with super efficient cars in their garages, still others designed fantastical cities on their computers. It was an exciting time to be young. But it was becoming clear that the problems of the world knew no borders.

NEWS REPORT
Global population is now approaching nine billion.[32]

DAN GILBERT
Professor of Psychology, Harvard University
It seems unlikely to me that we here on the island we call North America, can sit happily with all of our resources while the rest of the world simply goes quietly into that good night so that we can continue to consume at our present rate.
Very few people lay down and die. When they recognize that their lives are threatened, they do whatever it takes.

NEWSCAST
Hundreds of thousands of environmental refugees fleeing drought and famine are streaming towards Europe.[33]

JAY GULLEDGE
Senior Scientist, Pew Center on Global Climate Change
They will move across borders by the droves, by the millions, and that will be something we've never seen before and that might be the thing that we'll find the most difficult to cope with.

NEWSCAST
From Laredo to Tijuana, millions of Latin Americans are massing along the US border.

JOHN PODESTA
President, Center for American Progress
You'll see intense pressure for people to move and be on the move, from the Caribbean, from Latin America, from Mexico in particular, into the United States. And that'll put huge stress on the systems of the United States to try to cope with that.

MICHAEL KLARE
*I can't imagine the horrors that will take place on the border as millions of refugees try to get into the United States***.**

Graphic Novel Element:

LUCY

I was working the midnight shift when a call came from the border police. Be careful, Joshua said, this doesn't sound good. Thousands of refugees had been arriving at the border, searching for water and food.[34] Someone had blown a hole through the wall and thousands of people were streaming through. They called in the border police.

I don't know how it started, who fired first, but suddenly the police were shooting into the crowd. There were people falling, panic everywhere. Joshua heard it on the news and how he found me in the midst of all the chaos, I'll never know.

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[18] "We've seen we've already lowered the pH of the ocean by a tenth of a point. In this century we'll lower it under business as usual by another quarter of a point. And while that doesn't sound like much, it's a lot of acidity in the ocean. And it's a big change in the capacity of these organisms to make their shells. And that's not just coral reefs, but it's crustaceans of all kinds, shrimp, lobsters, crabs. We're making a big problem for the ocean." (John Holdren, Professor, Harvard University, in conversation with Michael Bicks for ABC News)

"The water of the ocean is warming at a rate which is higher than the most dire predictions of the whole global climate report." (Jeremy Jackson, Scripps Institution of Oceanography, in conversation with Michael Bicks for ABC News)

[19] Many of the biggest names in the oil industry now agree on one point: that whatever the ultimate cause—be it political, geological or a mix of both—the world is now entering a new era of high energy costs and constrained supplies. Just as 1908 marked the birth of the Model T and the advent of the automotive age, historians may one day mark 2008 as the beginning of the end of the age of petroleum. The evidence is strong that this period is not a blip. John Hess, the taciturn chief executive of Hess Oil, made a particularly gloomy case earlier this year for why, as he said, "an oil crisis is coming." Demand growth around the world is unrelenting, and has abated only slightly as prices have soared to unimagined highs. But more to the point, he said, is that the industry isn't investing enough to surmount the many challenges on the supply side. As a result, oil supply capacity could hit its ceiling by 2015. Others argue that the shortfall could come much sooner. (CNAS, "Peak Oil: A Survey of Security Concerns," September 2008)

[20] Source: United Nations Department of Economic and Social Affairs/Population Division, *World Population to 2300,* New York, 2004, TABLE A1. Population of the World by Development Group and Scenario: 1950-2300.

[21] Model experiments show that even if all radiative forcing agents were held constant at year 2000 levels, a further warming trend would occur in the next two decades at a rate of about 0.1°C per decade, due mainly to the slow response of the oceans. About twice as much warming (0.2°C per decade) would be expected if emissions are within the range of the SRES scenarios. Best-estimate projections from models indicate that decadal average warming over each inhabited continent by 2030 is insensitive to the choice among SRES scenarios and is *very likely* to be at least twice as large as the corresponding model-estimated natural variability during the 20th century. (Source: IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*)

[22] Annual-mean precipitation is projected to decrease in the south-west of the U.S. but increase over the rest of the continent (Christensen et al., 2007: Section 11.5.3.2). Increases in precipitation in Canada are projected to be in the range of +20% for the annual mean and +30% for the winter. (Source: IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Page 627)

[23] A decline in summer precipitation was likely over the central parts of arid and semi-arid Asia leading to expansion of deserts and periodic severe water stress conditions. (Source: IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Page 472)

