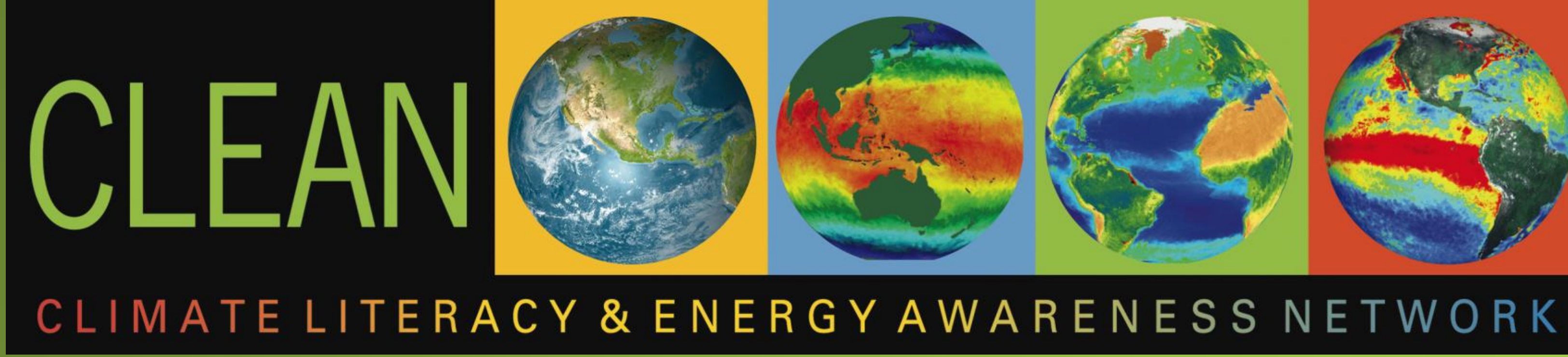

Moving Toward Collective Impact on Climate and Global Change Education

Tamara Shapiro Ledley – TERC, Cambridge, MA
Daniel Zalles – SRI International, California

Moving Toward Collective Impact on Climate and Global Change Education Session Agenda

- 1:45-2:45 – Setting the Stage
  - What is Collective Impact and where are we with Collective Impact on Climate Literacy?
  - STORE Overview and how it might take advantage and contribute to Collective Impact
  - EarthLabs Overview and how it might take advantage and contribute to Collective Impact
  - Synergies between STORE and EarthLabs

- 2:45-3:45 Discussion with all session participants
  - What could an overarching backbone organization do to provide coordination and leveraging across member networks and partners to increase their reach and collective impact – review summary of shared doc http://tinyurl.com/mgwndtr
  - Can we begin to develop a common agenda for an overarching backbone network?

Collective Impact - Background

- Collective Impact
  - A way to frame discussions and organize diverse organizations around a shared vision
  - has proven successful in a variety of local to global-scale initiatives
- Conversations within the climate education community on how to more effectively organize and coordinate efforts began in 2012
  - Discussions at 6 formal meetings
  - the shared doc (http://tinyurl.com/mgwndtr) summarizes the current state of the discussions.

- Kania, J., and Kramer, M., (2011), Collective Impact: Stanford Social Innovation Review, v. 9, no. 1, p. 36-41, http://www.ssireview.org/articles/entry/collective_impact.

Collective Impact on the Local to Global Challenges Presented by Climate and Global Change Education, Literacy, Preparedness, Adaptation, and Mitigation

Tiny url for this page - http://tinyurl.com/mgwndtr

This is an evolving document that is integrating community input to define the elements of effective collective impact on climate and energy literacy. The venues at which input was obtained are listed at the bottom of this document. We are maintaining an email list of those who have participated in these discussions.

As of 5/16/14 input from all previous conversations has been integrated. The earlier document is at http://tinyurl.com/mzy8v4w .

Table of Contents

Pre-conditions of Collective Impact

1. Influential champion or small group of champions
2. Adequate financial resources
3. Sense of urgency for change

5 Elements of Collective Impact

Partners/contributors need to

1. Develop a *COMMON AGENDA*,
2. Develop a *SHARED SYSTEM OF MEASURES* to track progress and success,
3. Engage in *CONTINUOUS COMMUNICATION* that facilitates the building of the community of stakeholders,
4. Identify *MUTUALLY REINFORCING ACTIVITIES* that address the *common agenda* and contribute to the measures of progress, and
5. Have a *BACKBONE SUPPORT ORGANIZATION* with ample funding that can engage and coordinate all stakeholders in addressing and implementing of these elements.

