



GOALS AND OBJECTIVES OF ANNUAL REPORT PEER REVIEW (PICK 1 OF 2)

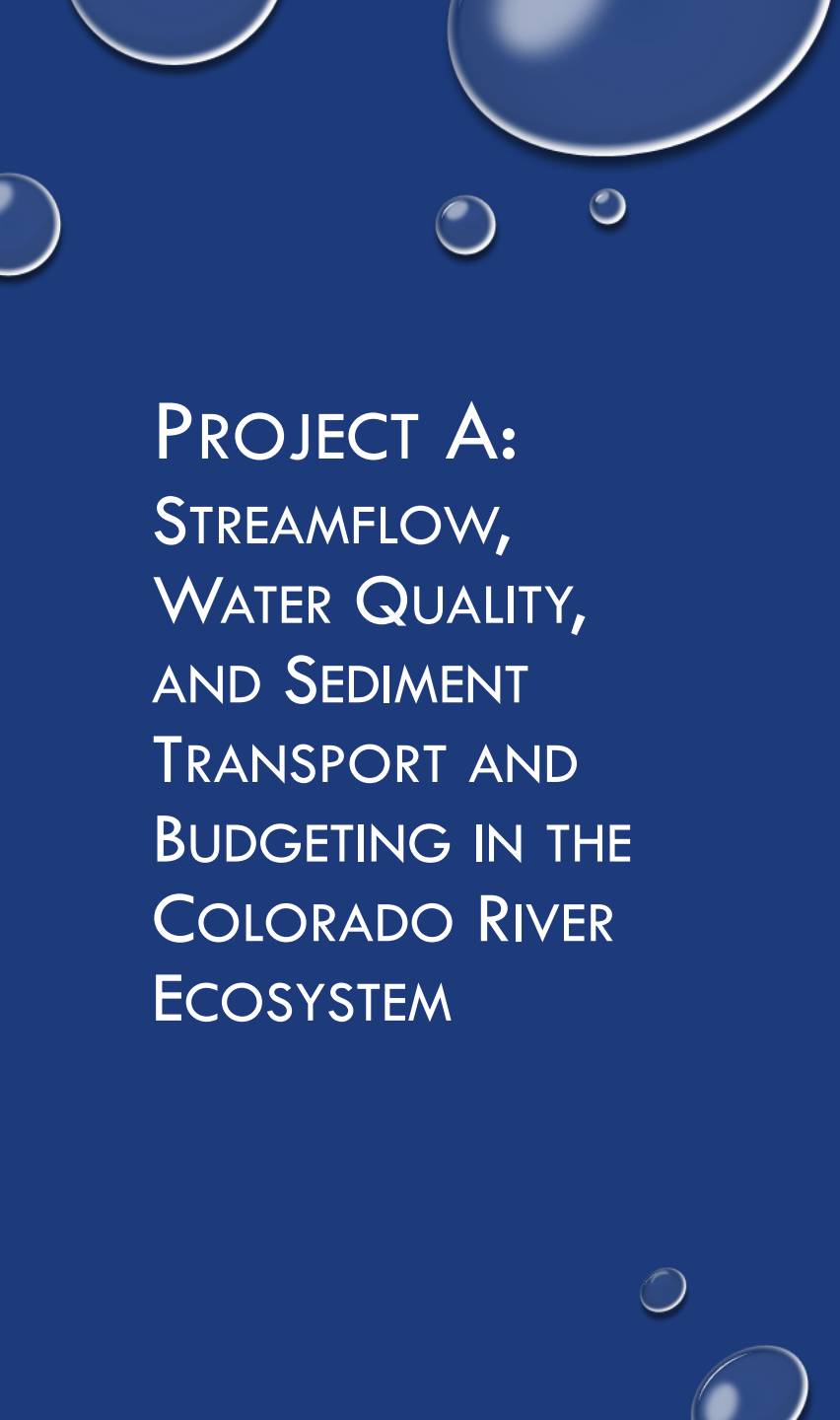
- REVIEW EACH PROJECT IN THE 2020 GCMRC ANNUAL REPORT
- INDEPENDENT SCIENTIFIC REVIEW AND RECOMMENDATIONS RELATED TO MONITORING OF RESOURCES AFFECTED BY GLEN CANYON DAM OPERATIONS
- FEEDBACK ON WHETHER THE QUESTIONS STUDIED PROVIDE GCDAMP WITH ANSWERS TO CARRY OUT ITS MISSION
- FEEDBACK ON WHETHER THE PROGRAMS ADVANCE UNDERSTANDING OF THE GRAND CANYON ECOSYSTEM AND CONTRIBUTE TO ADAPTIVE MANAGEMENT OF DAM OPERATIONS