Decreased precipitation prevails in the subtropics and mid-latitudes, with particularly strong decreases in southern North America and Central America, southern South America (parts of Chile and Argentina), southern Europe and the Mediterranean region in general (including parts of the Middle East), and in northern and southern Africa. (Source: CNAS, *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change,* November 2007, Page 45)

[24] http://www.unep.org/dewa/assessments/ecosystems/water/vitalwater/summary.htm
It is estimated that two out of every three people will live in water-stressed areas by the year 2025. In Africa alone, it is estimated that 25 countries will be experiencing water stress (below 1,700 m^3 per capita per year) by 2025. Today, 450 million people in 29 countries suffer from water shortages. (Source: UNEP Vital Water Graphics Executive Summary)

[25] The glaciers of the Tibetan Plateau supply water to over 40 percent of the world's population, and the region is a climate change hotspot, experiencing temperature gains well above the global average…As glaciers disappear from the Tibetan Plateau, the water supply for two billion people living in downstream areas—including India and China—will diminish as well. And supplies of potable water are already tight in these countries. (Source: The Asia Society, "Asia's Vanishing Glaciers," November 5, 2008)

Nearly 2 billion people in Asia, from coastal city dwellers to yak-herding nomads, will begin suffering water shortages in coming decades as global warming shrinks glaciers on the Tibetan Plateau, experts said. The plateau has more than 45,000 glaciers that build up during the snowy season and then drain to the major rivers in Asia, including the Yangtze, Yellow, Brahmanputra and Mekong. Temperatures in the plateau, which some scientists call the "Third Pole" for its massive glacial ice sheets, are rising twice as fast as other parts of the world, said Lonnie Thompson, a glaciologist at Ohio State University, who has collected ice cores from glaciers around the world for decades. (Source: The China Post, "Tibetan Glacial Shrink to Cut Asian Water Supply," January 18 2009)

[26] Tibetan Plateau glaciers of 4 km in length are projected to disappear with 3°C temperature rise and no change in precipitation. If current warming rates are maintained, glaciers located over Tibetan Plateau are likely to shrink at very rapid rates from 500,000 km2 in 1995 to 100,000 km2 by the 2030s. (IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Page 481)

[27] The GFDL CM2 models project a drier Sahel in the future, primarily due to increasing greenhouse gases. If this projection of long term rainfall reductions occurs, Sahel droughts would be more frequent and severe than in the 20th century…given the quality of CM2's simulation of the spatial structure and time evolution of the 20th century Sahel rainfall variations, we believe that its prediction of a dramatic 21st century drying trend should be considered seriously as a possible future scenario. (Source: Isaac Held et al. "Sahel Drought: Past Problems, An Uncertain Future," *The National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluid Dynamics Laboratory (GFDL)*, January 2007)

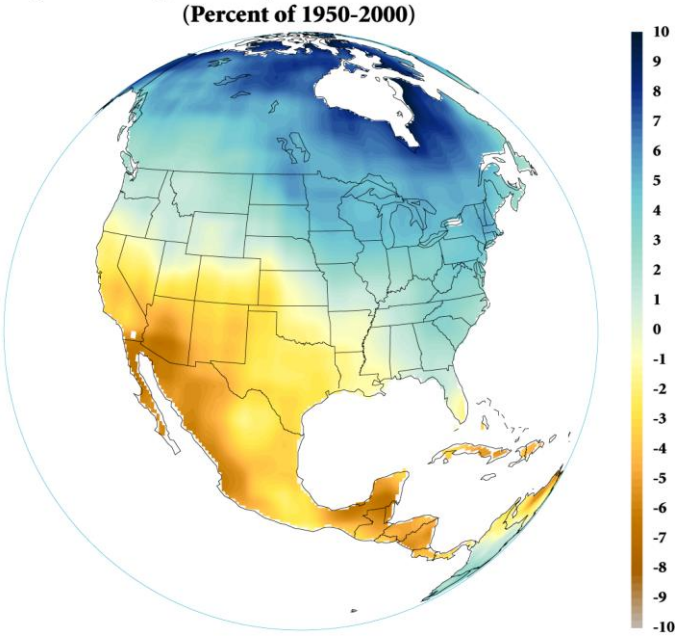
[28] There is a 50 percent chance Lake Mead, a key source of water for millions of people in the southwestern United States, will be dry by 2021 if climate changes as expected and future water usage is not curtailed, according to a pair of researchers at Scripps Institution of Oceanography, UC San Diego.

Without Lake Mead and neighboring Lake Powell, the Colorado River system has no buffer to sustain the population of the Southwest through an unusually dry year, or worse, a sustained drought. In such an event, water deliveries would become highly unstable and variable, said research marine physicist Tim Barnett and climate scientist David Pierce.

