

Education and Diversity (ED) in MMAP

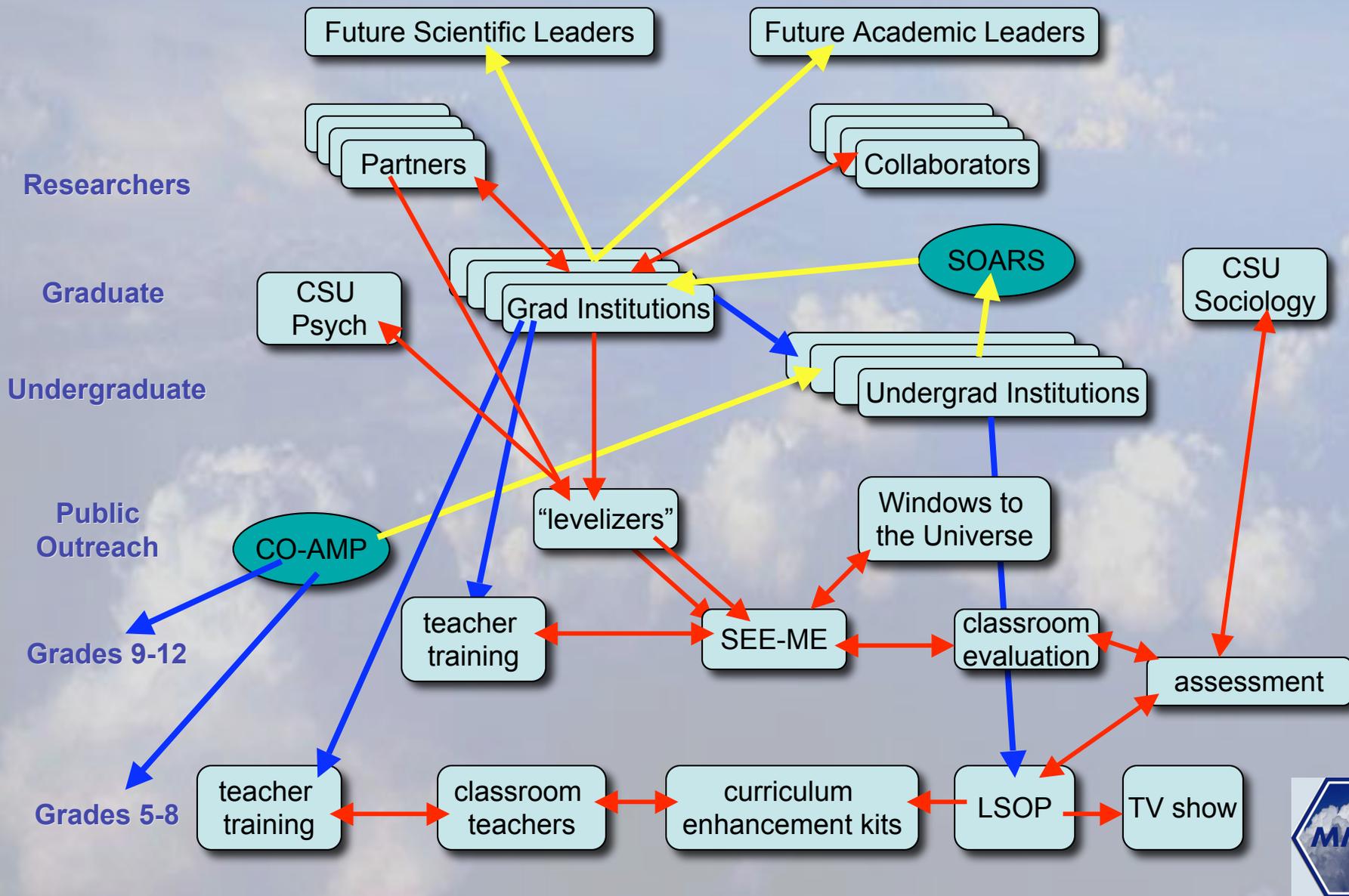


Feeding the Pipe

- By middle school, if students aren't interested in science, we've lost them ...
- **Strengthen Earth System Science education at all levels**
 - Content, curiosity, inquiry, real research
 - Teach new faculty how to teach
- Draw from the **diversity of the whole population** rather than only a portion



Integrated Education and Diversity



Education Mission

Educate and train a diverse population in climate and Earth System Science by enhancing teaching and learning at all educational levels, disseminating science results through multiple media, engaging stakeholders and policymakers, and improving science pedagogy.



