Polar **L**earning **A**nd **R**esponding:

PoLAR Climate Partnership

Partners: Columbia Climate Center at the Earth Institute, Columbia University Center for Research on Environmental Decisions; Barnard College; Teachers College; University of New Hampshire; University of Alaska-Fairbanks; American Museum of Natural History; International Arctic Research Center

The vision of the PoLAR Climate Partnership is to use fascination with the changing polar regions and novel educational approaches to engage adult learners and inform understanding and response to climate change

National Science Foundation, Phase II Climate Change Education Partnerships

Max. $6.25 million over 5 years

"… of a large enough scale that it will have catalytic or transformative impact that cannot be achieved through other core NSF program awards"…

- Catalyze changes in educational practices
- Improved public understanding:
  - Fundamental processes of the climate system
  - Role of human systems in climate change
  - Potential impacts and implications of climate change for human systems
- Realistic strategies to engage diverse and underrepresented communities
- Serve as communications hub for coordinated, dissemination and communication
- Research intended to advance knowledge on more effective climate education

Polar Learning and Responding -- PoLAR

Focus on the poles, on adult learners, and on interactive and game-like educational approaches

- Why the poles?
  - They are ground zero for climate change.
  - Polar changes have global impacts, e.g. sea level rise.
  - The public identifies global warming with polar processes and fauna.
- Why adult learners?
  - Adults, including college students and their professors, pre- and in-service teachers, and life-long learners in the general public, are today's decision-makers.
- Why use interactive and game-like approaches?
  - They allow for independent discovery.
  - They reach different people in different ways.
  - They motivate people to pay attention.
  - They help people evaluate and make decisions regarding complex material.
  - They can be easily disseminated and used in diverse settings.

Our Partnership

Climate Science

- *Natural Science:* Columbia's Lamont-Doherty Earth Observatory (LDEO) and Columbia Climate Center (CCC), Barnard College, International Arctic Research Center (IARC)
- *Social Science:* University of New Hampshire (UNH), University of Alaska, Fairbanks (UAF)

Learning and Decision Science

- *Learning Theory and Practice:* Teachers College (TC), IARC, Columbia Center for New Media Teaching and Learning (CCNMTL)
- *Decision Theory:* Columbia Center for Research on Environmental Decisions

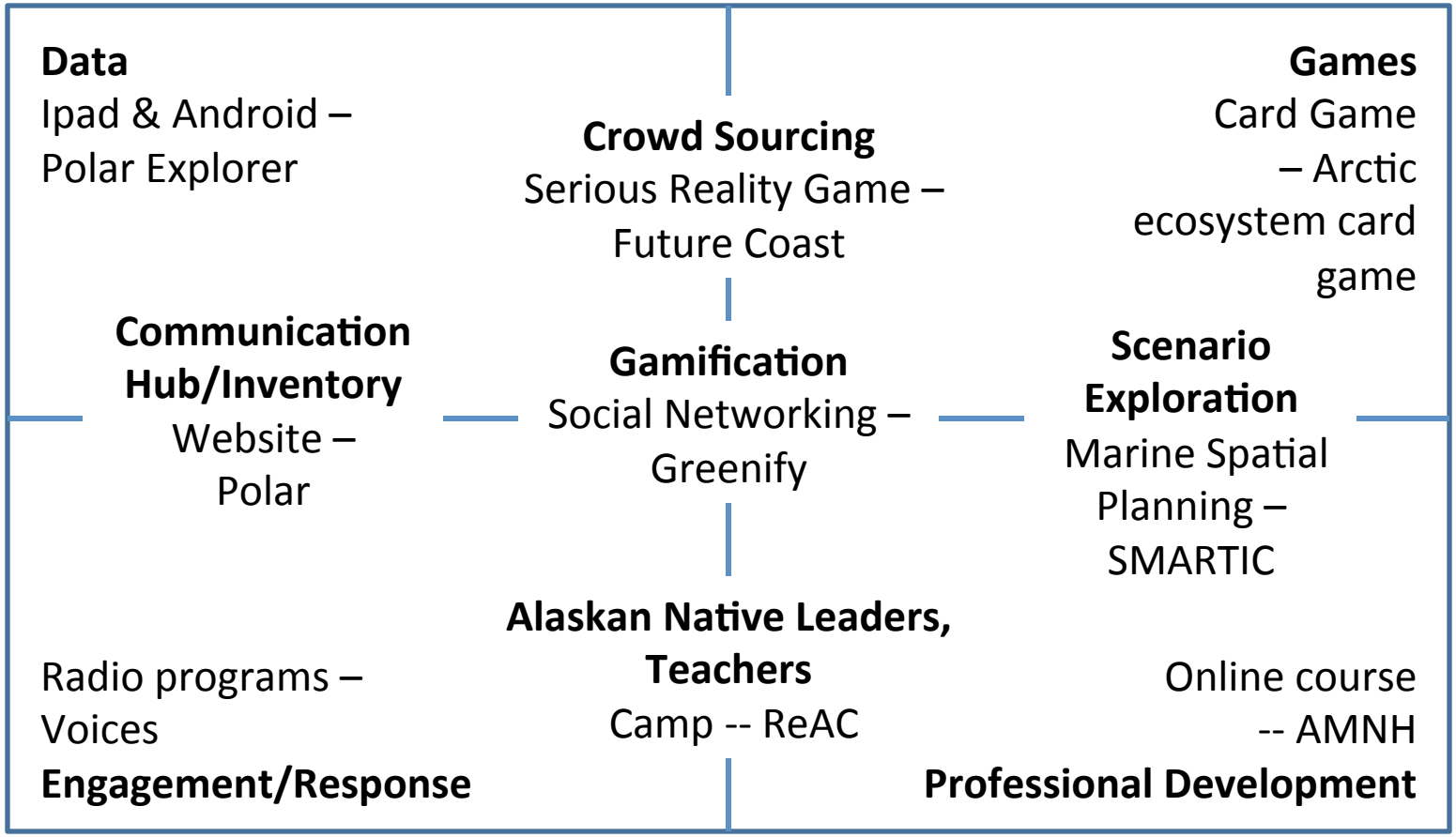
Practitioners

- *Formal education practitioners*: Barnard College, TC, UNH, & UAF
- *Informal education practitioners:* American Museum of Natural History (AMNH) and IARC
- *Gaming practitioners:* Eklund