Collective Impact on Climate Literacy Summary of Evolving Discussion

- A Network of Networks
  - Overarching Backbone Support Organization
    - the network that fosters collaborations, sharing, leveraging and partnering between member networks
    - Aids member networks in identifying funders and securing funding
    - Supports member networks in defining their common agenda and shared measures
  - Member Networks
    - Large range in size – small individual project to national (or beyond) effort with multiple partners and audiences
    - Would benefit from coordination and leveraging with other aligned or complementary efforts

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Overarching Backbone Support Network

- Have an overarching common agenda that can scale down to the concrete goals of the Member Networks common agenda

- Enabling excellent communication with and between Member Networks

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Activities of an Overarching Backbone Support Organization

- Enable overarching issues to be effectively addressed in different networks/communities
- Facilitate communication and leveraging of services, information, knowledge, experiences, resources and materials
- Development of partnerships from external groups/communities with needed expertise
- Unified messaging – dissemination, marketing, outreach
- Support Member Networks
- Shared Measures – Evaluation of progress across networks

Overarching Backbone Organization: Support for Member Networks

- Provide support Member Networks in the development of their specific common agenda and shared measures
- Help Member Network reach larger and more diverse audiences
- Work with Member Networks to seek and secure funding
- Provide facilitators for Member Networks for these activities when needed

Collective Impact on Climate Literacy Vision and Common Agenda

- Drafted December 2013

Enabling society and the future generations to understand, address, and solve pressing local to global challenges presented by climate and global change.

- Extensive comments have been received during the subsequent meetings – listed in share document

Collective Impact & the STORE Project

Daniel Zalles, PI
DRK12 PI Meeting
Aug 5, 2014
SRI International

STORE

Studying Topography, Orographic Rainfall, and Ecosystems

HOME RESEARCH CURRICULA DATA & SOFTWARE PAPERS & PRESENTATIONS OTHER RESOURCES CONTACT

SESIS Home

Welcome to STORE

STORE is a three-year project using innovative Geospatial Information Technology-based learning in high school environmental science studies with a focus on the meteorological and ecological impacts of climate change. Through a co-design and design-based research approach with teacher partners, the project has developed (1) GIS data files that promote learning of the analytical skills necessary to scientifically investigate the potential consequences of projected climate change on local ecosystems and (2) a place-based curriculum module exemplar consisting of six lessons that demonstrate how the tool can be used in classrooms for student study of the focal science concepts. To increase the likelihood of successful classroom implementation and impact on student learning, we have devised a teacher professional development process that provides the conditions for the teachers to make good adaptability decisions for successful follow-through. We are examining the use of the tool and curriculum during two years of classroom implementation.

NOTE: Until September 2013, STORE will still be in development and field testing phases. Hence, materials on this website may be revised or updated without notice until then.

This material is based upon work supported by the National Science Foundation through DRL Grant 1019645. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

STORE Development Goal

- Getting teachers to use in their science classes rich data sets about regional "study areas“ that illustrate key principles in Earth science, environmental science, and biology
  - Orographic rainfall, dew point, temperature lapse rate, relative humidity, air pressure
  - Climate as an outcome of repeating weather patterns
  - How different biomes form different predominating vegetation
  - How scientists use models to project climate changes and effects on the ecosystems in the study area
  - To maximize teacher interest across science domains and courses, usage of the data, not the lessons

