***SCAPE2* Annual Report**

September 2018 – July 2019

**INTRODUCTION**

Overview

*SCAPE (Sustainable Communities and Place-based Education)* is a pilot high school and community-based science education project combining online learning and field observations linked to high schools across seven western States. Initially funded by the EPA in 2016 with a $192K grant, the project utilizes recognized environmental education (EE) curriculum design guidelines and workshops and provides opportunities for science teachers to learn both the science of water quality and best practices for EE. *SCAPE* trained teachers introduce students to the hydrology of the CR System, methods for measuring in-stream flow, and techniques for testing water quality. Resources are provided in computer literacy, environmental history, policy, and ethics, with special emphasis on “water in the West.” *SCAPE* incorporates state and national education standards and can be used to augment existing teaching plans. The program uses EE pedagogy to create lessons related to real-world problems—in particular, water quality and supply—and gives our partner teachers the tools and methods to move from knowledge to action.

The first iteration of the SCAPE curriculum—August 2016 through June 2018—focused on the Colorado River and several of its tributaries and engaged 10 high schools across Arizona, Utah, Nevada, Colorado, and Wyoming. The program received a second grant (for about 50% of the original $192K) to extend the program across the Intermountain West. This current program (*SCAPE2*) serves five high schools across Colorado, Wyoming, and Montana.

During the 2018-2019 academic year, the original *SCAPE* curriculum was refined to reflect comments and criticisms from the 2016-2018 period. Comprised of seventeen lessons, the curriculum originally introduced students to the history and health of the Colorado River system, procedures for sampling and testing the river’s water quality, methods for measuring in-stream flow, techniques for gathering and identifying species living in the river, and strategies for identifying potential sources of pollution across the CR Basin. It also introduced them to computer-based methods of storing, analyzing, and visualizing data gathered in the course of doing field work. With the help of *SCAPE* faculty and the Core team, the curriculum has been expanded to encompass a much broader geographic area (some of the original “Colorado River States” plus Wyoming) in the areas of environmental ethics, community mapping, and occupational training.

Educational Advancement

Through a STEM-focused curriculum, students become stewards of the environment by linking their experience of place (personal habits and patterns of living) with conditions and evidence from specific locations (local, regional, global), as well as with a network of living classrooms across West through the *SCAPE* website. Each classroom adopts a section of their local watershed as a kind of living classroom for conducting fieldwork and stewardship activities. The *SCAPE* curriculum uses online tools, documentary video, field research, and discussions and readings of environmental history, policy, and ethics to raise students’ awareness of the importance of healthy river ecosystems and water security.

At the end of the school year, students share projects from their local communities. Through their projects and reports, they illustrate any behavioral changes evidenced in their own behavior and that of their family, friends, and community towards water. Finally, career opportunities in environmentally related fields are highlighted. These steps fulfill the priority of educational advancement by connecting STEM skill development to local communities and real environmental conditions and outcomes.

EE Teaching Skills

In Year One of *SCAPE2*, master teachers, curriculum designers, and media experts met to refine the SCAPE EE curriculum. *SCAPE2* classroom teachers learned about the curriculum through one-on-one training sessions, conference calls, and accessing online resources. In Year 2, in the Fall, classroom teachers will introduce their students to the *SCAPE2* curriculum in their regular classrooms.

Participants

##### Core Team

Dan Collins—Principal Investigator, Arizona State University, AZ / Telluride Institute, CO

Kaard Bombe—Videographer, Phoenix, AZ

Monica Elser—Co-Investigator, Flathead Lake Biological Station, MT

Zora Ziazi—Evaluator, UOEEE, Arizona State University, Tempe, AZ

Elena Ortiz—Co-Investigator, Professor, Phoenix College, Phoenix, AZ

Vicki Phelps—Co-Director, Watershed Education Program, Telluride Institute, CO

Jeff Sellen—Professor, School of Environment & Sustainability (ENVS),

Western Colorado U., Gunnison, CO

Renu Singh—Director, Gifted & Talented Academy., Maryvale HS, Phoenix, AZ

Shaun Ylatupa-McWhorter—Networking & Database Specialist, Arizona State University

Elizabeth Stuffings—San Miguel Watershed Coalition / Telluride Institute, Telluride, CO