Catalytic Associates

- Games for Change, WWF/Coca-Cola, AMNH (marketing), Barnes and Noble (committed to review proposal), Sustainable Cities, American Geophysical Union, Tourist Cruises? Science Friday? NSTA

What We Propose



Arctic Ecosystem Card Game

Stephanie Pfirman Barnard/Columbia/LDEO and Joey Lee, Teachers College

- Pilot testing in classes and in focus groups (~65 people), indicates that the game is both fun and effective in developing an understanding of Arctic ecosystem function and vulnerability to climate change and other stress
  - "I certainly felt an adrenaline rush as I kept the possibility of a major disaster impacting my web at the forefront of my mind to strategize the best possible food web combination."
  - "This activity definitely kept my interest because I am a competitive person who loves games. I also enjoyed building the web and seeing the relationships between the organisms."

"Arctic Home" Catalytic Impact

- AMNH (marketing) and Barnes and Noble production
- Dissemination through free distribution at ASTC, NSTA, AECO-Association of Arctic Expedition Cruise Operators
- Linked to Coca-Cola/WWF "Arctic Home" website
  - Coca-Cola: 33 million facebook friends
  - Collect a deck?
- Inupiat terminology to reach diverse audiences

Arctic SMARTIC
Strategic Management of Resources in Times of Change

Stephanie Pfirman Barnard/Columbia/LDEO, Ben Orlove, CRED, and Joey Lee, Teachers College

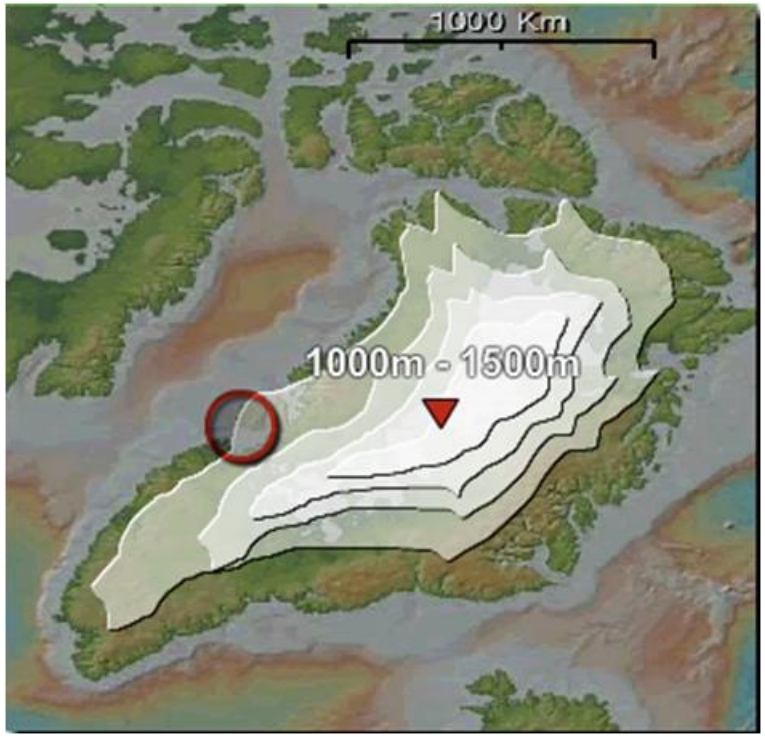
- Marine spatial planning game to develop a strategy to manage competing Arctic marine resources as sea ice retreats
- Pilot testing with 102 people in settings including classrooms, focus groups, and a tourist cruise
  - Participants are able to identify vulnerable areas within the game region and come to understand the complexity of managing stakeholder interests in a changing climate
  - "… before this activity, I had thought of the stakeholders, but I thought they were all in conflict with each other; it turns out that only certain ones are in conflict with each other in certain areas."

SMARTIC Catalytic Impact
-- can be used anywhere

- Production by Barnes and Noble with AMNH (marketing)
- Dissemination through WWF/Coca-Cola, free kits for ASTC, NSTA, AECO
- Google education -- foundation for the game is Google images

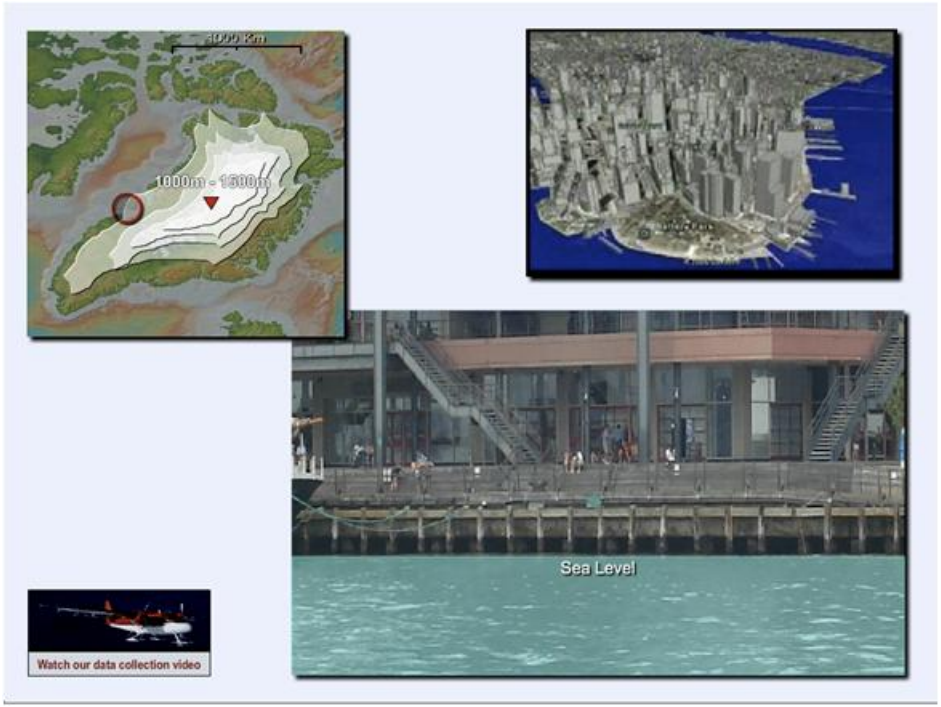
Polar Explorer: A Tool for Accessing & Visualizing Polar Data