Strategy for Education

- Provide opportunities for students at **all levels** to engage in active learning of Earth Science and Climate by experimentation.
- Work with successful and well-established **partners in curriculum development, science communication, and multimedia** for maximum impact
- **Intervene early** to draw from the whole range of our diverse population
- **Link Education, Outreach, and Diversity** elements of the Center, so leverage investments in all three.



Strategy for Education (cont'd)

- Structured **mentoring interactions** to bring science content to all levels, to help future educators **learn to be better teachers**, and to provide strong **role models** of a motivated, diverse population of young scientists
- Provide opportunities for current and future leading scientists to learn to be better teachers, both formally (through **pedagogical instruction**) and informally (through mentoring)



Strategy for Education (cont'd)

- Combine **curriculum development** and implementation with classroom **evaluation and formal assessment**
- Maintain active **communication across Center** components through an EOD Committee, summer institutes, and twice-yearly meetings



Education Goals

- Enhance the climate science workforce of the future
- Enhance teaching and learning of Earth System Science at all levels
- Disseminate MMAP science results to the public and to climate stakeholders



Education Objectives

Objective	Action Steps	Responsible Person & Team	Location	Time-frame
Develop, implement, disseminate and evaluate improved Earth System Science curricula for middle and junior high schools	Develop and test curriculum enhancement kits for local schools	Jones	CSU	Ongoing
	Develop climate content for LSOP & TV show	Jones Denning	CSU CSU	Ongoing
	Teacher training course	Jones TIR	CSU PSD,TVS	Ongoing
	Evaluation/assessment	Lacy	CSU	Ongoing
Improved climate education at high school level	SEE-ME web-based modeling tools Teacher training course UCAR levelizers Classroom evaluation Formal assessment Climate summer program, Catamount	Denning Foster ED coord Lacy Drossman	UCAR PSD Schools CSU Catamount Institute	Ongoing
Dissemination of MMAP science to public via web	Windows to the Universe web site Science communication analysis	Foster Denning ED coord Russell Jones Canetto	UCAR CSU	Ongoing