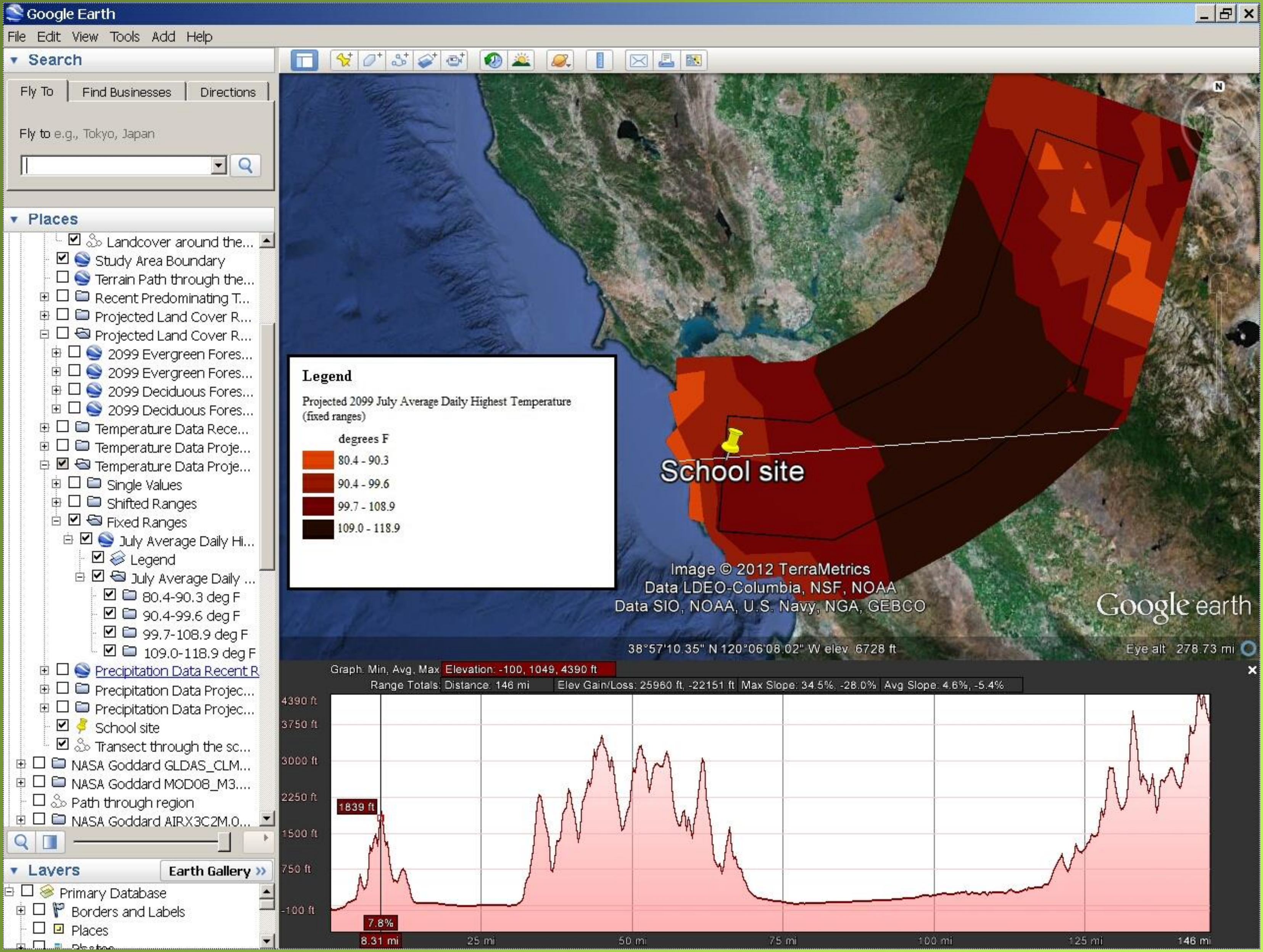
STORE Research Goal

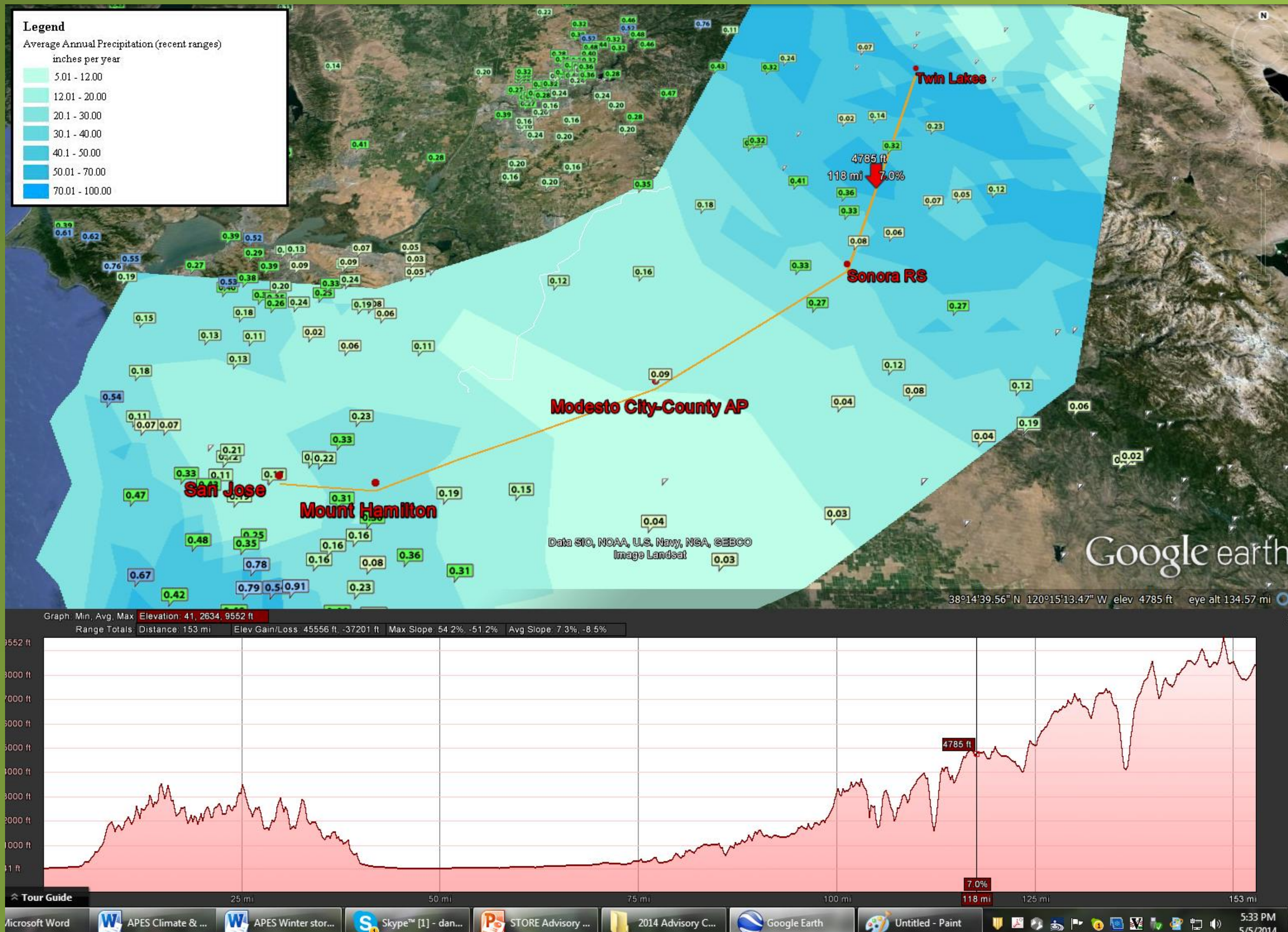
- Study what it takes to maintain teacher engagement and what professional development strategies are feasible relative to teachers' constraints
- Gather information about how teachers build their technological, pedagogical, and content knowledge with the innovation

STORE Strategy (cont.)

- Look at relationships between teacher plans, implementation practices, and student outcomes using a common assessment instrument
- Create an archive of freely downloadable geo-data, core lessons and teacher adapted lessons
- Make the data usable in free non-cloud-based software programs Google Earth and ARC GIS Explorer Desktop

STORE technology (cont.)




Legend
Average Annual Precipitation (recent ranges)
inches per year
5.01 - 12.00
12.01 - 20.00
20.1 - 30.00
30.1 - 40.00
40.1 - 50.00
50.01 - 70.00
70.01 - 100.00
Twin Lakes
Sonora RS
Modesto City-County AP
San Jose
Mount Hamilton
4785 ft
118 mi
7.0%
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Google earth
38°14'39.56" N 120°15'13.47" W elev 4785 ft eye alt 134.57 mi
Graph: Min, Avg, Max Elevation: 41, 2634, 9552 ft
Range Totals: Distance: 153 mi Elev Gain/Loss: 45556 ft, -37201 ft Max Slope: 54.2%, -51.2% Avg Slope: 7.3%, -8.5%
25 mi
50 mi
75 mi
100 mi
118 mi
125 mi
153 mi
Tour Guide
5:33 PM
5/5/2014

STORE Project-developed lessons

- *Basic Lesson 1*: Students learn key meteorological principles that are used throughout the STORE curriculum
- *Basic Lesson 2*: Students study temperature and precipitation changes in the California study area, which encapsulates a series of weather stations at different elevations.
- *Basic Lesson 3*: Students compare mean annual precipitation and for weather stations along the Bay Area/Sierra profile against the elevation of each station. They also compare ground surface temperature lapse rates with atmospheric lapse rates to see how they differ and why.
- *Basic Lesson 4*: Students explore how local climate affects vegetation in the study areas by overlaying vegetation zones (grouped by vegetation communities) on maps of precipitation and temperature, and digitally analyze these data.
- *Advanced Lesson 1*: Students use the GIS software to compare projected year 2050 precipitation from the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) to current precipitation, analyze the relative amount of change in precipitation within the California study area, and map the projected 2050 spatial distributions of vegetation communities in the Sierra Nevada Mountains portion of the California study area.in 2050.
- *Advanced Lesson 2*: Students use the GIS software to compare projected year 2050 air temperatures from the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) to current temperatures, then map the projected 2050 spatial distributions of vegetation communities in the Sierra Nevada Mountains portion of the California study area. Students use the GIS software to compare projected year 2050 temperatures from the CCSM to current temperatures, then project the future spatial distribution of vegetation in the Sierra Nevada Mountains portion of the California study area.