Robin Bell and Margie Turrin, LDEO

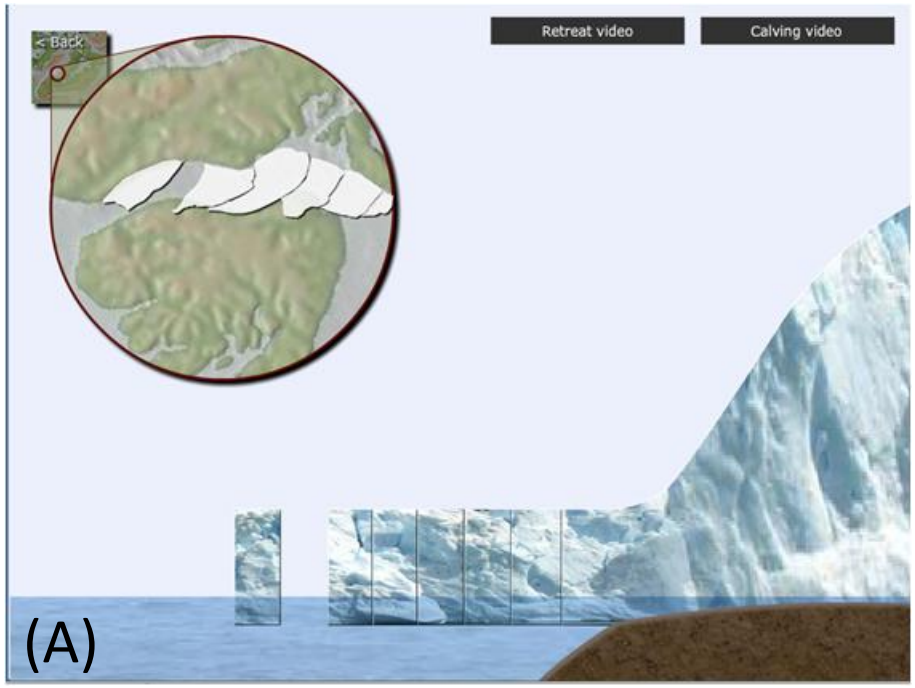


In this example activity we connect ice elevations on Greenland to the potential sea level rise in Manhattan.

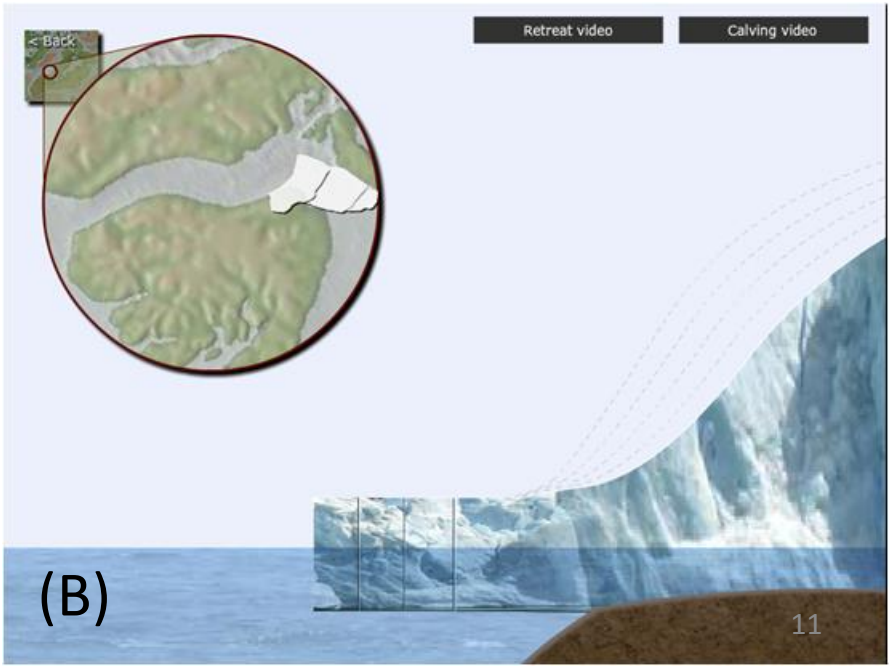
A user friendly way to access the wealth of Earth System Data & Social Science data for the polar regions.



‘Explorer’ will develop short interactives & visualizations around the data



In this example, viewers will drag ice sections from Jakobshavn Ice Stream (A) into the ocean (B) to see how when floating ice unhinges from the land, ice surges from the land into the ocean, causing land ice elevation to drop and sea level to rise.



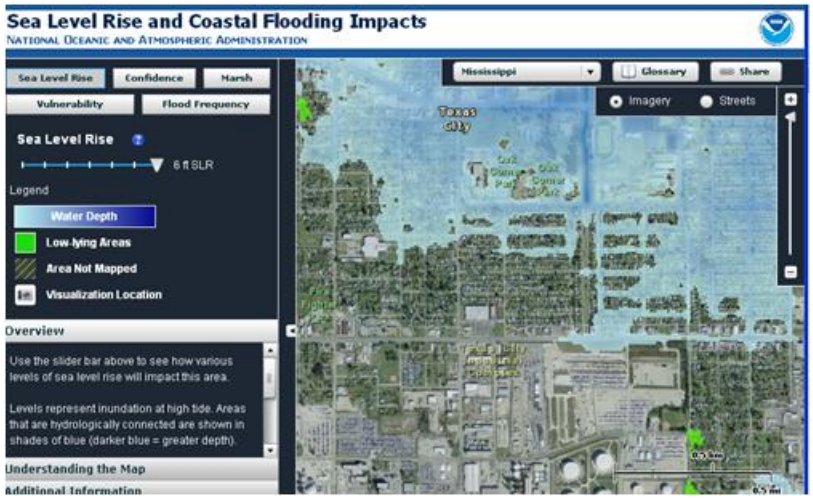
Polar Explorer Catalytic Impact

- Weekly links of news stories, events, blogs, and science advances to of polar climate natural and social science data to provide context and allow for independent discovery.
- Increased accessibility to natural and social science data

A massively collaborative alternate reality game – August through November, 2013
Ken Eklund, Peter Schlosser, Columbia and Ben Orlove, CRED

FUTURE COAST seeks to engage people with sea level rise – a compelling here-comes-the-future story.
We believe this project will command attention through its crowdsourced exploration and visualization of the future along the lines of Eklund's WORLD WITHOUT OIL.