PEER REVIEW PROCESS

- **REVIEWER SELECTION:**
 - SCIENTIFIC PUBLICATIONS, RELEVANT EXPERTISE, EXPERIENCE WITH SIMILAR REVIEWS, AND INDEPENDENCE FROM GCDAMP
 - PANEL COMPOSITION: HYDROGEOMORPHOLOGY, SEDIMENT TRANSPORT, FISHERIES, AQUATIC MACROINVERTEBRATES, STAKEHOLDER INVOLVEMENT, LARGE RIVER MANAGEMENT, SOCIOECONOMICS OF RIVER USE
- **MATERIALS PROVIDED:**
 - 2020 GCMRC ANNUAL REPORT, INCLUDING APPENDICES
 - WEBEX RECORDING OF THE ANNUAL REPORT MEETING
- **INDIVIDUAL REVIEWS:** EACH REVIEWER SELECTED PROJECTS TO REVIEW, BASED ON THEIR EXPERTISE AND EXPERIENCE, INDEPENDENTLY OF OTHER REVIEWERS
- **SUMMARY REPORT:** KEY POINTS FROM EACH INDIVIDUAL REVIEW FOR EACH GCDAMP PROJECT

REVIEWERS

- **MICHAEL E. COLVIN, PHD** - MISSISSIPPI STATE UNIVERSITY – EXPERTISE WITH BIG RIVER FISHERIES, SALMONIDS, AND ARID ECOSYSTEMS
- **STEFANIE A. KROLL, PHD** - DREXEL UNIVERSITY – EXPERTISE WITH FOOD WEBS, AQUATIC MACROINVERTEBRATES, AND COMMUNITY SCIENCE
- **LYNNE Y. LEWIS, PHD** - BATES COLLEGE – EXPERTISE IN ECONOMICS, HYDROPOWER, AND COMMUNITY SCIENCE
- **BEN LIVNEH, PHD** - UNIVERSITY OF COLORADO – BOULDER – EXPERTISE IN SEDIMENT TRANSPORT, HYDROGEOMORPHOLOGY, AND ARID ECOSYSTEMS
- **JOHN C. STELLA, PHD** - STATE UNIVERSITY OF NEW YORK – EXPERTISE IN RIPARIAN VEGETATION ECOLOGY



PROJECT A: STREAMFLOW, WATER QUALITY, AND SEDIMENT TRANSPORT AND BUDGETING IN THE COLORADO RIVER ECOSYSTEM

- IT IS DIFFICULT TO BALANCE THE GOAL OF SUPPLYING SUFFICIENT SEDIMENT TO MAINTAIN SANDY BANKS AND SAND BARS FOR RECREATIONAL AND TRIBAL ACTIVITIES, WHILE COMPETING WITH THE PROBLEMS OF TURBIDITY FOR BIOTA.
- THE NEGATIVE FEEDBACK BETWEEN WATER DISCHARGE AND SAND SUPPLY PROVIDE CLEAR SIDEBARDS FOR MANAGEMENT FOR DAM RELEASES AND HIGHLIGHT THE NARROWNESS OF THE DECISION SPACE FOR DAM MANAGEMENT.
- CONTINUOUS MONITORING OF SAND WOULD BE MORE INFORMATIVE, ESPECIALLY RELATED TO CURRENT AND FUTURE SAND RESOURCES AND CRITICAL CONNECTIONS BETWEEN SAND CONCENTRATIONS AND HIGH FLOWS.
- LONG-TERM PRECIPITATION GAGE DATA COULD IMPROVE REGRESSIONS AND UNDERSTANDING OF VARIABILITY, RELATIONSHIPS, AND UNCERTAINTY.