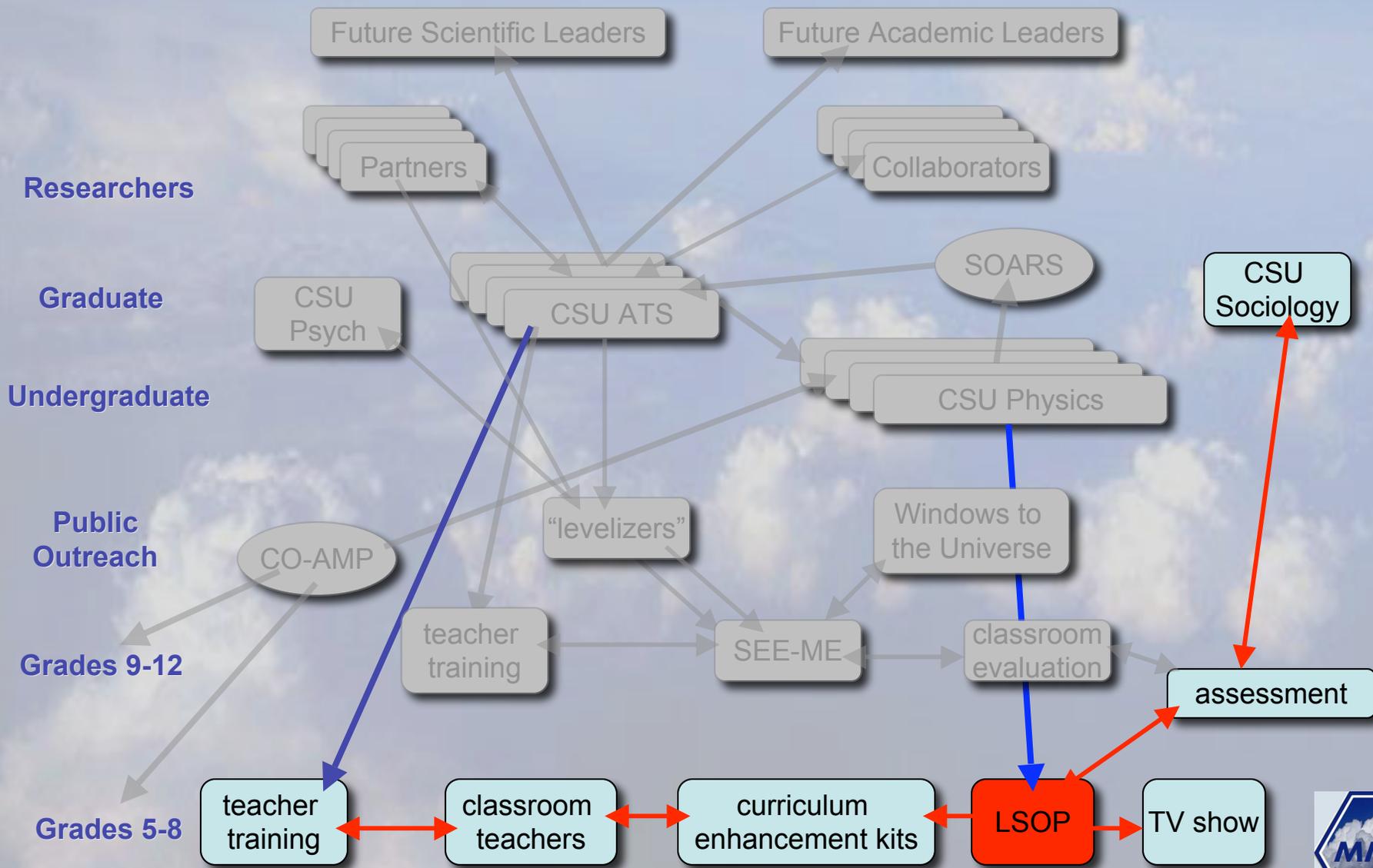


Education Objectives (part 2)

Objective	Action Steps	Responsible Person & Team	Location	Time-frame
Outreach to climate stakeholders & policymakers	Climate white papers for stakeholders Summer workshops Short course on policy for MMAP grad students	Kathlene Denning ED coord Foster	CIPP UCAR	Ongoing
Improved undergraduate climate education	New climate courses Minority recruiting and retention	Denning Drossman ED coord El-Hakim	CC Regional institutions (CO-AMP)	Ongoing
Graduate education and research	Recruiting excellent and diverse students Improved climate coursework Direct involvement with research	Denning MMAP faculty ED coord	All institutional partners	Ongoing
Teaching future teachers	Teacher training course Mentoring interactions LSOP internships	Denning ED coord Stevens Jones	CSU PSD Schools MMAP partners	Ongoing



Obj 1: Middle School Curricula



Little Shop of Physics

Brian Jones (CSU Dept. of Physics)

Sheila Ferguson and Karen Hammann Poudre School District



Hands-On School Programs: 1 Year=

- 50 schools / 15,000 K-12 students
- 150 CSU students
- Special emphasis on rural & underserved populations