##### Contributors

Brian Anderson—Fiscal Specialist, HIDA, Arizona State University,

Alison Cook-Davis—UOEEE, Arizona State University, Tempe, AZ

Kevin Dunbar—Science Teacher, Cedaredge High School, Cedaredge, CO

Paul Haberstroh—Professor, Mohave Community College, Lake Havasu City, AZ

John Hausdoerffer—Dean, School of Environment & Sustainability (ENVS),

Western Colorado U., Gunnison, CO

Kelly Houle, Science Teacher, Columbia Falls High School, Columbia Falls, MT

Laurie Lundquist—Environmental Artist, Telluride, CO

Deb Noble—Science Teacher, Pinedale High School, Pinedale, WY

Amanda Scott—Science Teacher, Paradox High School, Paradox, CO

Steve Smith—Science Teacher, Animas High School, Durango, CO

1. SUMMARY OF MAJOR ACCOMPLISHMENTS in 2018-2019
	1. Refined and expanded *SCAPE*, a 320 page EE curriculum combining classroom, field, and online learning;
	2. Trained new teachers to create and interact with *SCAPE2* in 5 InterMountain high schools and institutions;
	3. Taught students and citizens sustainability, water quality/supply, and environmental protection.
	4. Refined the computing resources “in the cloud” for uploading and sharing data and doing comparative analysis across our schools.
	5. Implemented an equitable funding mechanism for sub-awardee grants of $5000 or less for *SCAPE 2* schools and institutions.
	6. Added significantly to a library of documentary videos and an archive of photographs.
	7. Presented the *SCAPE 2* concept and curriculum at major regional and national conferences as well as partner academic institutions (NAAEE, Arizona State University/GIOS, Western Colorado University/ENVS, University of Montana/FLBS).
	8. Distributed completed *SCAPE* curricular materials to an expanded cohort of educational partners and environmental leaders across the West