STORE lessons developed or adapted by teachers

Teacher	Course	Student Demographics	Grade level	Collaborator	Description	Links
Alice Albertson	AP Environmental Science	At the school: - Total Students: 1,764 - Classroom Teachers (FTE): 95.05 - Student/Teacher Ratio: 18.56 - Title 1 School - American Indian/Alaskan: 7 - Asian/Pacific Islander: 128 - Black: 66 - Hispanic: 996 - White: 536 - Two or more races: 31 In the district: - ELL students in the district: 1,818 - Students with IEPs in the district: 1,035	11, 12		(1) Content Representations for the various SRI project-developed STORE lessons that this teacher used. (2) Some extra worksheets about climate.	01 AA STORE Content Representation for Geospatial Technology Class 02 AA STORE Content Representation for Environmenal Science Classes 03 AA Biome template assignment (extra) 04 AA Climatogram assignment (extra)

STORE lessons developed or adapted by teachers (cont.)

Jack Thomas	Geospatial Technology	A rural community college Ethnicity: - American Indian/Alaskan: 1.65% - Asian: 1.54% - Pacific Islander: .76% - Filipino: .59% - Black: 5.86% - Hispanic: 14.20% - White: 61.10%	Community College		GIS-intensive version of STORE Basic Lesson 2, enhanced with attention to plate tectonics.	01 JT STORE Content Representation 02 JT GIS-intensive STORE Basic Lesson 2 for ARC GIS Explorer Desktop
Jerry Randolph	Science and Math	Private school in rural community: Ethnicity: - Asian: 5 - Hispanic: 6 - White: 162	7	Linda Carson	(1) Field work activities for observing and collecting data about the forest environment around the school. (2) Adaptation for middle school of the math-centered and conceptually dense STORE Basic Lesson 1;	01 JR Adaptation of SRI pre-developed STORE Basic Lesson 1 02 JR Content Representation for STORE GE Lab Activities 03 JR STORE GE Lab More Structured

Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

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Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

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Self-selected design partner teachers recruited

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Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

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Modified data layers, new tool, adaptable versions of core lessons

Design Research – Exploratory STORE Project

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Larger set of self-selected teachers recruited by word of mouth

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Iterative PD implementation, assessment

↓

Word of mouth dissemination

Alliances and collaborations with other stakeholders in the greater educational system to strengthen STORE's impacts

- Employ principles of design based implementation research to build the most systemic support and the most systemic impact on student learning
- District administrators
- Local university teacher training programs

Challenges for future sustainability of the innovation

- Updating the data - new climatologies, new predominating land cover surveys, revised climate change projections
- Keeping up with changing software features imposed by the vendors (ESRI, Google)
- Mixed teacher abilities to check for student understanding and respond to student questions
- Reaching out successfully beyond the innovators to impact early adopters, early majority, late majority, and laggards [Rogers, E. M. (1962). *Diffusion of innovations*. New York: Free Press.]

Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

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Self-selected design partner teachers recruited

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Iterative PD implementation, assessment

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Word of mouth dissemination

Design-based implementation research

Systemic school/district input, endorsement & support

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Design-based implementation research