Barnett and Pierce concluded that human demand, natural forces like evaporation, and human-induced climate change are creating a net deficit of nearly 1 million acre-feet of water per year from the Colorado River system that includes Lake Mead and Lake Powell. (Source: Scripps Institution of Oceanography, February 12 2008, http://ucsdnews.ucsd.edu/newsrel/science/02-08LakeMead.asp)

[29] http://www.ldeo.columbia.edu/res/div/ocp/drought/science.shtml
Southwestern North America and other subtropical regions are going to become increasingly arid as a consequence of rising greenhouse gasses. The transition to a drier climate should already be underway and will become well established in the coming years to decades, akin to permanent drought conditions.
This is a robust result in climate model projections that has it source in well represented changes in the atmospheric hydrological cycle related to both rising humidity in a warmer atmosphere and poleward shifts in atmospheric circulation features.

Projected Change in Precipitation 1950-2000 to 2021-2040
(Percent of 1950-2000)



Projected change in precipitation for the 2021-2040 period minus the average over 1950-2000 as a percent of the 1950-2000 precipitation. Results are averaged over simulations with 19 different climate models. Figure by G. Vecchi.

(Source: Richard Seager, Lamont-Doherty Earth Observatory of Columbia University, "An imminent transition to a more arid climate in southwestern North America")

[30] The Carlsbad desalination Project will provide San Diego County with a locally-controlled, drought-proof supply of high-quality water that meets or exceeds all state and federal drinking water standards. Public water agencies serving the cities of Carlsbad, Oceanside, San Marcos, San Diego, Encinitas, Solana Beach, Rancho Santa Fe, Escondido, Chula Vista, National City and the unincorporated communities of Rainbow, Bonsall and Fallbrook will

be the direct beneficiaries of a new, affordable and reliable water supply developed at no expense to the region's taxpayers. After ten years of planning and five years in the state's permitting process, the Carlsbad Desalination Plant has now received final approvals from every required regulatory and permitting agency in the state, including the California Coastal Commission, State Lands Commission and Regional Water Quality Control Board. The Carlsbad Desalination Project is scheduled to begin construction in 2009 and will be operational before the end of 2011. (Source: http://www.carlsbad-desal.com/ accessed May 22, 2009)

A plan by a private company to build a $320-million desalination plant along the coast of northern San Diego County was unanimously approved Wednesday by the San Diego Regional Water Quality Control Board. Proponents say the plan could provide more than 56,000 acre-feet of drinkable water by 2012, enough to satisfy the needs of more than 100,000 families. (Source: Los Angeles Times, "San Diego board approves desalination plant" May 13, 2009)

[31] "The Southwest is especially dry. Phoenix, Albuquerque, Tucson, Las Vegas, Los Angeles. Those are cities that we built in deserts, and then we figured out, all right, let's move the water from where we have it, to where we want it. And that's been pretty successful up until now. But that's not sustainable in the long run. We cannot keep growing in water-short areas, and assume that the water is going to be available. I think it's questionable now how sustainable many of the communities in the Southwest are." (Peter Gleick, President, Pacific Institute, in conversation with Michael Bicks for ABC News)

Lake Mead has dropped steadily in recent years…The seven states – Arizona, California, Nevada, Utah, Wyoming, Colorado and New Mexico – that use river water have agreed to reduced deliveries if the lake drops to an elevation of 1,075 feet. Arizona would absorb most of the initial shortages because of a deal struck years ago to ensure construction of the Central Arizona Project Canal, which moves water from the Colorado River to Phoenix and Tucson. (Source: "Warming Could Spur Water Crisis," The Arizona Republic, Shaun McKinnon, April 21 2009)

[32] Source: United Nations Department of Economic and Social Affairs/Population Division, *World Population to 2300,* New York, 2004, TABLE A1. Population of the World by Development Group and Scenario: 1950-2300.