On the Air: Everyday Science

- Poudre School District
- Rocky Mountain PBS
- DVD series

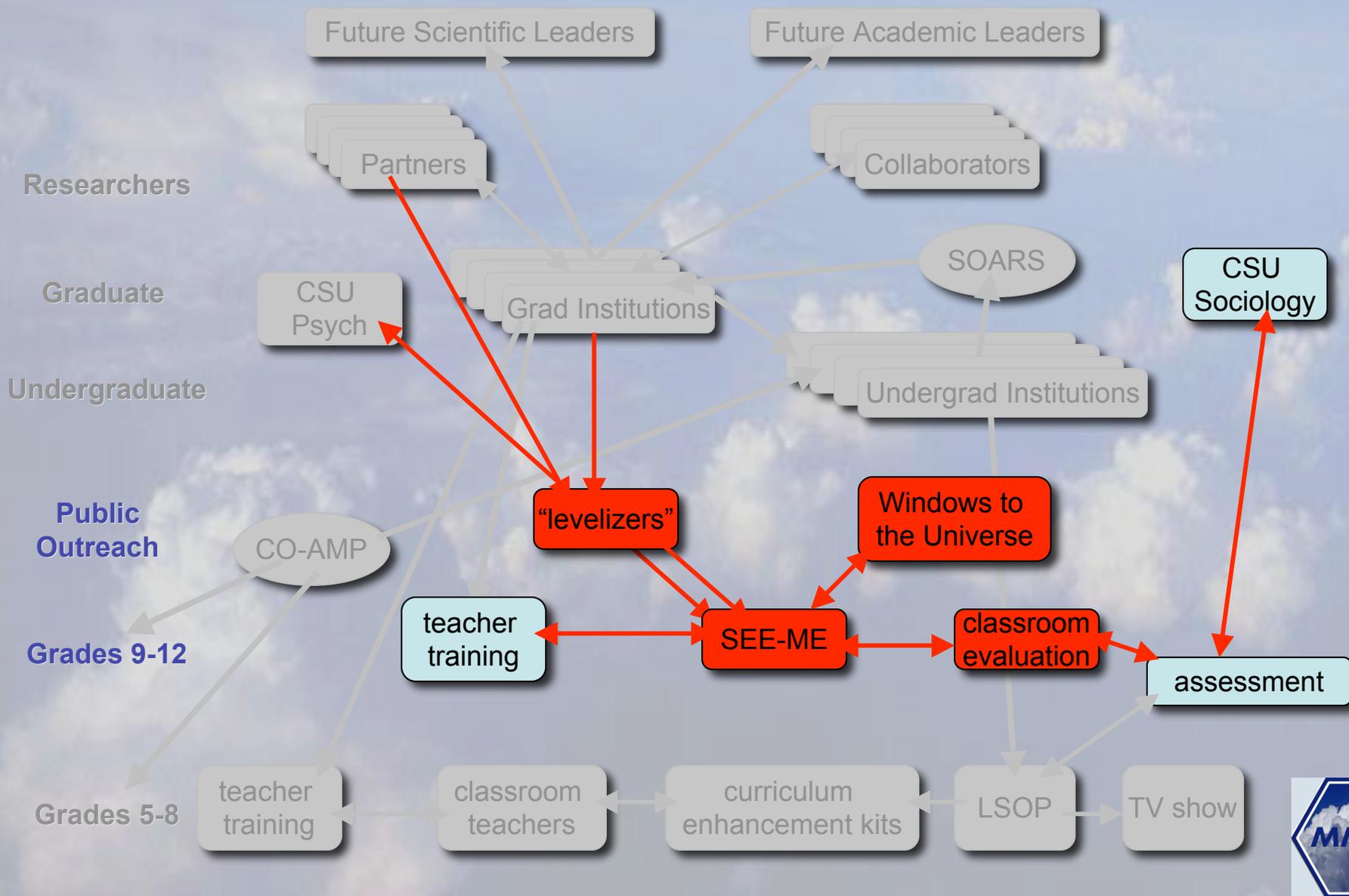


Teacher Workshops

- Current & Future Teachers
- 200+ Teachers Yearly
- International Connections



Obj 2 & 3: Secondary Ed & Web

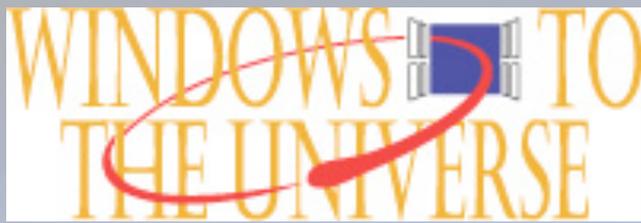


SEE-ME

A STEM Educational Experience in Modeling the Earth System

- A web-based, interactive educational tool and resources
- Exploring clouds, weather, climate, and modeling
- Targeting grades 9 - 12, teachers, and the public
- Informed by sound pedagogy and scientific research
- Disseminated on Windows to the Universe web site
- MMAP providing a new focus for our EO mission





www.windows.ucar.edu

- Spans the Earth and space sciences, with arts and humanities connections
- Integrated classroom activities, interactives, and models
- Largest education and outreach venue at NCAR/UCAR, with over 5 million visitors since last October (~43 million page views)
 - ~65% K-12 students, 25% in Spanish



Partnership with Public Schools

- UCAR "levelizer" concept
- Web-based dissemination tools (Windows, SEE-ME) developed with teacher involvement at Rocky Mountain High School
- Collaboration with CSU Psychology Dept (Prof. S. Canetto and students)
- Material to be used in AP Environmental Science and Introduction to Earth Science, with student feedback
- Assessment study at CSU Sociology (Prof. M. Lacy and students)