***1. Time Line with Milestones and Evaluation, Fall 2018 – Summer 2019 (reflects original Proposal)***

|  |  |
| --- | --- |
| **Time Frame** | **Activity** |
| Sept. 2018 | **Organized and launched communication framework for all project partners**. With exception of new schools in Montana (Columbia Falls HS), we prepped partner high schools within the InterMountain West system for involvement in the project. Skype calls between HS and Curriculum Design (team combines scientific, educational, computational, and evaluative expertise from ASU and off-campus partners). Built website for communication among partners. Posted archive on website and Google Drive of prior related research (SCAPE 1) for use by development team.*Accounting and Procurement Management:* The project manager is now working with a new contact in the Dean’s office, Brian Anderson, of the Herberger Institute of Design, for all expenditures for supplies, travel, and other expenses. |
| Fall 2018 | **Curriculum Design**. Using the EPA EE guidelines, Next Generation Science Standards (NGSS Lead States, 2013), and Common Core standards (NGACBS, 2010), a rubric was created to guide development of curricular materials, including online content.*SCAPE 2* development (*beyond SCAPE 1*) focused on the content management system, interface design, integration of curriculum design with digital tools, development of evaluation instruments and materials, development of online resources in specific content areas, and user-experience benchmarking.  |
| Late Fall 2018 | Q1 2018 product development and evaluation with focus on the **results of the Curriculum Design process**. While a working prototype was completed by Summer 2018. Additional Lessons/Units are under development by our new project partners. Special focus has been given to environmental ethics, water rights and sovereignty, indigenous perspectives.*Accounting and Procurement Management:* Water quality test kits have already been procured by three of the five partner schools. Their feedback is being used to refine the kits made available to the two new schools (e.g., Hach traditional water quality kits eliminated). |
| 2018 – 2019Academic Year | Kevin Dunbar, Cedaredge HS Science teacher, and Deb Noble,Pinedale HS Science teacher, will **beta-test the *SCAPE* Curriculum** with their classes. The *SCAPE 2* team is fine tuning curriculum and software based on the feedback from *SCAPE 1* teachers.**Evaluation:** High school students’ and teachers’ knowledge and understanding of water quality issues will be evaluated using pre- and post-tests based on common measures about environmental science in general and water quality and supply in particular. These tests will be used to detect change in perception and interest in stewardship (i.e., increased motivation towards water quality issues). Using established resources (e.g., American Association for the Advancement of Science, NAEP, TIMSS, PISA), we are targeting areas of water quality, water supply and environmental science that are misunderstood by most high school students. These resources target focal areas and have developed appropriate questions to assess knowledge and understanding of content and critical thinking in environmental science. |
| 2018 – 2019Academic Year (con’d). | **Formative Feedback to Development Team from Beta Test Teachers**Individual conference calls with teachers, approximately every two months (end of Oct. Dec. Feb. April) between beta test teachers and development team. Adjustments to online materials can be made remotely via Google Docs. Development team will seek feedback from both teachers and students via *SCAPE 2* interface and related emails, tweets, and blog postings.**Evaluation:** Selective evidence of student and teacher engagement and collaboration via *SCAPE 2*. Evidence of increased knowledge, including from vocabulary and details of posts, and skills in content areas, including local and systemic environmental policies and practices, water quality, and environmental science. Coding of online feedback provides grounded method (Strauss, 1987; Charmez et al, 2001) for capturing key constructs, common themes, technical issues, and novel outputs. |
| June - July 2019 | **Summer Curriculum Design Activities**. With the benefit of lessons learned from the beta-test of *SCAPE* in 2018-2019, the core project team met numerous times (virtually and face-to-face) in Colorado to refine the curriculum. To date, Collins has had meetings with Vick Phelps (Telluride Institute), Amanda Scott (Paradox High School), Steve Smith (Animas High School), and Jeff Sellen (Western Colorado University). Our goal was to have final *SCAPE 2* curriculum completed by end of July. However, in early August, with the help of Dr. Jeff Sellen at Western Colorado University, we are still refining the lessons associated with Environmental Ethics. *Accounting and Procurement Management:* Water quality test kits and other necessary equipment have not as yet been ordered for new partner schools. |
| July – Sept. 2019 | Following Curriculum Design process, Core team will connect with science teachers from each partner high school for hands-on training in water sampling and test of online *SCAPE 2* “cloud-based” software. Training of partner schools on the Ute Nation will be scheduled for late August.Collins and videographer, Kaard Bombe, will fly to Montana over Sept. 19th weekend to document field work by the Columbia Falls high school students of science teacher Kelly Houle and members of the Flathead Lake Bio Station.  |
| Fall 2019 | Roll out of *SCAPE* curriculum to all five partner schools.**Evaluation:** Administration of pre- and post-tests, surveys, and other relevant evaluation instruments are overseen by the evaluation team from UOEEE (ASU’s University Office of Evaluation and Educational Effectiveness. |

***2. A comparison of actual accomplishments to the outputs/outcomes established in the work plan for the performance period (9/1/18 – 7/31/19)***