Where will the shoreline be in 2100?
How would that change your community?
What is the process of change going to be?
What is actually going to happen to the coastal properties of today?
How will the process of adaptation play out?



Future Coast:

Players strive to create authentic 'voicemails from the future'

- Investigate science projections: Impact Mapper etc.
- Investigate visualizations: Polar Explorer etc.

Game characters guide curation of voicemails

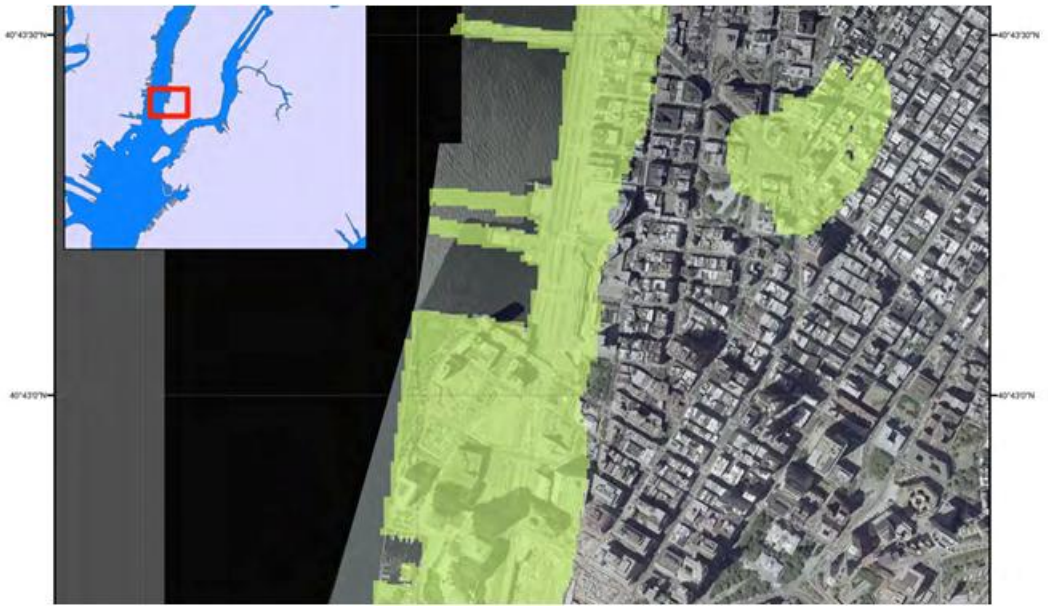
- Organize voicemails into narratives

Real-world geolocated missions

- Investigate coastlines threatened by future flooding etc.

Sea Level/Storm Surge 2080

Engaging the New York public



FUTURE COAST Catalytic Impact

- Partnering with affiliated organizations (Sustainable Cities, Positive Feedback, etc.)
  - outlet for desire to take positive action
  - community creation
  - personal narratives = press-friendly … Science Friday?
- Scales to massive participation
  - 10,000 core
  - 100,000s participatory
  - 500,000s followers

User-created real world missions to learn and take action about climate change

Joey J. Lee and
Peter Schlosser, Columbia

TEACHERS COLLEGE
COLUMBIA UNIVERSITY

Goal: Making climate change education -- and taking action – a ***social*, *fun* and *crowdsourced* experience**

(1) Increase **knowledge and understanding**

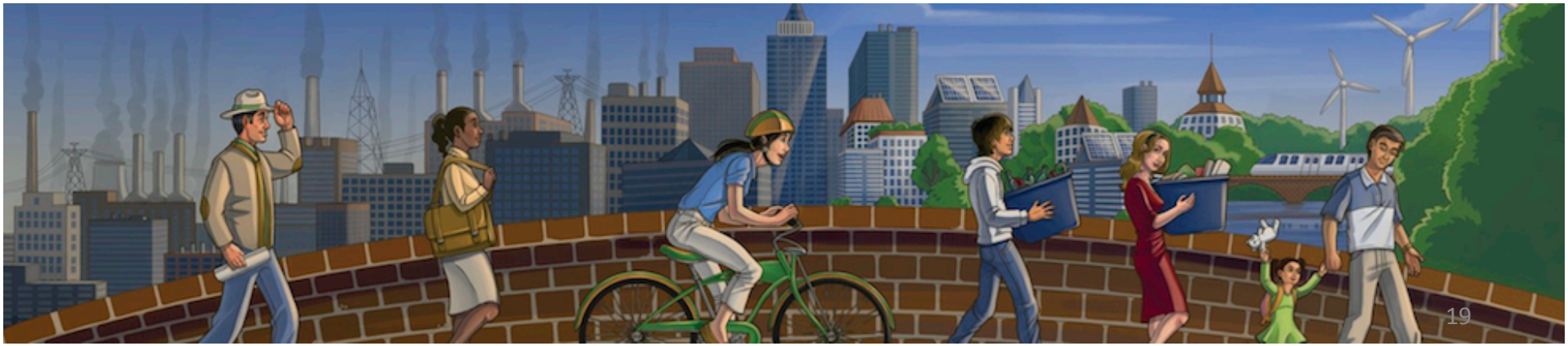
- Easily digestible science concepts, current events (news), personal stories

(2) Change **attitudes**

- Make climate change a **relevant, practical, personal issue**
- Encourage people to *want* to inspire change among their social circle
- Increase empathy of people, animals, and the environment

(3) Motivate positive **action**

- Create and do real-world actions *directly* as part of the game itself
- Change behaviors (e.g., reduce, reuse, recycle)
- Share ideas, solutions, deeds among peers



Kinds of Missions

(1) **Action** Missions

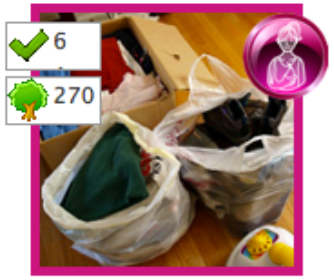
Reduce, reuse, recycle missions

Do something about a problem, share your solution

Future Coast – implement a field program

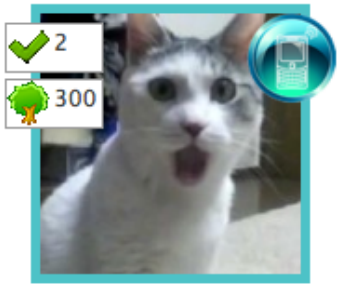
Oh! Organic! Challenge

Foods taste better and your body and the earth will thank you when you go organic. Can you make the switch?