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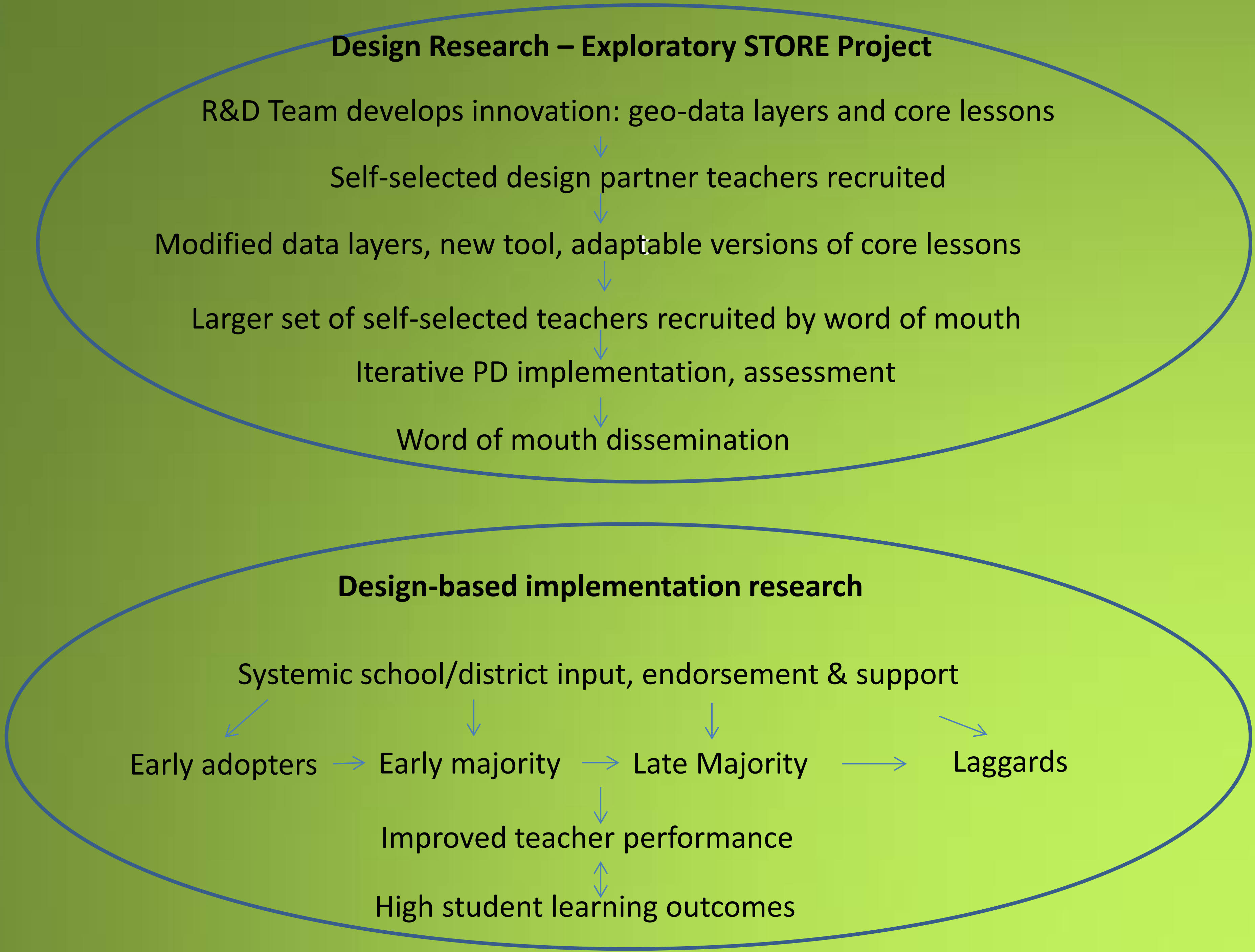
Early adopters → Early majority → Late Majority → Laggards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Word of mouth dissemination
Design-based implementation research
Systemic school/district input, endorsement & support
Early adopters
Early majority
Late Majority
Laggards
Improved teacher performance
High student learning outcomes

Wide
innovation
success

Systemic adoption & support of innovation → Wide innovation success

Systemic adoption & support of innovation → Wide innovation success

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Supportive systemic processes and structures (technology infrastructure, professional development, formative assessment, incentives)

Systemic adoption & support of innovation → Wide innovation success

↑

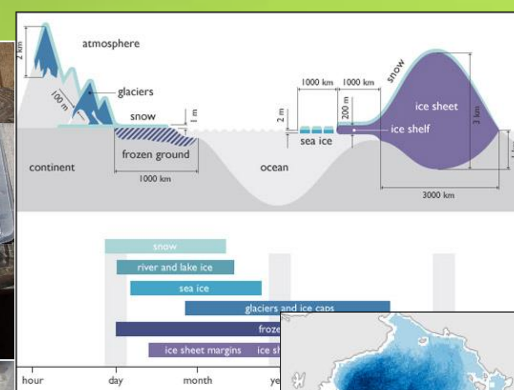
Supportive systemic processes and structures (technology infrastructure, professional development, formative assessment, incentives) ← Organizations making it possible for the practitioner systems to find the innovations and do what is needed to make them worth implementing