Obj 4: Climate Stakeholders and Policymakers

- Colorado Institute for Public Policy (CIPP),
Dr. Lyn Kathlene, Director
- Convene 6-month working groups of
scientists and stakeholders to produce
“white papers” on climate and impacts with
local-regional focus (e.g., water, farming)
- Conduct educational “hands-on” workshops
for policy makers and the public
- Teach short course on policy process for
MMAP graduate students



Obj 5: Undergraduate Education

- Academic content in climate courses developed and tested at Colorado College (Prof. H. Drossman)
- Internships for MMAP grad students to teach these courses (block structure)
- Evaluation in classroom and through student achievement
- Dissemination of results through national pedagogical media



Obj 6: Graduate Education & Research

- The core of ED in MMAP
- 19 grad students at 5 institutions
- A diverse pool (HU, SOARS, AGEF, scholarships), 6 to 8 from underrepresented groups
- Cutting edge climate research in leading universities
- A new focus on pedagogy for graduate students in top research programs
- Very strong record of placement on climate faculties worldwide



Obj 7: Scientists as Good Teachers

- Pedagogical study as part of MMAP graduate study
- MMAP students work with Drossman to develop & teach at CC
- MMAP students develop and teach content in teacher training courses
- CSU undergrads work as LSOP interns



Diversity Mission

Increase the number of women and underrepresented minorities in climate science by aggressively recruiting these groups as MMAP grad students, helping them become excellent scientists and educators, and placing them in leadership faculty positions. Enhance the science and engineering pipeline through mentoring and recruiting at earlier academic levels. Study diversity problems and solutions, and disseminate results.



Diversity Goals

- Support and matriculate graduate students whose gender and ethnic makeup reflect those of the US population
- Improve understanding of the structural barriers to gender and ethnic balance in science
- Encourage participation in science and engineering by women and minorities at all academic levels



Diversity Objectives

Objective	Action Steps	Responsible Person & Team	Location	Time-frame
Recruit and matriculate representative Ph.D. students from MMAP	2 Ph.D. students at HU	Denning ED coord	HU	Ongoing
	2 grad students and 3 summer interns per year through SOARS	Pandja	UCAR	Ongoing
	3 summer internships for HU undergrads	El-Hakim	HU	Ongoing
	2 CSU minority scholarships in ATS		CSU	Ongoing
Improved recruitment of ethnic minorities to undergraduate science and engineering programs	Present climate science to 400 minority high school students per year through CO-AMP and Drossman	Denning ED coord El-Hakim Drossman	CSU CSU CSU Catamount Institute	Ongoing
Better retention of women in the science pipeline	Mentoring program pairing female ATS grad students with female high-school students	Denning ED coord	CSU CSU	Ongoing
	Women in LSOP	Jones Canetto	CSU CSU	Ongoing
Study diversity problems and solutions, and disseminate results	Study of media portrayal of gender in science Longitudinal study of women in science careers Assessment of McNair mentoring program	Denning Canetto McPhee ED coord	CSU CSU CSU CSU	Ongoing