PROJECT B: SANDBAR AND SEDIMENT STORAGE MONITORING AND RESEARCH

- PROJECT B NEEDS TO BE MORE CLEARLY TIED TO LTEMP OBJECTIVES.
- THE RESULT OF HIGH FLOW EXPERIMENTS, IN PARTICULAR, SHOULD BE MONITORED IN TERMS OF THE OBJECTIVES OF PROJECTS E, F, AND OTHERS TO ENSURE THAT SUPPORTING ONE OBJECTIVE DOES NOT END UP DETRACTING FROM ANOTHER OBJECTIVE.
- SUGGESTIONS FOR FUTURE WORK AND ANALYSIS ARE PROVIDED, PARTICULARLY AROUND RECREATIONAL EXPERIENCE, CAMPING, CLIMATE CHANGE, AND REMOTE SENSING.

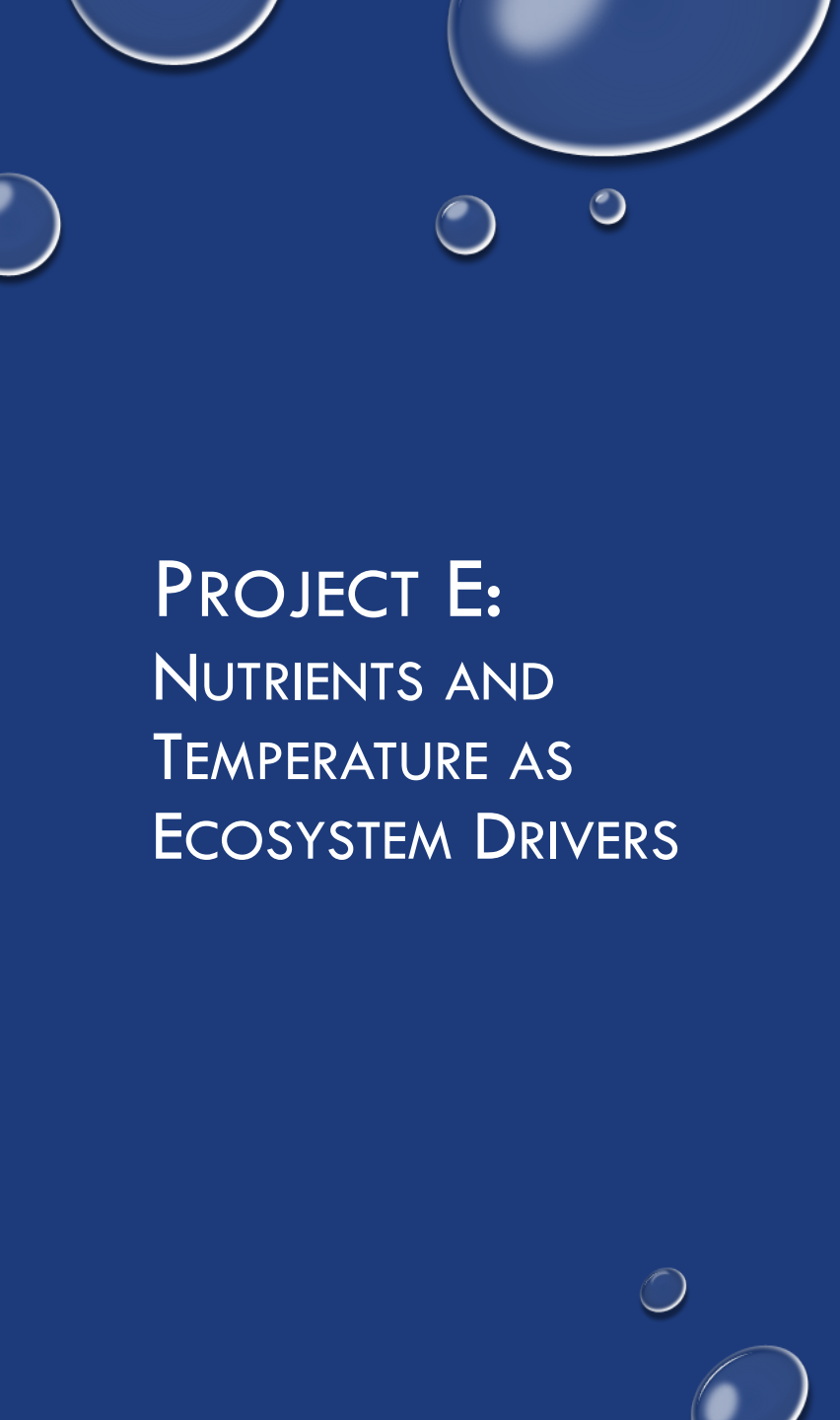
PROJECT C: RIPARIAN VEGETATION MONITORING AND RESEARCH

- THE MONITORING DATA AND METHODS THAT CONNECT VEGETATION WITH FLOW, ENVIRONMENTAL VARIABLES, AND MANAGEMENT ARE USEFUL.
- IT WAS NOT CLEAR WHAT THE SPECIFIC OBJECTIVES WERE OR HOW THEY INFORM MANAGEMENT ACTIONS?
- HOW DO THE INTERACTIONS BETWEEN PLANTS AND THE FLUVIAL SYSTEM EITHER SUPPORT OR UNDERMINE THE MULTIPLE LTEMP GOALS? WHAT ARE THE MOST LIKELY RESTORATION ACTIONS AND HOW DO THEY SUPPORT THE LTEMP GOALS?