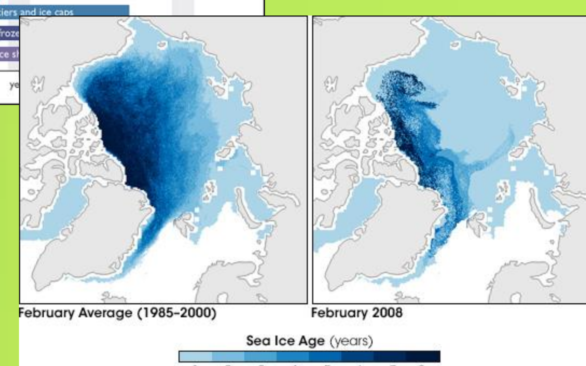
What it would take to sustain STORE over the long term to remain a continually viable and useful resource

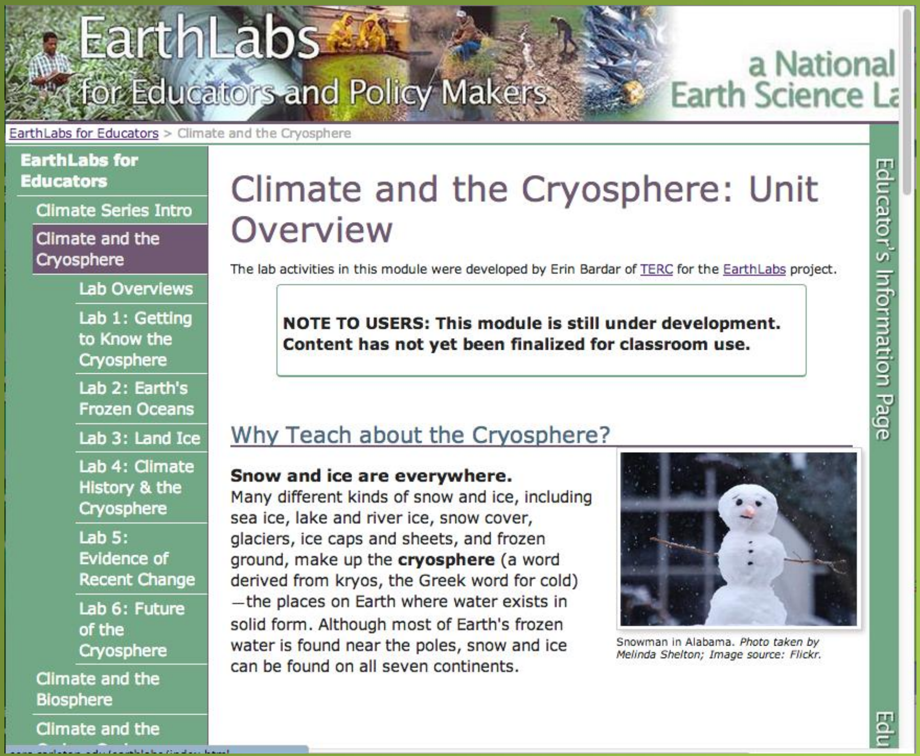
- Brokers helping practitioners and the STORE team find each other and explore common interests
- Solutions-oriented professional development that builds administrative support and holds open the possibility of different types of solutions relative to cost.
- Selectable alternatives:
  - Parallel data sets for study areas in the regions of the newly participating practitioners
  - Alignments to local standards
  - Staff development options (release days, summer days, weekends)
  - Whether to use a mentorship approach for scaling up
  - Whether to also train administrators in the innovation