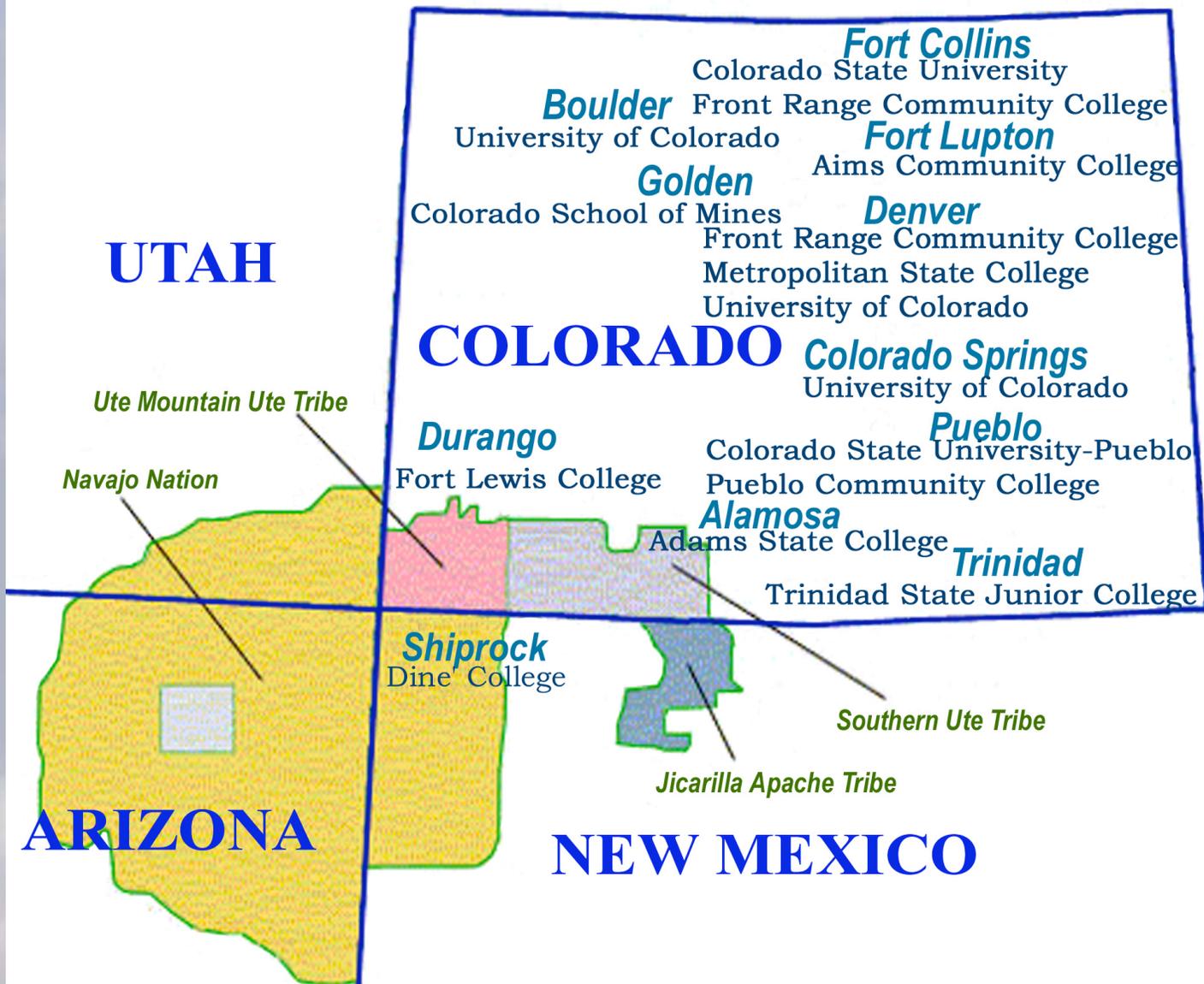


Obj 1 & 2: Academic Bridges

- High school to undergraduate bridge (CO-AMP, Catamount Institute)
 - Residential program recruits 400 students/year from underrepresented groups
 - Introduction to STEM opportunities and CSU community
 - Urban youth engaged in climate science as part of larger environmental program
- Undergraduate to graduate bridge (SOARS, AGEP)
 - Residential summer research internships
 - Community support
 - Graduate student research assistantships



Louis Stokes Colorado Alliance for Minority Participation
Serving Colorado and the Four Corners Region