Donate Unwanted Items

Free your living and working space from unused items.



Amazing Facts Challenge

OMG! Find and share the most amazing facts you can find about climate change.

Debate: Sulfate Aerosols?

Should we deliberately inject sulfate aerosols into the stratosphere? Join the debate!

(2) **Learning and Debate** Missions

Go and learn facts; find the answer

Given a set of data, compute the correct answer

Debate an issue: Do research and argue your stance

Tasty Yummy Veggie Spot

Share with the Greenify community the tastiest, yummiest veggie options in your local area.

Picture the Problem

Post pictures that show effects of Arctic warming.

(3) **Sharing and Reflection** Missions

Share strategies, tips, and practical ideas

Share photos and reflections

You have read 59% of 44 articles

59%

Page 1 of 3: 1 2 3 Next »

Greenify News

NY Must Take Action Now

Written by: Joey

Scientists believe New York must take action now about climate change. Read this AP article.

+ Read Again...

Do Humans Cause Global Warming?

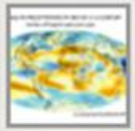
Written by: wcjord

How do we know that humans are the major cause of global warming?

+ Read Again...

Projected Shifts in Climate

Written by: wcjord



Climate scientists use computer models to predict different possible futures.

+ Read Again...

Trisha's story: Hawaii

Written by: Joey

Trisha's story about how climate change has impacted Hawaii.

+ Read Again...

Greenify News

Are Humans Causing Global Warming?

Written by: Woonhee Sung

Do humans cause global warming? What does the scientific evidence show? Read these ten indicators.

+ Read Again...

Effects of Global Warming

Written by: Woonhee Sung

What are some of the effects of global warming?

+ Read Again...

U.S. GHG Emissions

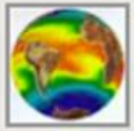
Written by: wcjord

U.S. greenhouse gas emissions by economic sector.

+ Read Again...

Climate Feedback Loops

Written by: wcjord



Feedback mechanisms can either minimize change or amplify it. The second kind can lead to runaway reactions...

+ Read Again...

Greenhouse Gases

Written by: pinar ceyhan

Gases that trap heat in the atmosphere are called greenhouse gases. Try this interactive presentation!

+ Read Again...

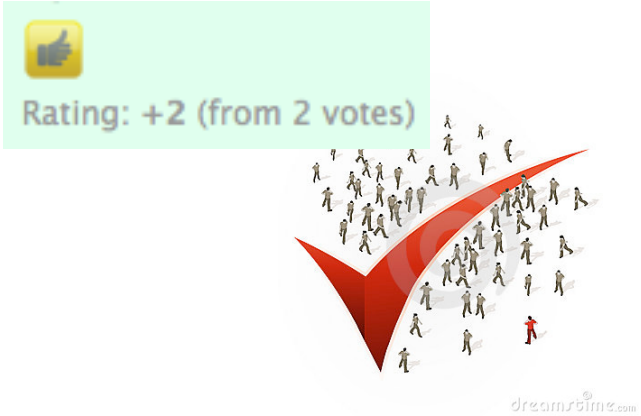
Polar bear pets – develop as the player learns and completes missions

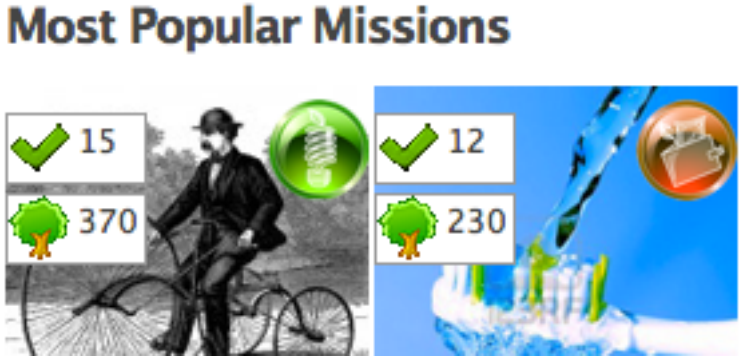
if player doesn't complete missions regularly, sea ice level decreases and pet happiness level goes down

Zine is a smart bear.
(30 Explore Articles read)
Happiness: 73%

Greenify Catalytic Impact

- Link with “Arctic Home” campaign …
- Crowdsourcing to determine good solutions, actions and knowledge
  - Trackable – for research
- Empower ordinary people/give them a way to inspire change
  - Take ownership of climate change issues -- earn points for players completing the missions *you* created





Polar Voices – Radio Broadcasts

Polar Climate Science Expertise: Maribeth Murray, Media Design Expertise: Theresa Bakker, Roger Topp, Inupiat language expert : University of Alaska Fairbanks

- Series of 24-28 minute radio episodes, with Inupiat version and a companion 90 second version
- Explore collaborations between scientists and northern residents to
  - explain impacts of and responses to polar climate changes, indigenous climate knowledge of arctic peoples
  - Immersive narrative and audio soundscape help listeners explore polar environments and peoples
- Episodes supported by multimedia web-based companion material provides accessible information on relevant science, including Polar Explorer, scientific and stakeholder individuals and communities

Polar Voices Catalytic Impact

- 90 second versions for Isla Earth – distributed to 300 radio stations
- Translation connects with diverse and underrepresented communities, whose experience of climate change exceeds that of the average global citizen