OUTPUTS & OUTCOMES

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| --- | --- |
| **Outputs** | **Outcomes** |
| **Short-term** | **Medium-term** | **Long-term** |
| **Objectives**Develop and implement recruitment plan for teachers and students withemphasis on rural and low income/high minority school districts**2018-19 Accomplishments** Recruitment plan developed for *SCAPE 2* with a focus on rural and underserved communities. | **Objectives**Identify 5 schools and teachers and ~250 students. Increased access and engagement by under-represented communities to EE resources**2018-19 Accomplishments** Five schools successfully recruited for *SCAPE 2.* | **Objectives**Participants will demonstrate increased awareness and comprehension of environmental issues and how policies and practices affect their community’s environment.**2018-19 Accomplishments** Teachers demonstrated increased awareness by tying *SCAPE*2 objectives to research on local “experts” (Paradox, CO) and community partnerships (Mountain Studies Institute, City of Durango). | **Objectives**Establish sustainable EE programs on water conservation and quality in targeted regions featuring well-defined, professionally formatted curricula**2018-19 Accomplishments**  |
| **Objectives**Develop training for high school teachers and community educators **2018-19 Accomplishments** Met one on one (in some cases via SKYPE or phone) with each of the project teachers to discuss opportunities and challenges of introducing SCAPE 2 in their school. |  **Objectives**High school teachers and community educators participated in summer training, online tutorials, and service learning work to increase awareness.**2018-19 Accomplishments** Met one on one with all project teachers either FTF or via SKYPE or phone. | **Objectives**Teachers to integrate increased knowledge of EE best practices into the classroom. Teachers and students will lead environmentally- focused projects in their schools and their communities.**2018-19 Accomplishments** Classroom rollout, Fall 2019. Stay tuned! | **Objectives**Share materials online and with educators at local and national EE and science teacher conferences **2018-19 Accomplishments**Presentations at NAAEE conference, Spokane, WA, (Oct. 2018.) *a2ru* conference, U. of Georgia (Nov. 2018), Telluride Institute (December 2018); Western Colorado U./ENSV (August 2019). Widely distributed video documentation via *SCAPE* Vimeo channel. |
| **Objectives**Develop high quality online-accessible curricular materials on sustainable water use and quality, assist teachers in developing materials for wider use**2018-19 Accomplishments** Online materials refined; specific enhancements made by select schools (e.g., Animas High School). |  **Objectives**Increase capacity and motivation for teachers to develop quality EE materials. Reinforce local identity. Assessment and evaluation of materials**2018-19 Accomplishments** Teachers (Animas HS, Cedaredge HS, Pinedale HS) developed site-specific adaptations of the curriculum. | **Objectives**Will take specific actions on water conservation and quality at campus and community levels to reinforce local identity.**2018-19 Accomplishments** Classroom rollout to start Fall 2019. Classroom projects will reflect local conditions and career paths in environmental fields. | **Objectives**Students and teachers will demonstrate behaviors and commitments to environmental protection and educated others outside of program about environmental issues— especially in under-served communities. Persistence in and knowledge of STEM skills. Wide adoption and dissemination of *SCAPE2* curriculum. Comprehensive summative report to be completed and submitted to EPA (July 2020).**2018-19 Accomplishments** Classroom rollout to start Fall 2019. Students will demonstrate learning outcomes in Spring 2020 school-based exhibitions, online publications, and public colloquia. |
| **Objectives**Support teachers in implementing STEM-driven environmental education (EE) program focused on sustainable water use and quality.**2018-19 Accomplishments** Discussions with individual teachers about appropriate application of *SCAPE* learning outcomes to local school curricula—especially those limited by State Standards and mandated testing.  | **Objectives**Increased capacity for teachers to implement EE programs tied to STEM learning objectives. Increased teacher and student understanding and awareness of water quality across the InterMountain West.**2018-19 Accomplishments** Teachers engaged in discussions about the landscape and water use in and around their school. Students will engage these issues starting in Fall 2019. | **Objectives**Formative assessment of student and teacher actions will be completed quarterly (starting Fall 2019) tracking local environmentaloutcomes and STEM learning. We are looking for persistent application of proven STEM and EE learning methods.**2018-19 Accomplishments** Classroom rollout to start Fall 2019. Stay tuned! |

***3. Progress on awards to sub-grantees and any data on the sub-grant projects.***

* + 1. *Summaries of results of reviews of financial and programmatic reports.*

N/A

* + 1. *Summaries of findings from site visits and/or desk reviews to ensure effective sub-grantee performance.*

Discussions with individual teachers about appropriate application of *SCAPE* learning outcomes to local school curricula—especially those limited by State Standards and mandated testing. Online materials refined; specific enhancements made by select schools (e.g., Animas High School expanded water-quality testing field work to include math students engaged in statistical analysis of heavy metal concentrations in the upper Animas River). Science teacher Amanda Scott at Paradox High School developed matrix of stakeholders—a retired chemist, local cattle ranchers, Bureau of Reclamation personnel, old hippies engaged in soil/water conservation and organic farming. Kevin Dunbar at Cedaredge high school expanded biology curriculum to include macroinvertebrate collection and developed partnerships with local environmental non-profits and National Forest Service.

*c. Environmental Results the sub-grantee achieved.*

Nothing to report in first year as students will not engage curriculum and field work until

second year of grant.

*d. Summaries of sub-grant audit findings, if any, and related management decisions by the recipient.*

(N/A)

* + 1. *Actions the pass-through entity has taken to correct deficiencies such as those specified at 2 CFR 200.331(e), 2 CFR 200.207 and the 2 CFR Part 200.338 Remedies for Noncompliance.*

(N/A)

* 1. *Difficulties encountered and reasons for slippage if established outputs/outcomes were not met by the recipient or any of its sub-grantees.*

One Montana school (Ronan High School), had to pull out of the program due to staffing issues. This precipitated a last minute search for a fifth school to represent Montana. Fortunately, we were able to identify and receive commitment from Columbia Falls High School (just north of Flathead Lake). Additionally, one of our Colorado schools (Paradox High School), recently had to leave the program due to lack of staffing. The main science teacher in this tiny rural high school, Amanda Scott, had a baby, and no satisfactory teacher replacement could be found. We are currently working to identify another regional high school on the Ute nation near Towaoc, Colorado through our contact on the school board there, Ms. Regina Lopez-Whiteskunk.