- HOW WERE LONG-TERM CHANGES EVALUATED AND WITH WHAT METRIC(S)?
- HOW WELL DID THE MODEL PERFORM?
- ADDITIONAL DATA SHOULD BE REPORTED/COLLECTED TO HELP INFORM MANAGEMENT OF CAMPSITES AND OTHER RECREATIONAL AREAS.
- A SUMMARY RELATED TO CAMPING AREA, LANDSCAPE BEAUTY, AND SHADE SHOULD BE INCLUDED AND TIED TO PROJECT J.



PROJECT D: GEOMORPHIC EFFECTS OF DAM OPERATIONS AND VEGETATION MANAGEMENT FOR ARCHAEOLOGICAL SITES

- AN EVALUATION OF HOW FLOW AND NON-FLOW ACTIONS AFFECT CULTURAL RESOURCES, PRESERVATION OF RESOURCES, VEGETATION, AND SEDIMENT DYNAMICS SHOULD BE COMPLETED.
- CLARIFICATIONS ON METRICS, HOW THEY ARE ESTIMATED, AND HOW THOSE METRICS FIT WITH THE LTEMP RESOURCE GOALS AND OVERALL MONITORING OBJECTIVES WOULD BE HELPFUL.
- CLARIFICATION IS NEEDED ON HOW WEATHER DATA IS USED TO ACHIEVE MONITORING OBJECTIVES.
- METEOROLOGICAL MONITORING AND DATA COLLECTION IS EXTREMELY VALUABLE AND SHOULD BE CONTINUED.
- SPACEBORNE REMOTE SENSING COULD COMPLEMENT EXISTING AERIAL IMAGERY.