Reaching Arctic Communities Facing Climate Change -- ReAC

Climate Scientist/Science Educators: Dr. Elena Sparrow, IARC and Polar Science Climate Experts (IARC & UAF Climate Scientists); Learning Science/Education Practice Experts: Association of Interior Native Educators (AINE) and Malinda Chase (Executive Director and Learning Styles Director, AINE); Alaska Native Elders/Cultural Experts: Regional and Statewide Elders, including Samuel Demientieff

- Culturally responsive project
  - Involves educators, local leaders, planners and community members
  - 3 annual gatherings of 14
- Facilitates in depth dialogue about climate change and its impacts
- Integrates local and Alaska Native knowledge about climate and the environment with PoLAR activity development and implementation
  - e.g. stories from elders seed FUTURE COAST

ReAC Catalytic Impact

- Engages important perspectives of a critical community that is experiencing climate change and is underrepresented in the global dialogue
- Multiplier effect as leaders report back and engage larger groups at meetings of their professional/ community societies
  - Honorarium to encourage them to share with/ present to at least 20 others so that we would reach 280 every year

AMNH On-Line Climate Course

Rob Steiner and Ro Kinzler, AMNH, and Roger Anderson, Teachers College

- Design, development, implementation, evaluation and revision of a set of web-based educational materials – to be initially developed for teachers and then adapted to a broader adult audience – focusing on climate system science
- Materials available as stand-alone modules, for example webinars for the general public, linked with events/data on the Polar website
  - as well as an integrated, facilitated professional development experience for teachers
- Integration of PoLAR activities and resources, including interactive and game-like activities (including both Web-based and lower tech approaches) as tools for inquiry, exploration, visualization and analysis
- Repository of climate change curricular unit plans

On Line Course Catalytic Impact

- Expanded access to the AMNH online graduate course on climate change science developed under the NASA Innovations in Climate Education (NICE) program, now with enhanced polar-specific resources, discussions and assignments
- Promotes use of games and game-like approaches in classrooms
- Hundreds of secondary school and community college teachers can participate
  - Scholarships for community college teachers to broaden reach

Communications Hub

Larry Hamilton – University of New Hampshire

- Rapid response to emerging issues facilitating connections between current events, underlying data, and curricular resources
  - Real-time capability for educational use of new studies and breaking news
  - Provide science-informed response to misunderstandings that arise in the media
- Linked with learning missions in Greenify

Example: NYT op ed, Sunday 2/26/12

Getting Arctic Drilling Right

Before Shell gets the green light, it must show it has all of the safety systems in place

Oil drilling off the North Slope of Alaska now seems virtually a sure thing. This month, the Interior Department gave tentative approval to Shell's plans for responding to a potential spill in the Chukchi Sea, an important step toward approval of the company's plan to drill six wells in the Chukchi's frigid and forbidding waters. The company still needs a permit, and before the administration grants one it must be absolutely sure that Shell can meet the safety conditions stipulated in the approval.

The costs of a mistake could be very high. Many environmentalists have argued against any drilling in Arctic waters, given their value to wildlife — and given weather conditions that would make cleaning up a spill especially difficult. We believe this particular project is worth the effort, but only if done right. Estimates of recoverable reserves in the Chukchi and nearby Beaufort Seas range as high as 30 billion barrels of oil, about four years' worth of consumption in the United States.

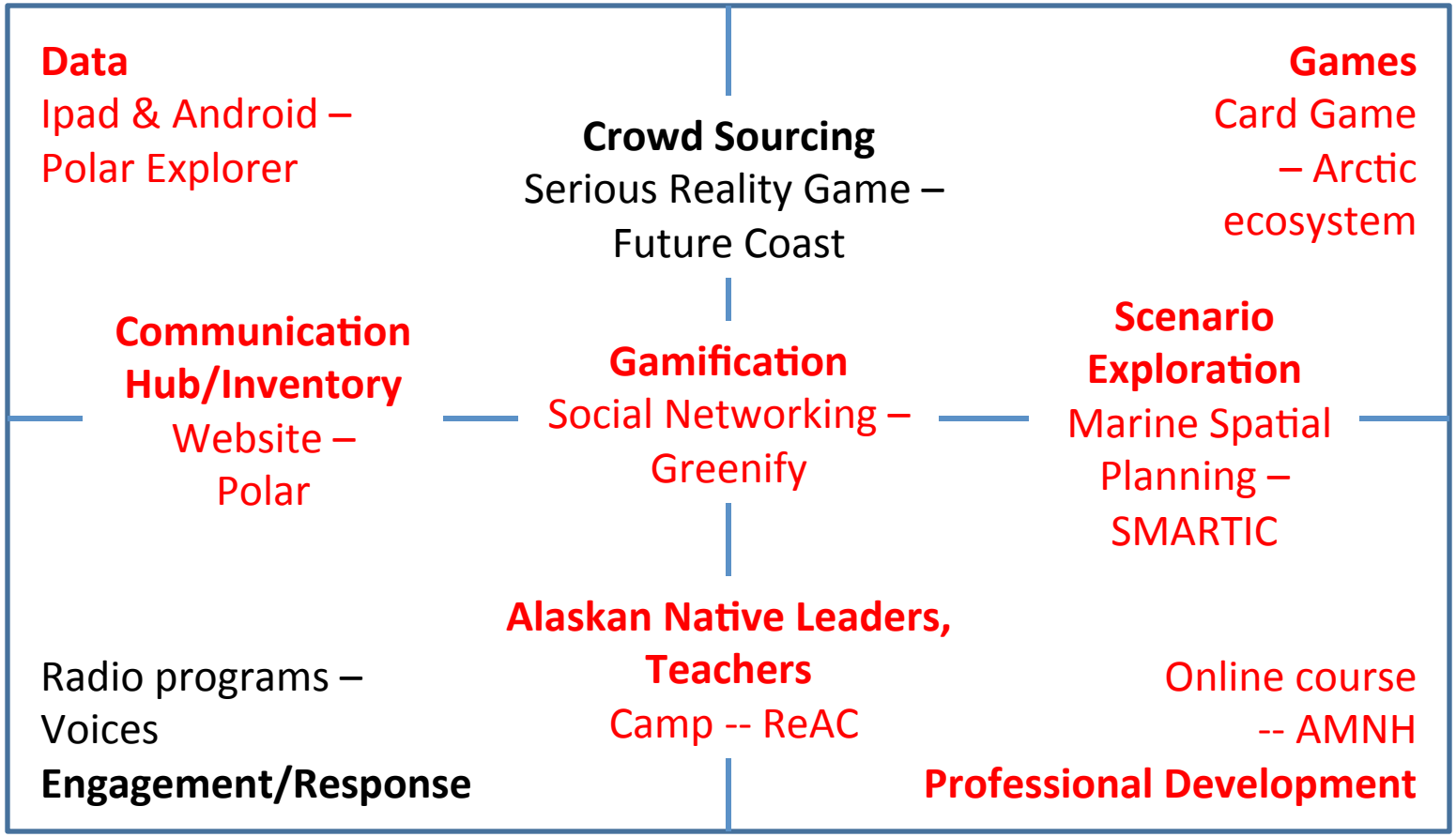
Shell must meet two main conditions. The first is to complete and test a well-capping system that can quickly contain a blowout in a harsh and unfamiliar environment. Among the most searing memories left by the BP blowout in the Gulf of Mexico was the complete helplessness of industry and government officials as a runaway well spilled nearly 5 million barrels, or 206 million gallons, before it was finally capped.