[33] "I could imagine a very significant mass outmigration of Chinese fleeing and seeking opportunities elsewhere. In none of the predictions of how climate change will affect China do you see a positive impact. So I think there's, there's a real threat that's being posed to both China and to the rest of the world by how China is behaving domestically with its own environment and development and how climate change is likely to intensify that process." (Elizabeth Economy, Director for Asia Studies, Council on Foreign Relation, in conversation with Linda Hirsch for ABC News)

While most African and South Asian migration will be internal or regional, the expected decline in food production and fresh drinking water, combined with the increased conflict sparked by resource scarcity, will force more Africans and South Asians to migrate further abroad. This will likely result in a surge in the number of…immigrants to the European Union (EU). (CNAS, *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change,* November 2007, Page 59)

[34] The United States will also experience border stress due to the severe effects of climate change in parts of Mexico and the Caribbean. Northern Mexico will be subject to severe water shortages, which will drive immigration into the United States in spite of the increasingly treacherous border terrain. Likewise, the damage caused by storms and rising sea levels in the coastal areas of the Caribbean islands—where 60 percent of the Caribbean population lives—will increase the flow of immigrants from the region and generate political tension. (CNAS, *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change,* November 2007, Page 56)

Leon Fuerth: The Rio Grande is a very important source of water for Mexico, and it's regulated by an agreement between the United States and Mexico, but essentially its fate depends on what happens to it in the United States.

If you look at the state of California or at the western region, what's going on? Reduced snow cap, melting of glaciers, meaning reduced flow into the rivers, increased US demand for water…and especially if the climate becomes more and more arid…

Interviewer: But what can happen between Mexico and the United States? If we start diverting more and more of that water and they get less and less?

Leon Fuerth: Well one of the things that that would do, would be to increase pressure on Mexicans to find a way out of Mexico and into the United States by any possible means, at any, at any cost. (Source: Leon Fuerth, Professor of International Affairs, George Washington University, in conversation with Linda Hirsch for ABC News)

EARTH 2100—ACT FIVE

GRAPHIC NOVEL ELEMENT:

LUCY
In San Diego, Josh and Molly and I took long walks on the beach to look for birds. Over the years, our favorites disappeared. The worst was the end of the albatross—these marvelous birds had finally been done in by fishermen's long lines, and the garbage they swallowed.[35]

It was a bad omen for the rest of us.

STUART PIMM
Professor of Conservation Ecology, Duke University
Probably a third of all species will be on an inexorable path to extinction by 2050. They will include familiar species, um, like lions and tigers and bears, but they will also be huge areas of the planet which presently are really lovely and beautiful and diverse, those places will have essentially disappeared.

BOB WOODRUFF
In the history of the earth there have been five mass extinctions in which at least half the species on earth disappeared. They were caused by natural disasters—massive volcanic eruptions, rapid climate change, meteors hitting the earth.[36]

Today in the 21st century we are in the midst of what scientists are calling the sixth extinction. And for the first time it is being caused by a single species—us.[37]

EUGENE LINDEN
Author, *The Winds of Change*
When one species proliferates beyond any other, ultimately it sort of knocks out the life support system, and it collapses. And in a way, that's what we're doing at every level around the world.

BOB WOODRUFF
Today, in 2009, the idea that we could do so much damage to our natural environment that it could cause our global civilization to collapse may seem farfetched.

JOSEPH TAINTER
Author, *The Collapse of Complex Societies*
Every society that collapsed thought it couldn't happen to them. The Roman Empire thought it couldn't happen. The Maya civilization thought it couldn't happen. Everyone thought it couldn't happen to them. But it did. And it usually creeps up on you unforeseen.

BOB WOODRUFF

At its peak, the Maya civilization numbered more than ten million.[38]

JARED DIAMOND
Author, *Collapse*
They had astronomy. They had the only writing in the new world. They had great art.

PETER DEMENOCAL
Professor of Environmental Sciences, Columbia University
They were the biggest game in town. They were the equivalent of us in their era.

HEIDI CULLEN
These city centers were supporting 25 to 50,000 people. So, they were very well-adapted to their surroundings and they were able to grow.

BOB WOODRUFF
But they grew too much and exhausted their resources.

JARED DIAMOND
Growing population, meaning growing demands on the land, resulting in deforestation and soil erosion, which tied into warfare, there was chronic warfare among the Mayan states.

BOB WOODRUFF
And then their climate suddenly changed.

HEIDI CULLEN
There were these series of extended droughts, and those droughts just kept hammering away and hammering away. And you lose your forests, you lose your soils, if you lose your soils you can't grow anything, and if it stops raining then forget about it.

EUGENE LINDEN
The end game for the Mayans must have been horrible indeed.
It's highly likely that there were also periods of starvation. And it's a truly hideous and ugly way to die.

BOB WOODRUFF
The Roman Empire faced many of the same problems that we face today.

THOMAS HOMER DIXON
It's kind of a precursor of our globalized economy.

BOB WOODRUFF
In just a few short centuries, Rome built an empire that stretched across three continents.

THOMAS HOMER DIXON

As it expanded, the requirements for simply its cities and feeding its army became so large that the empire couldn't generate enough food energy, enough grain, to adequately meet all its obligations. So there was a constant fiscal crisis and financial crisis.