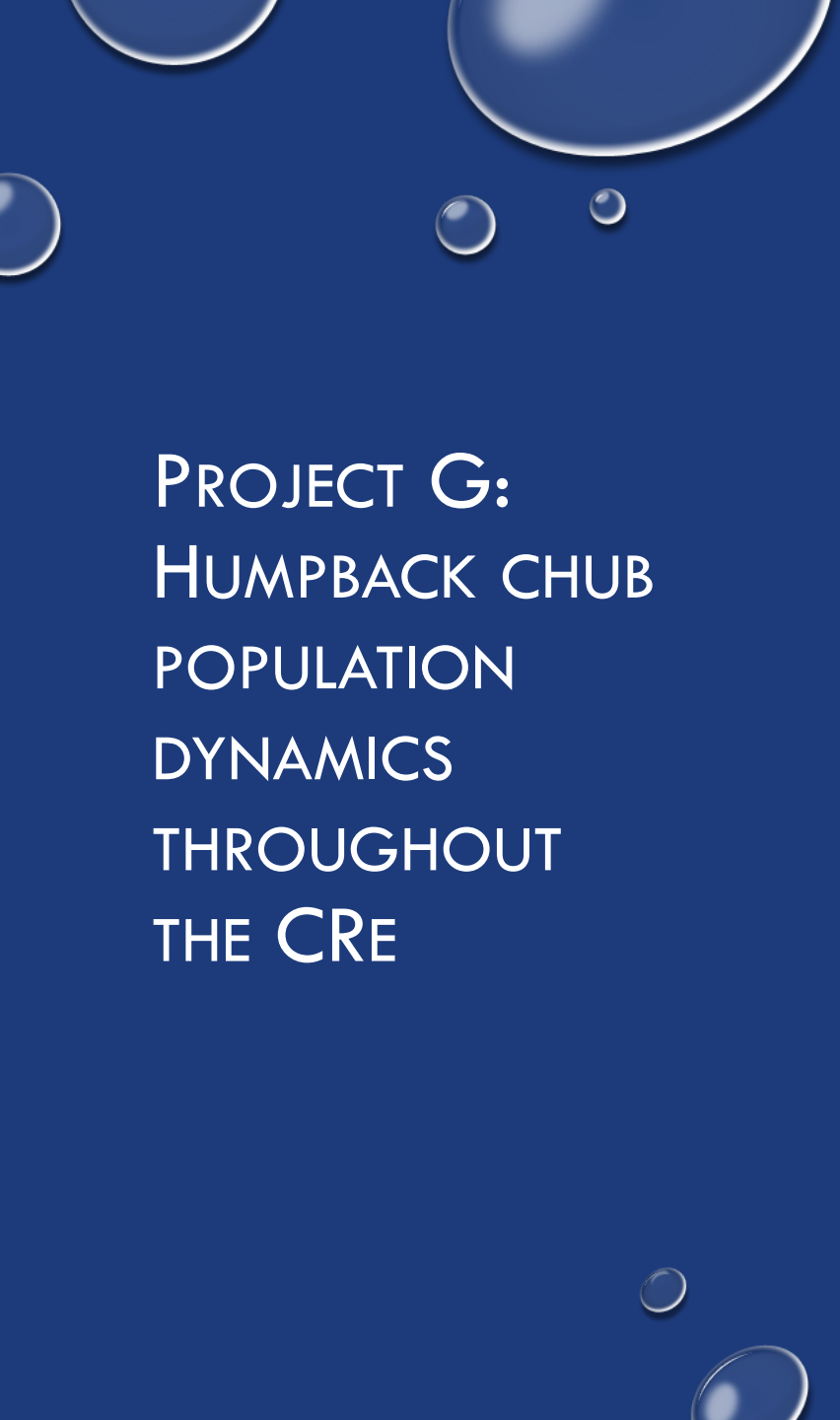


PROJECT E: NUTRIENTS AND TEMPERATURE AS ECOSYSTEM DRIVERS

- METRICS MONITORED MAY NOT DIRECTLY RELATE TO LTEMP RESOURCE GOALS BUT ARE A NECESSARY PRECONDITION TO ACHIEVING LTEMP RESOURCE GOALS RELATED TO BIOTA (HUMPBACK CHUB, RAINBOW TROUT, OTHER NATIVE FISH).
- THE APPROACH TO MONITORING AND STUDYING P DYNAMICS IS WELL DESIGNED.
- THE STUDIES BEFORE AND AFTER FIRE ARE SOUND, AND THE SHIFT TO STUDYING GROSS PRIMARY PRODUCTION WILL HELP UNDERSTAND THE DYNAMICS OF NUTRIENTS IN THE SYSTEM, ESPECIALLY FOR THE FOOD WEB.
- CLEARER JUSTIFICATION OF THE WATER TEMPERATURES CHOSEN SHOULD BE PROVIDED IN THE CONTEXT OF EXISTING POOL TEMPERATURES AND TEMPERATURES RELEVANT FOR OTHER PROJECT COMPONENTS.