The other condition is that Shell, along with the Coast Guard and other agencies, conduct extensive spill response drills — in the open ocean, not "tabletop" exercises — to test the booms, skimmers, support vessels and all the other moving parts necessary to collect whatever oil escapes before a blowout is plugged. The Interior Department's announcement said Shell had "committed to provide" the capping stack and an oil collection system. But it should insist on multiple tests involving government and outside observers before allowing exploration to proceed.

Shell's proposals are a big improvement over earlier plans, in part because the Interior Department has applied many of the lessons learned in the gulf — insisting, for instance, on a redesigned blowout preventer capable of closing a well within seconds. The plan also shortens the summer drilling season to around two months. The company must stop before sea ice begins to form, ensuring it has time to fix a blowout while operating in open water.

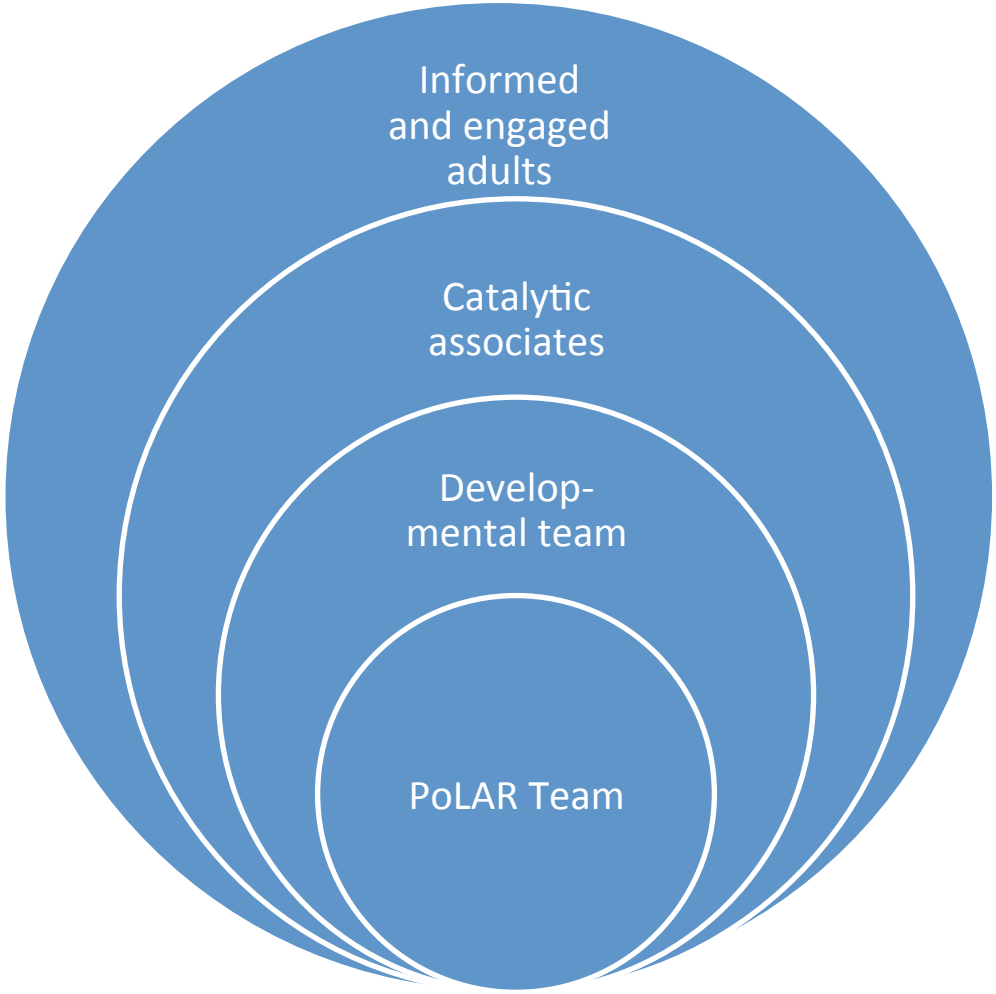
President George W. Bush recklessly proposed opening just about all of the Chukchi and Beaufort Seas to drilling. The Obama administration canceled that plan in favor of what it says will be a more modest and scientifically rigorous proposal, due in midsummer. Environmentalists are urging the government to put particularly sensitive areas off-limits entirely, and we agree. The most important thing right now is to get off to a credible start by making the Shell project as mistake-proof as possible.