***3.* *Expenditures, including an overall budget summary comparing approved budget with actual expenses in each budget class including EPA and match funding.***



Financial Summary Report: 9/1/18- 7/31/19 (Project timeframe: 9/1/18 – 8/31/20)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BUDGETED CATEGORIES** | **BUDGET** | **CURRENT PERIOD EXPENSES** | **EXPENSES****TO DATE** | **ENCUMBRANCES** | **AVAILABLE** **FUNDS** |
| SALARIES & ERE: COLLINS | $6,976.00 | $0.00 | $0.00 | $0.00 | $6,976.00 |
| SALARIES & ERE: YLATUPA-MCWHORTER | $6,768.00 | $0.00 | $0.00 | $0.00 | $6,768.00 |
| WAGES & ERE: HOURLY STUDENT WORKER | $5,052.00 | $0.00 | $0.00 | $0.00 | $5,052.00 |
| SERVICE FEES: UOEEE | $5,000.00 | $0.00 | $0.00 | $0.00 | $5,000.00 |
| SERVICE FEES: ELENA ORTIZ | $3,000.00 | $0.00 | $0.00 | $0.00 | $3,000.00 |
| SERVICE FEES: VIDEOGRAPHER | $5,040.00 | $0.00 | $0.00 | $0.00 | $5,040.00 |
| SERVICE FEES: HABERSTROH (MCC) | $500.00 | $0.00 | $0.00 | $0.00 | $500.00 |
| SERVICE TRAVEL: ELENA ORTIZ | $2,148.00 | $0.00 | $0.00 | $0.00 | $2,148.00 |
| SERVICE TRAVEL: VIDEOGRAPHER | $1,186.00 | $0.00 | $0.00 | $0.00 | $1,186.00 |
| TRAVEL | $4,499.00 | $0.00 | $0.00 | $0.00 | $4,499.00 |
| PUBLICATION: FEES | $999.00 | $0.00 | $0.00 | $0.00 | $999.00 |
| M&S: WATER-TESTING PROBES | $1,400.00 | $0.00 | $0.00 | $0.00 | $1,400.00 |
| SUBAWARD: W. ST COLORADO UNIV | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: RONAN SCHOOL DISTRICT 30 | $4,000.00 | $0.00 | $0.00 | $0.00 | $4,000.00 |
| SUBAWARD: CO: DELTA CO SCH DIST | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: WY: SUBLETTE COUNTY SCH DIST #1 | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: UNIVERSITY OF MONTANA | $3,000.00 | $803.98 | $803.98 | $3,000.00 | -$803.98 |
| SUBAWARD: PARADOX VALLEY CHARTER SCH | $4,000.00 | $0.00 | $0.00 | $4,000.00 | $0.00 |
| SUBAWARD: CO CHARTER SCH INSTITUTE | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: TELLURIDE INSTITUTE | $2,000.00 | $0.00 | $0.00 | $2,000.00 | $0.00 |
| DIRECT COSTS SUBTOTAL | $67,568.00 | $803.98 | $803.98 | $21,000.00 | $45,764.02 |
| FACILITIES & ADMINISTRATIVE COSTS (48%) | $32,432.00 | $385.91 | $385.91 | $10,080.00 | $21,966.09 |
| TOTAL PROJECT COSTS | $100,000.00 | $1,189.89 | $1,189.89 | $31,080.00 | $67,730.11 |

* Funds allocated to Ronan School District are being re-budgeted for Columbia Falls High School in Montana.
* Funds allocated to Paradox High School to be re-budgeted for Ute Mountain Tribe in Towoac, Colorado (pending tribal approvals).
* University of Montana's payment will be reflected it in the October 2019 Report
* Award requires match of $33,833. The proposed details included $17,549 Dan's salary, $4,973 ERE, $10,811 F&A and $500 in-kind from San Miguel Watershed

If there is an expense/encumbrance that was incorrectly budgeted/included or if there is any other issues with this report, please contact HIDAResearch@asu.edu.