Young Environmental Stewards Programs



- ❖ Science
- ❖ Technology
- ❖ Leadership



Obj 3: Women in Science Pipeline

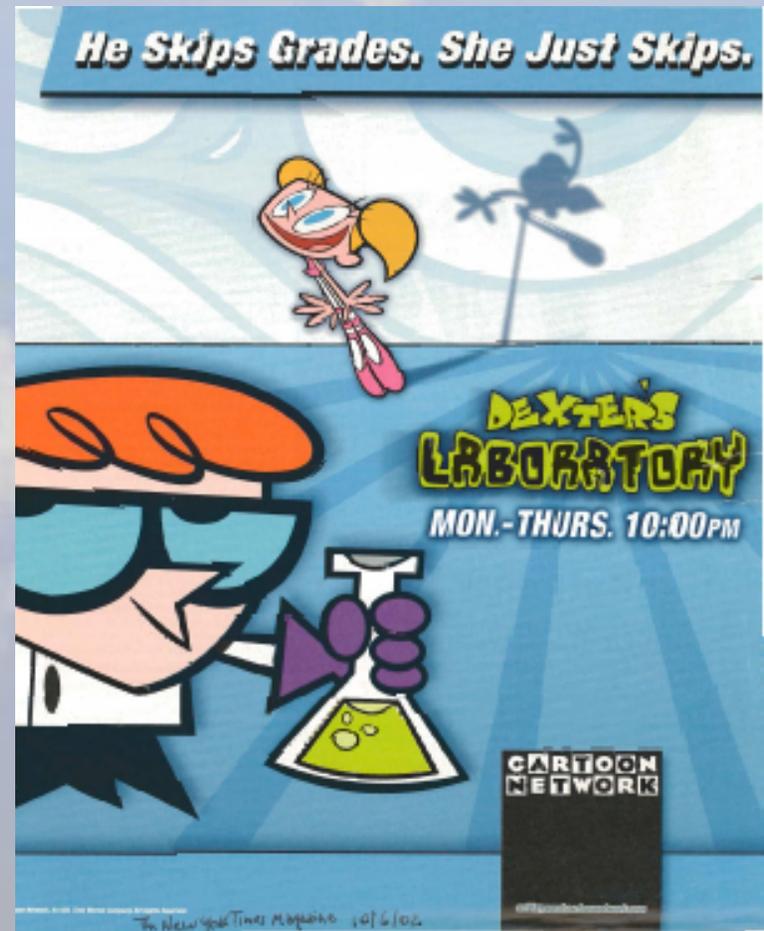
- Mentoring program pairs women graduate students with female high school students, to model success
- Women as LSOP interns



Obj 4: Understanding the Barriers

MMAP Research on Diversity

- Gender and Science in Media (Canetto)
- Longitudinal study of barriers and successes for women in science careers (Canetto)
- Assessment of McNair mentoring program (McPhee)



Metrics for Edu Objectives 1 & 2

- Number of new curriculum kits and DVD sets developed through LSOP and tested in PSD classrooms
- Number of science teachers trained through CSU course
- Number, duration, and quality of visits to Windows to Universe and SEE-ME web tools
- Formal assessment of classroom effectiveness and student performance, with publication of findings through national conferences and peer-reviewed journals

See draft plan for metrics broken out by objective



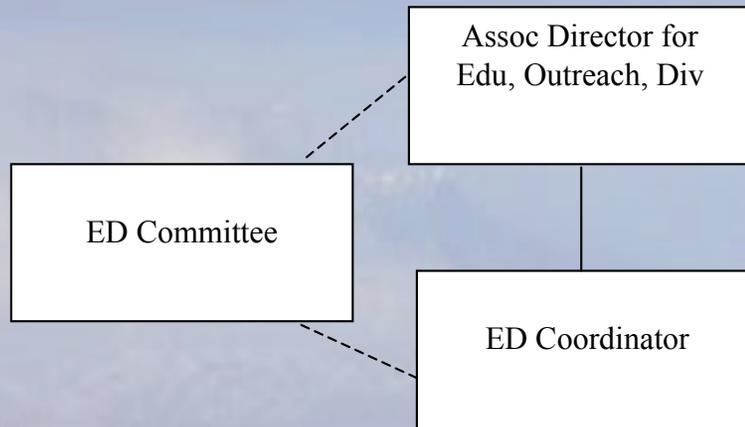
Metrics for Diversity Objective 1

- Number of women and underrepresented minority students supported by MMAP, and comparison to demographic data
- Number of SOARS protégés placed in PhD programs
- Number of MMAP-supported women and minority PhDs obtaining faculty positions

See draft plan for metrics broken out by objective



Management Structure in ED



Education and Diversity elements of STC are managed as a single package

- Assoc. Director for ED serves on Executive Committee
- Full-time ED Coordinator manages day-to-day operations in collaboration with other STC administrative staff
- ED Committee provides oversight, and engages scientific talent through rotation



ED Coordinator

- Works with the Center Administrative Director and ED partners to **track performance** of component activities
- Organizes **twice yearly progress reports** from EOD partners
- Manages **communications among ED partners**, and between MMAP scientists and ED resources
- Organizes **monthly telecoms** among ED partners and management
- Organizes and schedules ED component of **twice-annual MMAP meetings**