PROJECT F: AQUATIC INVERTEBRATE ECOLOGY

- GOOD INTERACTION WITH OTHER PROJECTS TO SUPPORT INFERENCE AND PROVIDE AUXILIARY INFORMATION TO EXPLAIN AMONG YEAR DIFFERENCES IN HIGHER TROPHIC LEVELS, LIKE NATIVE FISH AND TROUT.
- WEEKEND “BREAKS” ARE AN EXCELLENT IDEA FOR EGG SURVIVAL AND OTHER POSSIBLE MECHANISMS FOR MACROINVERTEBRATE SUCCESS AND INCREASING DIVERSITY.
- ONCE THIS EXPERIMENT IS COMPLETE, WILL THERE BE ANOTHER STUDY ON HOW WEEKEND FLOWS CAN BE BEST DESIGNED AS ECOLOGICAL FLOWS FOR MACROINVERTEBRATES?
- THE COMMUNITY SCIENCE INVOLVED IN THIS PROJECT WAS A GREAT COMPONENT, BUT SOME SUGGESTIONS PROVIDED FOR EXPANDING OR STRENGTHENING THIS COMPONENT.



PROJECT G: HUMPBACK CHUB POPULATION DYNAMICS THROUGHOUT THE CRE

- THE PROJECT PROVIDES ADVANCED APPROACHES TO ESTIMATE POPULATION DYNAMICS AND PROJECT RESULTS HAVE THE POTENTIAL TO INFORM DECISIONS.
- HOW IS THE POPULATION TREND BEING EVALUATED?
- WILL TRANSLOCATION DECISIONS BE INFORMED BY MONITORING RESULTS?



PROJECT H: SALMONID RESEARCH AND MONITORING

- THIS IS VALUABLE RESEARCH. HOW WILL THE LONG TERM DATASETS BE USED TO EVALUATE EXPERIMENTAL FLOWS?
- THE ECONOMIC VALUE DATA IS FROM 2016. HAS MORE RECENT DATA BEEN COLLECTED AND HOW DOES IT COMPARE?
- THERE IS LITTLE ECONOMIC INFORMATION PROVIDED ABOUT THE RECREATIONAL FISHERY OR HOW OPERATIONS IMPACT THE ECONOMIC VALUE. RESULTS OR AN UPDATE RELATED TO THE INCENTIVE PROGRAM ARE VALUABLE AND SHOULD BE INCLUDED.

PROJECT I: WARM-WATER NATIVE AND NONNATIVE FISH RESEARCH AND MONITORING

- HOW ARE TRENDS CALCULATED FROM MONITORING DATA? THIS IS LIKELY IMPORTANT FOR INFORMING ADAPTIVE OPERATIONS OF GLEN CANYON DAM AND WHETHER OPERATIONS CAN ACHIEVE MANAGEMENT OBJECTIVES.
- WHY IS ASIAN TAPEWORM MONITORING IMPORTANT AND HOW DOES THIS SUPPORT GCDAMP AND LTEMP?
- HOW DOES THIS SAMPLING INFORM A) SAMPLING EFFORTS NEEDED AT A LARGER SCALE TO DETECT WARM-WATER INVASIVE FISH AND B) IF WARM-WATER INVASIVES ARE EXPANDING IN RANGE?
- HOW IS THE eDNA PERSISTENCE FROM UPSTREAM FACTORED INTO THE eDNA ANALYSIS COMPLETED?

PROJECT J: SOCIO- ECONOMIC RESEARCH IN THE COLORADO RIVER ECOSYSTEM

- IMPORTANT COMPONENT THAT ALLOWS FOR BROAD ASSESSMENT OF THE CONNECTIONS OF ONGOING ACTIVITIES WITH NEEDS AND ECONOMICS DOWNSTREAM.
- A NUMBER OF REVIEWERS COMMENTED ON DIFFICULTY LINKING THIS PROJECT WITH THE LTEMP OBJECTIVES AND MANAGEMENT ACTIONS.
- HOW WILL SURVEY INFORMATION FROM THE TRIBES BE USED TO INFORM DECISION MAKING AND ADAPTIVE MANAGEMENT?
- THE DELIVERABLES BASED ON USGS SCIENCE FOR USE BY TRIBAL COMMUNITIES IS VALUABLE. ARE THERE OTHER WAYS TO ENGAGE TRIBAL COLLABORATORS BESIDES WORKSHOPS?
- THE MODEL SELECTED FOR WILLINGNESS TO PAY DATA IS NOT NEUTRAL AND SENSITIVITY ANALYSIS IS IMPORTANT.
- THERE IS NO MENTION OF THE ON-GOING SEVERE DROUGHT OR CLIMATE CHANGE.