BOB WOODRUFF
As resources ran out, their empire collapsed.

JOSEPH TAINTER
The city of Rome itself went from a million people down to perhaps 30,000. And that was the largest city in Western Europe at the time.

HEIDI CULLEN
Civilizations in the past have lost the fight. They have collapsed as a result of the inability to deal with several different events going on at once. I think the takeaway is that honestly we are not that special.

BOB WOODRUFF
Easter Island: one of the most remote places in the world.

HEIDI CULLEN
Easter Island is sort of, this iconic image of what collapse looks like. You know, because you, you can see it so visibly, they, they built these massive monuments, and there's nothing there now.

BOB WOODRUFF
It's hard to imagine that a civilization once thrived on such a barren island. But it didn't always look like this.

JARED DIAMOND
Easter Island used to be covered by a forest of dozens of tree species including the biggest palm tree in the world.

BOB WOODRUFF
But as their population grew, so too did their demand for wood.

JARED DIAMOND
As they gradually cut down more and more trees, the trees didn't grow back rapidly enough to replace the trees that were being cut down. So sometime in the 1600's the last tree was cut down.

HEIDI CULLEN
You saw all of the classic signatures of collapse, they stopped building these monuments, the population plummeted, there was starvation, and, I mean essentially they turned to cannibalism. The question is, what was that person on Easter Island thinking when they chopped down the last tree.

BOB WOODRUFF
The pattern is clear. Civilizations that grow too large and consume too much damage their own life support systems. As resources run out, they begin to fight each over what little is left. Then, they either starve, or leave. But in our case, where can we go?

HEIDI CULLEN
I think Easter Island is the perfect metaphor because it's this small fragile island, sitting within the Pacific Ocean, it's very remote, and, and it, it no longer was able to sustain the population that lived there. It's no different than Earth being this small planet, in a vast galaxy.

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[35] "Some of the changes that we're seeing happen so fast that twenty years ago, we would have thought that albatrosses would be okay, and now we realize that we could lose several albatross species within the next decade or two. It's a weird puzzle. Albatrosses live in the vast, open reaches of the ocean, um, they nest on the remote islands, you'd think they'd be okay. Unfortunately, they like fish. They like squid. And we like those species too, and we catch those fish species on hooks, on long monofilament lines, and as the fishermen bait the hooks, the albatrosses come in, try and take the bait, get caught on the hooks and drown. So within twenty years, the world's albatrosses, and there's about twenty different kinds of albatross, are going from being, you know, just fine, okay, to the fact now where two thirds of them are in imminent danger of extinction. So here's a bird that more than anything else, summarizes the sort of the wild and the beauty and the remoteness of the world's oceans, and it too could go in a very short period of time." (Stuart Pimm, Professor of Conservation Ecology, Duke University, in conversation with Linda Hirsch for ABC News)

Resource Use Overfishing by humans reduces and alters the food supply for many seabirds. Longline fisheries worldwide unintentionally injure and drown as many as 60 bird species, especially surface-feeding seabirds such as albatrosses.

Pollution Pesticides, herbicides, heavy metals, and oil harm ocean birds. Major oil spills kill thousands of birds, but small spills and chronic releases from boats and ports also cause significant harm. Many seabirds consume floating plastic and may feed it to their chicks. Ninety percent of Laysan Albatrosses surveyed on the Hawaiian Islands had plastic debris in their stomachs.

Climate Change Sea-surface temperatures have risen up to 4 degrees Fahrenheit in the North Sea and are expected to continue increasing across the world's oceans, affecting important food sources for ocean birds. Breeding failures of some seabirds in northern latitudes have been attributed in part to increased pests and diseases that survive in warmer winters. (Source: North American Bird Conservation Initiative, U.S. Committee. The State of the Birds, United States of America, 2009. U.S. Department of Interior: Washington, DC. http://www.stateofthebirds.org/pdf_files/State_of_the_Birds_2009.pdf)

[36] Over the past half-billion years, there have been at least twenty mass extinctions, when the diversity of life on earth has suddenly and dramatically contracted. Five of these—the so-called Big Five—were so devastating that they are usually put in their own category. The first took place during the late Ordovician period, nearly four hundred and fifty million years ago, when life was still confined mainly to water. Geological records indicate that more than eighty per cent of marine species died out. The fifth occurred at the end of the Cretaceous period, sixty-five million years ago. The end-Cretaceous event exterminated not just the dinosaurs but seventy-five per cent of all species on earth. (Elizabeth Kolbert, "The Sixth Extinction?" *The New Yorker*, May 25, 2009)