***4. A description of equipment, techniques, websites, software, and materials developed, used or evaluated****.*

**EQUIPMENT LIST** (developed with input from Core team & Project teachers)

**DIGITAL WATER QUALITY TEST EQUIPMENT**

|  |  |  |  |
| --- | --- | --- | --- |
| **Notes** | **Description** | **Unit Price “wired”** | **Unit price “wireless ”** |
|  | WATER QUALITY WITH VERNIER | 48.00 | 48.00 |
|  | VERNIER LabQuest2 | 329.00 | 329.00 |
|  | STAINLESS TEMP SENSOR | 28.13 |  |
|  | STAINLESS TEMP SENSOR (Go Direct wireless)\* |  | 59.00 |
|  | PH SENSOR (wired) | 79.00 |  |
|  | PH SENSOR (Go Direct wireless)\* |  | 79.00 |
|  | OPTICAL DISSOLVED OXYGEN SENSOR\*\* | 299.00 | 299.00 |
|  | CONDUCTIVITY SENSOR (wired) | 95.00 |  |
|  | CONDUCTIVITY SENSOR (Go Direct wireless)\* |  | 89.00 |
|  | TURBIDITY SENSOR\*\* | 108.64 | 108.64 |
|  | FLOW RATE SENSOR\*\* | 129.00 | 129.00 |
| Wireless link converts standard wired sensors. | Go Wireless Link (includes charging cable) | 89.00 | 89.00 |
| School choice | One Sensor chosen by school. |  |  |
|  | LABQUEST VIEWER SOFTWARE | 79.00 | 79.00 |
|  | Shipping (pro rata) | 12.90 | 12.90 |
| **Total “wired”** |  | **$1296.67** |  |
| **Total “wireless”** |  |  | **$1321.54** |

**MACROINVERTEBRATE COLLECTION KIT**

|  |
| --- |
| **Ben Meadows Scientific Supply** |
| **Measurement** | **Instrument or Material** | **# of units** | **Unit Price** | **Total Price** |
| Water sample collection | 1 cases (24 count) 250 ml plastic bottles. | 1 | 6.37 | 6.37 |
| Aquatic or terrestrial vegetation / Algae collection | Amber Narrow-Mouth Safety- Coated Glass Bottles 24 per case = 140.10 | 1 | 14.01 | 14.01 |
| Aquatic or terrestrial vegetation / Algae collection | Foam-Backed PTFE-Lined Phenolic Caps (12 count) | 1 | 1.96 | 1.90 |
| Safety Equipment | LatexGloves.100per box. | 1 | 8.79 | 8.79 |
| Safety Equipment | Safety Glasses, Uncoated, Clear, 12/Box | 1 | 20.89 | 20.89 |
| Macroinvertebratecollection | Complete Bottom Kick Net - 40in handle, Nitex, 500µm. | 1 | 187.50 | 187.50 |
| Macroinvertebratecollection | Aquatic Invertebrate Lab Kit | 1 | 333.50 | 333.50 |
| **Ben Meadows Total** |  |  |  | **$572.96** |

**TOTAL Expenses per Vendor**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vendor Totals** | **Description** |  |  | **Total Price** |
| Vernier | Digital Water Quality Test Equipment Equipment (suggested) |  |  | 1321.54 |
| Ben Meadows | Macroinvertebrate Collection Kit |  |  | 572.96 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Grand TOTAL** | Estimated total may vary depending on your choice of Vernier Sensors.  |  |  | **$1894.50** |

**Content Management Systems: Google G-Suite**

A Content Management System (CMS) is an incredibly powerful tool. Not only does it provide an array of tools needed to complete tasks, it has a full range of enterprise critical features that provide for data management, data analysis, sharing, and security.