PROJECT K: GEOSPATIAL SCIENCE AND TECHNOLOGY

- IT WAS UNCLEAR WHAT THE GCDAMP AND LTEMP NEEDS ARE RELATIVE TO GEOSPATIAL SCIENCE AND DATA TECHNOLOGY. OR HOW THESE SYSTEMS SUPPORT DECISION-MAKING.
- THERE HAS BEEN AN IMPRESSIVE SET OF TOOLS DEVELOPED.
- THE MIGRATION OF DATA INTO DATABASES AND CLOUD COMPUTING RESOURCES IS AN IMPORTANT INNOVATION WITH PAYOFFS OVER THE LONG TERM.
- ARCGIS MAY NOT BE THE MOST EFFECTIVE TOOL DUE TO THE SIZE OF DATA SETS. OTHER MORE POWERFUL AND EFFICIENT TOOLS SHOULD BE CONSIDERED FOR THESE LARGER DATASETS AND ANALYSES.



PROJECT L: OVERFLIGHT REMOTE SENSING IN SUPPORT OF GCDAMP AND LTEMP

- THE EXPECTED OUTCOMES OF THIS EFFORT ARE UNCLEAR. HOW WILL THE RESULTS SUPPORT THE GCDAMP OR INTEGRATE WITH THE LTEMP? A TABLE THAT SHOWS THE RELATIONSHIP BETWEEN EXPECTED PRODUCTS AND THEIR APPLICATIONS IN PROJECTS WOULD BE HELPFUL.
- THE DETAILS OF THE OVERFLIGHT ARE NOT CLEARLY ARTICULATED, ALTHOUGH THERE IS VALUE IN ADDITIONAL REMOTE SENSING.
- EVALUATING OPPORTUNITIES TO INTEGRATE REMOTE SENSING IMAGERY WITH PUBLICLY AVAILABLE SPACEBORNE IMAGERY COULD PROVIDE COST-EFFECTIVE BENEFITS.



PROJECT N: HYDROPOWER MONITORING AND RESEARCH

- CONTINUE TO COORDINATE WITH PARTNERS TO IDENTIFY OPPORTUNITIES TO IMPROVE HYDROPOWER AND ENERGY RESOURCES, WITH EXAMPLES PROVIDED.
- GOALS AND OBJECTIVES COULD BE CLEARER.
- PROJECT N NEEDS MORE DETAIL AND IS LACKING INFORMATION ABOUT THE ECONOMIC VALUE OF HYDROPOWER.
- SUGGESTIONS FOR IMPROVING THE PRESENTATION AND QUESTIONS RELATIVE TO CLARIFYING METHODS AND ASSUMPTIONS WERE INCLUDED.

OVERALL COMMENTS

TECHNICAL THEMES

- SUGGESTIONS ACROSS MULTIPLE PROJECTS TO IMPROVE DATA PRESENTATION
- SUGGESTIONS FOR FUTURE ANALYSIS OR DIFFERENT WAYS TO ANALYZE DATA IN A FEW PROJECTS
- SEVERAL QUESTIONS RELATED TO HOW TECHNICAL RESULTS EITHER COULD OR DO ALREADY INFORM MANAGEMENT

GENERAL THEMES

- CLEARLY CONNECT EACH PROJECT TO LTEMP OBJECTIVES AND MANAGEMENT ACTIONS
- COMBINE (OR AT LEAST MORE CLEARLY CONNECT) EFFORTS BETWEEN PROGRAMS
- DIFFICULT TO UNDERSTAND HOW PROJECT RESULTS IMPACTED SOCIOECONOMICS