Initiative Integration



Dissemination Plan

- Range from small scale, leveraged programs to massively collaborative events to ongoing resources
- Coordination needed with catalytic associates



Evaluation

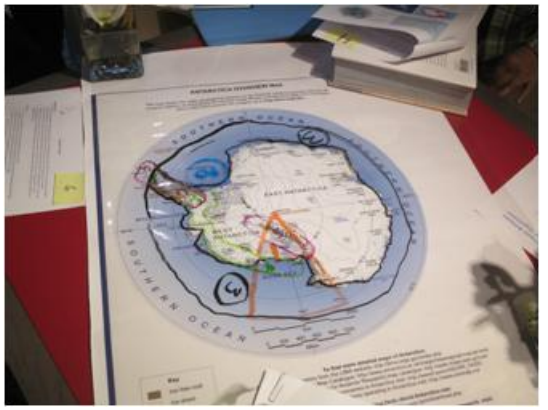
Programmatic aspect	Focus of evaluation	Kind of evaluation	Overall evaluation questions	Theoretical framework for evaluation	Examples of evaluation activities
PoLAR partnership	Networking and collaboration amongst various PoLAR partners	Summative (Year 1 -5)	Are the partners meeting their individual and partnership goals for Phase II? Does the partnership demonstrate characteristics of a successful partnership?	Collaboration assessment tool developed by Gajda (2004)	• Ongoing evaluation of the partnership through the use of partner focus groups, surveys, and interviews
PoLAR projects	• Serious games (Greenify, SMARTIC, Future Coast, Polar Explorer) • Teacher modules	Formative (Year 1 and 2)	Do the PoLAR projects demonstrate the potential for successful implementation?	Key characteristics of a learning game developed by Schaller(2005)	• Focus groups with target audiences to evaluate the game and its likelihood of attaining the audience outcomes • Online focus groups with teachers who have used the prototypes of teacher modules
		Summative (Year 3 -5)	To what extent are the PoLAR projects successful at achieving the intended audience impacts?	Assessment of audience outcomes	• Embedded assessments (e.g. online surveys embedded into the game) • Analyses of the game players' use of the game and its resources • Longitudinal analyses – following audience members over multiple time points • Pre-post surveys of pre-service teachers • Post-only surveys of in-service teachers
PoLAR communication, coordination, and dissemination	• PoLAR website • PoLAR educational camps • PoLAR radio outreach	Formative and Summative (Year 1-5)	To what extent is the PoLAR project successful at achieving its communication and dissemination goals through its website, educational camps, and the radio programs?	Assessment of audience outcomes	• Online surveys to assess the reach and impact of the PoLAR website • Analyses of audience's "activity" on the website • Online discussion forums (e.g. v-bulletin) to assess the community engagement aspect of the project • Online surveys to assess the reach and impact of the PoLAR radio programs

Research on Learning and Understanding of Polar Climate Change

"…to advance knowledge on more effective climate education"

- Gap identification
  - Include half a dozen questions per year on ongoing statewide surveys to identify gaps in public understanding that educational and the website will specifically address
  - Publishing the survey results
- Attribution analysis
  - Focus groups assembled for evaluation will also be used to probe sources of information to inform attribution of any changes in understanding or concern
- Platform analysis
  - Conduct a meta-level analysis of the efficacy/implications/interesting aspects of using simulations and/or games for outreach, education, decision making
  - Building from focus groups of users, will explore which attributes of the products they emphasize--game/play, tech/IT/simulation, fantasy, future, education
  - Focus on the relative values of different types of games, simulations and computer-mediated relations like social media from cultural and psychological perspectives
    - Are people less serious because they are in a playful context?
    - How do varying dimensions interact with the user characteristics?
    - Are the venues transformative because they create new possibilities?

Sustainability Plan



- AMNH online course for teacher professional development will continue
- In years 4 and 5, work with Games for Change (?) to pose challenges for continued development of novel polar climate educational resources
  - Would seed interest, and build capacity, in the the gaming community to connect with polar climate science
- WWF/Coca Cola Arctic Home campaign planned for 5 years, running from the winter of 2011-12 through 2016-17
  - Identify potential for future endeavors, beyond the life of the grant
  - For example, pose challenges to extend the card game
- Barnes and Noble prefers a package over 1 stand-alone game
  - Have initiated development of Antarctic versions of both the card game and SMARTIC
  - Income could support future game development and dissemination
- Polar Explorer and/or Arctic ecosystem card game app sold at a nominal fee

Summary

CCEP goals	PoLAR Approach	PoLAR Outcomes	PoLAR Impact
Catalyze changes in educational practices	Enhance credibility and use of game-like approaches	A suite of ready to use games/ activities with accompanying curriculum materials whose implementation has been assessed	Widespread use of novel/alternate approaches
Improved public understanding: • Fundamental processes of the climate system • Role of human systems in climate change • Potential impacts and implications of climate change for human systems	Spark • Engagement • Awareness • Curiosity • Challenge • Data access Identify gaps in public understanding	Improved public understanding of and access to information on: Fundamental processes (AMNH) • melting ice, shifting ecosystems, changing access (PE, FC, AH, SM) Role of human systems • individual role in anthropogenic contributions (Greenify) Potential impacts and implications: • sea level rise, implications for Arctic communities, changes in iconic species such as polar bears and penguins, characteristics of different management strategies (ReAC, PE, FC, AH, SM)	Improved response capacity • Motivated adults • With access to salient data/ information, skills and tools Gaps in public understanding are met through targeted dissemination (Voices, PH)

CCEP goals	PoLAR Approach	PoLAR Outcomes	PoLAR Impact
Realistic strategies to engage diverse and underrepresented communities	• Systems/sustainability framework rather than climate • Engage Alaskan and community college communities in knowledge integration and dissemination • Collaboration with WWF/Coca-Cola, AECO outreach to broader demographic	• Alaskan community leaders participate in radio broadcasts and workshops (Voices, ReAC) • Information is transmitted back to Alaskan Federation of Natives meetings and communities via the radio (Voices, ReAC) • Community college teachers enroll in AMNH online course • Widespread use if linked with WWF/Coca Cola Arctic Home and disseminated via cruises	Diverse communities are engaged
Communications hub for coordinated, dissemination and communication	Development of an agile, responsive and proactive network coordinated through the Polar website	• PH website highlights new developments and responds to breaking news • Engagement with CCEP alliance – links with other CCEP Phase IIs, NOAA, etc.	Serves community needs as evidenced by active and diverse use by scientists, teachers, organizations and the general public
Research intended to advance knowledge on more effective climate education	• Analysis of comparative value of various modes of engagement • Analysis of changes in public perception	Synthesis of value of game-like approaches for education and outreach	Improved understanding of what works, for whom, under what circumstances