[37] Selected references:

"A globally coherent fingerprint on climate change impacts across natural systems" By Camille Parmesan and Gary Yohe, *Nature* 421, 37-42 (2 January 2003) | doi:10.1038/nature01286; Received 5 March 2002; Accepted 22 October 2002

"Fingerprints of global warming on wild animals and plants" By Jeff T. Price, Kimberly R. Hall, Stephen H. Schneider, Cynthia Rosenzweig, J. Alan Pounds, Terry L. Root *Nature* 421**,** 57-60 (2 January 2003) doi:10.1038/nature01333 Letter

"Extinction risk from climate change" By Chris D. Thomas et al. *Nature* 427, 145-148 (8 January 2004) | doi:10.1038/nature02121; Received 10 September 2003; Accepted 13 October 2003

[38] "Maya being the most advanced Native American civilization in the New World before Columbus, when the Maya cities were abandoned, we don't see an influx of people into more northern Maya areas, so those people must have died, and there were lots of them, millions, maybe tens of millions of people." (Source: Jared Diamond, Author, *Collapse*, in conversation with Michael Bicks for ABC News)

During its Classic period (250–950 A.D.), Maya civilization reached a zenith. At its peak, around 750 A.D., the population may have topped 13 million. (Source: "Climate and the Collapse of Maya Civilization," American Scientist, July-August 2005)

EARTH 2100—ACT SIX

ALAN WEISMAN
Author, *The World Without Us*
Think about that cartoon movie that was made about the Beatles music yellow submarine. There was a creature in it, waddles around, and his head is a funnel that functions as a vacuum cleaner, suddenly its run out of things to point at, there's nothing left, so it's looking around for something, and finally it looks down- sucks itself up and there's a blank screen. There we go.

BOB WOODRUFF
The moral of that story? By grabbing everything in sight, we'll end up destroying ourselves.

And by 2050, the population is exploding, rain forests are disappearing, 9 billion of us are competing for ever scarcer resources.[39] A bad situation, made worse by widespread drought [40] and huge migrations of people. Life is changing for everyone, including Lucy.

GRAPHIC NOVEL ELEMENT:

LUCY
My parents both got sick the winter of 2050—it was a virulent flu that year, it seemed the viruses were getting worse each passing season. I kept them comfortable, and I'm glad they were at home and together when they died.

LUCY
After that, there was nothing to keep us in San Diego; Josh and I decided it was time to leave.

We were excited – Josh had been offered an amazing job in New York working on the sea barriers designed to protect the city from the rising seas.[41] Packing was easy. There wasn't much room in the truck. We took clothes, a few books, and fifty gallons of water. Everything else we left behind.

We headed north across the Mojave. By dusk we were on the outskirts of Las Vegas and greeted by mile after mile of abandoned suburbs, and acres of golf courses turned to dust. The silence was eerie. [42] Lake Mead, the source of the city's water and power, had gone dry.[43]

PETER GLEICK
Well, by 2050, Lake Mead, one of the great reservoirs of the Southwest, on the Colorado River, uh, has finally gone dry on a regular basis. There's not enough water to meet human needs.

LUCY
People in Las Vegas had depended on that lake for almost all of their water and power.

STANLEY FEDER
Former CIA Scenario Designer
Las Vegas, I would imagine, is gone. I mean, with a drought like that…You have got a city in the desert. I mean, it's gonna be really difficult to live there.

LUCY
When we got closer to the strip, we were lucky to hook up with a convoy headed east. Las Vegas was a strange sight -- most of the hotels dark, all those neon lights gone dead. Sin City had pretty much folded.

From there we drove through Arizona. Daybreak, rising out of the desert we saw something wonderful. These huge new solar plants, fifty square miles of reflectors. They hadn't been built soon enough to help Las Vegas, but one day they were supposed to power the whole West coast. It was comforting to know.

JOHN PODESTA
In the desert Southwest, there's a tremendous capacity to produce solar power and move it to where the great population centers in the United States are.

TRAVEL ADVISORY
The safest route heading east is Route 40.

EUGENE LINDEN
I think it would be almost impossible to do this journey unless you have some form of intelligence as to what areas are lawless or dangerous. I don't think strangers will be very friendly.

LUCY
By the time we got onto Route 15, we were grimy and achy and tired. The scene in front of us jolted us out of our daze. Hundreds of people packed the road – all of them streaming out of the southwest, heading north. It felt like the Dust Bowl all over again.