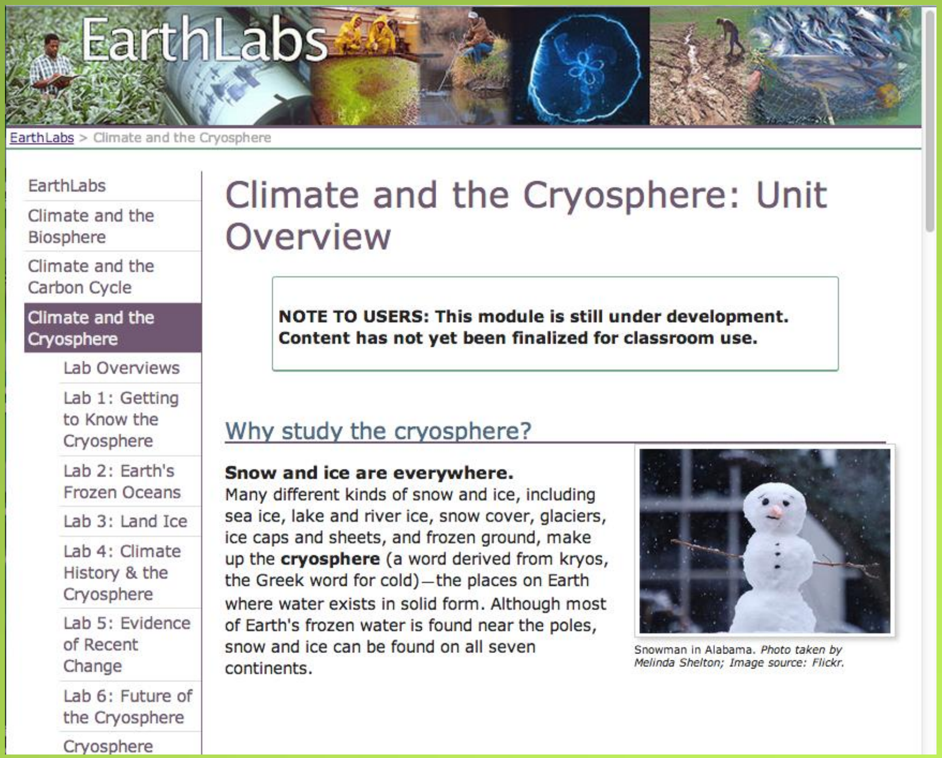
http://serc.carleton.edu/earthlabs

- A web-based Earth science resource comprised of lab based curriculum modules – laboratory component of high school capstone course
- Each module of 5-9 labs highlights an Earth system approach to understanding Earth Science and includes a mixture of
  - text
  - hands-on lab investigations
  - videos
  - data
  - web-based interactive visualizations









- Teachers Guide
  http://serc.carleton.edu/earthlabs
- Student Portal –
  http://serc.carleton.edu/eslabs

1. Climate and the Cryosphere
2. Climate and the Biosphere
3. Climate and the Carbon Cycle
4. Climate Detectives

NSF – DRK12 Confronting the Challenges of Climate Literacy – EarthLabs Climate

5. Earth System Science

NASA Innovations in Climate Education Earth System Science: A Key to Climate Literacy

6. Hurricanes
7. Drought
8. Corals
9. Fisheries

NOAA Environmental Literacy

EarthLabs – Climate Project Components

Curriculum Development	Teacher Professional Development (PD)	Research on Student Understanding of Change Over Time and Space
4 EarthLabs modules developed collaboratively by 4 curriculum developers with input from practicing teachers • Climate & Cryosphere • Climate & Biosphere • Climate and Carbon Cycle • Climate Detectives Feedback from Teacher Leaders, PD Evaluations, and research on student learning used to improve modules	Teacher Leaders 1. Review modules 2. Pilot Modules 3. Prepare to deliver PD to other teachers 4. Weeklong summer workshops in Texas and Mississippi led by 9 Teacher Leaders Workshop Participants 1. 20-25 in each workshop 2. 2012 - Two workshops • 1 in TX & 1 in MS 3. 2013 • 2 in TX & 1 in MS	Teacher Leaders & Workshop Participants implement modules in classroom for research Climate Concept Inventory Development • Student pre- and post-tests used to determine the extent to which modules support student understanding of change over time & space Eye-Tracking Studies • External Users test usability of the EarthLabs curriculum

STORE

EarthLabs

-Large regional "master data sets" and future climate projections that reify key science concepts

Information about how the data layers such as "predominating vegetation" are derived and displayed (data literacy)

Information about how the model-based projections are derived

GIS and Excel Tool-manipulation opportunities

Accompanying adaptable lessons, plus teacher –authored adaptations

Earth Labs: Modules containing lessons and highly structured computer and wet labs around key concepts

Expanded scope of offerings on module topics, such as climate & the biosphere

EarthLabs

- ~15 Teacher Leaders trained in TX and MS
  ~ 100 teachers trained in use of EarthLabs materials
  Model of professional development that can extend reach of effort
- Input on how to support student understanding of change over time and space.

STORE

12 teachers reached in CA and NY

Extend reach of the materials to more teachers

- Teacher PD model
- Extend to other states

Enhance website use (Eye Tracking analyses)

Moving Toward Collective Impact on Climate and Global Change Education Discussion

- What could an overarching backbone organization do to
  - to increase your individual project's effectiveness and reach (e.g., finding new audiences, incorporating others' innovations in your efforts)
  - help your project benefit others (e.g., providing your audiences and innovations to others)
- Link to shared document (in Google Docs) http://tinyurl.com/mgwndtr