The *SCAPE2* project continues to refine the CMS by Google called G-Suite and other Google cloud technologies. The following provides an overview of the G-Suite tool set:

The entire curriculum development process as well as project documentation and analysis is supported by the new G-Suite (formerly Google Apps) line of tools and cloud-based technologies. The various applications that we now utilize in the curriculum include the following Google products: My Maps (interactive mapping tool…different from Google Maps or Google Earth), Docs (a word processing app), Sheets (a spreadsheet app similar to Microsoft Excel), Forms (an easy way to create online tests and surveys), Google Analytics (a set of measurement and analysis tools that provide insight into website performance). And Google Site (to build a protected portal for project participants). Besides the distinct operations supported by each application, the integration of all of these apps in one Suite is extremely useful and efficient. When creating a set of building blocks and a “pipeline” for processing data, the products of one application can seamlessly “feed” into another. For example, data uploaded using Google Forms can be instantly viewed and manipulated in Google Sheets, which in turn can be viewed and visualized (as a map or graph or similar visualization). Further, the fact that each and every page has a unique URL allows for improved organization, navigation, and sharing. Finally, Google Analytics provides features such as automated data collection, real-time visitor tracking, and customizable reports. Analytics has also been built into popular video posting sites such as YouTube (which is now owned by Google) providing a window into student utilization and comparison of *SCAPE* video products.

Because of our relationship with the Telluride Institute, we were able to secure a non-profit account for no fee. This account, accessible to our Core Team, allows for coordination of the project. In addition, all of our researchers and teachers have dedicated user accounts (with the shared domain of @coloradoriverscape.org) that allow us to work together as an organization.

Newly developed lessons that specifically introduce the technology to the students are as follows:

Unit III / Lesson 1: Post Your data to the Cloud

Unit III / Lesson 2: Using Pivot Tables

Unit III / Lesson 3: Data Visualization

Unit IV / Lesson 3: Story Maps (using online GIS to visualize data and “stories of place.”)

Unit IV / Lesson 4: Collaborative “Smart Map” of All Partner Schools

Security and management

Security and management are critical. Careful consideration went into finding the right balance of freedom and control. The CMS had to allow viewing and engagement for a select group of researchers and teachers, but also provide a window into the project for the general public. The CMS enables secure active development and the hosting of finished forms, pages, and documents.

Implementation requires a lot of work and is loaded with many tasks such as helping people get access, applying access to users, providing a structure where people can effectively share and produce viable content, and trouble-shooting the inevitable problems that arise.

The content creators are the environmental science classes at our 10 partner schools. They have opportunities to publish different analysis spreadsheets, maps, or other documents to the *SCAPE* website and folders. Each school was set up with a web page—a “dashboard” —that hosted their data analysis and interpretive maps. As more data was added to the system there were opportunities for comparative analysis between the school and class site to the schools up and down river.

System Implementation

What are some of the key aspects of design and implementation of G-Suite as a Content Management System? We continue to support a diverse group of nearly 20 people, and these teachers, researchers, and education administrators are actively participating in the development of the written curriculum and the Water Quality survey form. The researchers have ‘write access’ to the content and the instructors have ‘read’ access.

Much time and energy has been spent creating and refining the *SCAPE* Field assessment Form, which supports the submission of water quality data. Not only is there a need to ensure that the process of entering values into the form is easy and understandable, the data being submitted needs to be secure of personally identifiable information as well as protected against erroneous data submissions.

This project is solely reliant on Google products. The services are very inexpensive, or free, but the quality of the tools only met and rarely exceeded the basic needs of the project.

Beyond any one digital tool or service, a mechanism for sharing water quality data between disparate communities across the West is now in place. Development is needed in integrating numerous online datasets (e.g., USGS, Forest Service, globe.gov; etc). This cloud-sourced data has potential for providing insights into the broader information “ecology.” It is clear that Content Management Systems can be applied to more than blogs or business—they can host environmental data for sharing and collaborative research.

The *SCAPE2* framework is developed, tested, and solid. Despite certain difficulties with technical implementation and meeting the needs of a diverse user-base at the beginning, the digital tools and cloud-based technologies were enthusiastically embraced and effectively utilized by project researchers, teachers, and the students.

***5. Any changes in Key Personnel. If personnel changes have occurred, submit a revised EPA Form 5700-54 (Key Contacts Form) and a resume for the new contact.***

N/A

***6. A statement about activity anticipated to take place during the subsequent reporting period.***

We are looking forward to the start of the new school year. This will be when the teachers, with whom we’ve been working over the past year, will be rolling out the curriculum to their students.