R. JAMES WOOLSEY
Former CIA Director
Think what it would be like if we have millions of neighbors to the south heading north, because they don't have food and they don't have water.

LUCY
They shouted at us as we drove past. Molly was half out the window, catching everything with her camera. Suddenly a man grabbed her arm. He had a gun and pointed it at Molly's face. "…get out of the truck right now," he yelled. I'd never

been so terrified, but within seconds two men from the convoy pulled their own guns, and the man melted back into the crowd. We knew now just how dangerous the border regions had become, and how lucky we were to be headed east.

LUCY
Just as people were migrating, so too were the pests. In Oklahoma, acres and acres of corn were threatened by a new insect. [44]

EUGENE LINDEN
To the degree that all ecosystems are extremely stressed by 2050, the pests will flourish. It's an arms race between breeding crops that are resistant to various pests, and the pests themselves. To the degree that we simplified our food system, we've made it massively vulnerable.

LUCY
For decades this had been predicted – these giant farms which supplied so much of the world's food were easy prey for new pests.

IAN LIPKIN
Director, Northeast Biodefense Center
People get their seeds for corn and for grain from a few manufacturers. And they're genetically very, very similar. So if in fact an agent were to come onto the scene that was capable of infecting one it would rapidly spread.

Halfway through Kansas we split off from the convoy. They were headed north to Canada, and we went east towards Greensburg, Kansas, leaving behind the pests and drought.

GREENSBURG VISITOR CENTER VIDEO
Welcome to the Greensburg Visitor Center. In 2007 a tornado destroyed our town—out of the rubble came a dream… [45] **President Obama: "A town that was completely destroyed by a tornado but is being rebuilt as a global example of how clean energy can power an entire community…how it can bring jobs..."**

LUCY
This was a wonderful place—completely self-sustaining. [46] **They had been one of the first and they knew what they were doing. They got their power from the wind and sun, their water from the rain, and they grew everything they ate.**

LUCY
Feeling a lot better, we hot-seated it the rest of the way. Compared to the Southwest, the fields were green and fertile. We saw some communities like Greenburg – we wished there were more. The closer we got to the end of our journey, the better we felt.

A day later we hit the outskirts of the city.

NEW YORK WELCOME VIDEO
New York City is engaged in the greatest urban experiment of our time. Inspired leaders and creative minds are working together to create an urban paradise.

LUCY
I looked across the George Washington Bridge at the skyline, and felt a surge of hope, but underneath ran a trickle of worry. With all we had seen, maybe we had seen nothing yet.

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[39] Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2009). *World Population Prospects: The 2008 Revision. Highlights.* New York: United Nations.

[40] http://www.ldeo.columbia.edu/res/div/ocp/drought/science.shtml
"Southwestern North America and other subtropical regions are going to become increasingly arid as a consequence of rising greenhouse gasses.

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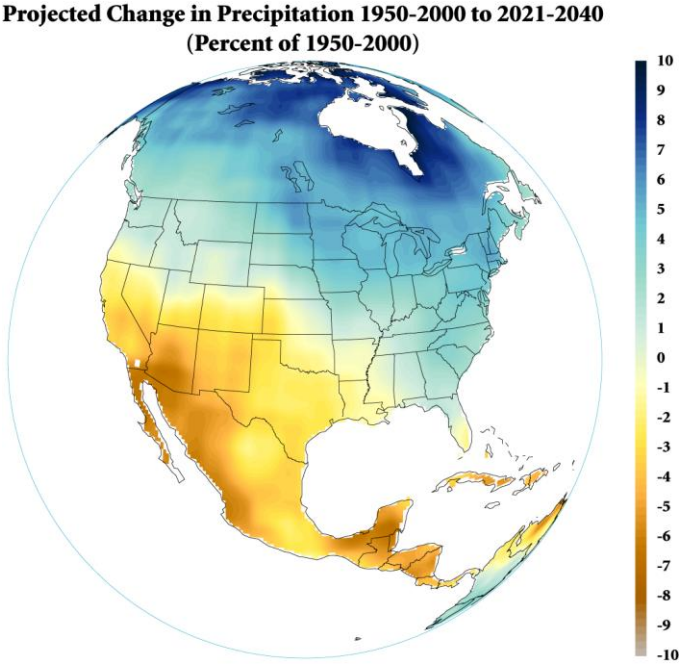

Projected change in precipitation for the 2021-2040 period
minus the average over 1950-2000 as a percent of the 1950-2000

precipitation. Results are averaged over simulations with 19 different climate models. Figure by G. Vecchi.

(Source: Richard Seager, Lamont-Doherty Earth Observatory of Columbia University, "An Imminent Transition to a More Arid Climate in Southwestern North America")

[41] "Well, a meter of sea level rise threatens in the United States, probably on the order of 20 coastal cities including, of course, you know, New York, Miami, even Houston, which is a little bit off the coast, but it's very close in, very close to the coast. New Orleans obviously is — New Orleans can't survive a meter of sea level rise…So we're talking about agricultural loss, we're talking about threatening cities which probably, with one meter, means working really, really hard to build sea walls and dikes and — and things to protect our cities which, of course, are more than just housing, they're also where our econ — economic houses stand as well." (Jay Gulledge, Senior Scientist, Pew Center on Global Climate Change, in conversation with Linda Hirsch for ABC News)

In March 2009, the Metropolitan Section of the American Society of Civil Engineers in conjunction with the Environmental Sciences Section of the New York Academy of Sciences held a conference to discuss the feasibility of building storm surge barriers in the New York metropolitan region. The proceedings of that conference can be found on the ASCE website at http://www.ascemetsection.org/content/view/274/725/#2009

[42] "Las Vegas exists because of the Colorado River…once Hoover Dam was built, Lake Meade fills up and Las Vegas fills up. The problem is that the Colorado River for the last twenty-five years or so has been over-subscribed. It's now used as the principal water source for numerous cities over a million. Vegas, much of Los Angeles, San Diego, Tijuana, Mexicali, half of Denver's water comes out of the Colorado River, Phoenix. Tucson's not at a million yet but, you know, we're talking about a lot of urban demand for the water. There's a lot of agricultural demand for the water, including some crops that are really thirsty crops, like cotton crops that are grown in the Southwest, in southeastern Arizona…So I think that something has to give. There's a good chance that Vegas may end up being one of the most expendable places. It's gonna start with all of the ornamental foliage, but at a certain point if Lake Meade can't fill, I mean, we have a crisis that is absolutely unprecedented and there's no way we can manufacture water. So I would not be shocked to see Las Vegas abandoned sometime over the next quarter century or so. It's hard to imagine it, but you know the Mayans couldn't imagine their fabulous cities, which were much bigger than Europe's cities, disappearing, and they disappeared rather quickly." (Alan Weisman, Author, *The World Without Us*, in conversation with Michael Bicks for ABC News)

[43] There is a 50 percent chance Lake Mead, a key source of water for millions of people in the southwestern United States, will be dry by 2021 if climate changes as expected and future water usage is not curtailed, according to a pair of researchers at Scripps Institution of Oceanography, UC San Diego.

Without Lake Mead and neighboring Lake Powell, the Colorado River system has no buffer to sustain the population of the Southwest through an unusually dry year, or worse, a sustained drought. In such an event, water deliveries would become highly unstable and variable, said research marine physicist Tim Barnett and climate scientist David Pierce.

Barnett and Pierce concluded that human demand, natural forces like evaporation, and human-induced climate change are creating a net deficit of nearly 1 million acre-feet of water per year from the Colorado River system that includes Lake Mead and Lake Powell. (Source: Scripps Institution of Oceanography, February 12 2008, http://ucsdnews.ucsd.edu/newsrel/science/02-08LakeMead.asp)

[44] http://www.purdue.edu/UNS/x/2008b/081216DiffenbaughCornpests.html
"Climate change could provide the warmer weather pests prefer, leading to an increase in populations that feed on corn and other crops, according to a new study. Warmer growing season temperatures and milder winters

could allow some of these insects to expand their territory and produce an extra generation of offspring each year, said Noah Diffenbaugh, the Purdue University associate professor of earth and atmospheric sciences who led the study." (Perdue University, December 16, 2008)

[45] At 9:45 pm on May 4th, 2007 an EF5 tornado leveled the rural town of Greensburg, Kansas. Just days after the storm, the community came together and decided to rebuild sustainably, striving to become a model green town for the future. (Source: http://www.greensburggreentown.org/history/)

[46] The ideal is to have a community that is zero waste, operates on just clean energy. There's a wind farm being built, also solar and geothermal ground source heat pumps, a diversified base – all our eggs won't be in one basket. Most significant is a green community. The material is a byproduct of green community. Wind farm, solar energy, organic foods, local foods, all of that is a byproduct of community. We took debris and made something beautiful, that's what happens in nature. Water conservation, being conscious of how we use it, how we can save it — a company donated 400 low flush toilets, state of the art water conserving fixtures, we use so much of our drinking water as waste water. Systems we can have in our homes and businesses that allow for use of gray water. (Source: Greensburg media representative, in phone conversation with Joanna Weiner)