



PROPOSED EVALUATION METRICS FOR ACTIONABLE RESEARCH PROGRAM

Our proposed *Actionable Research Program* mirrors our successful *Tribal Engagement Program*, which instituted an evaluation process during the most recent Host Agreement with the USGS. To align these two programs, we propose evaluation indicators to help track our progress and adjust the program as needed. ***The purpose of our evaluation is to understand what processes and interventions lead to certain outcomes as we conduct actionable science across the region.*** From this learning process, we can continue to modify our work toward those practices that tend to result in better outcomes. (Note: The evaluation will not be used for annual evaluation of individual CASC staff members.)

Previous scholars, however, recognize that traditional methods of evaluation of science programs (e.g., number of publications, citation rate) do not emphasize key elements of actionable science successes (Banzai-Dodson and McPherson 2022). In addition, as discussed by Meadow and Owen (2021), it is difficult to attribute a societal decision, new policy, or change in the environment to the results of a particular research program or product. Hence, the evaluation indicators presented here instead reflect that the research process or output is likely a *contributing factor* to impact at various scales (e.g., ranging from an individual societal partner or product user to a community or ecosystem), as shown in **Fig. 1** from Meadow and Owen (2021).

How Research Contributes to Societal Impacts

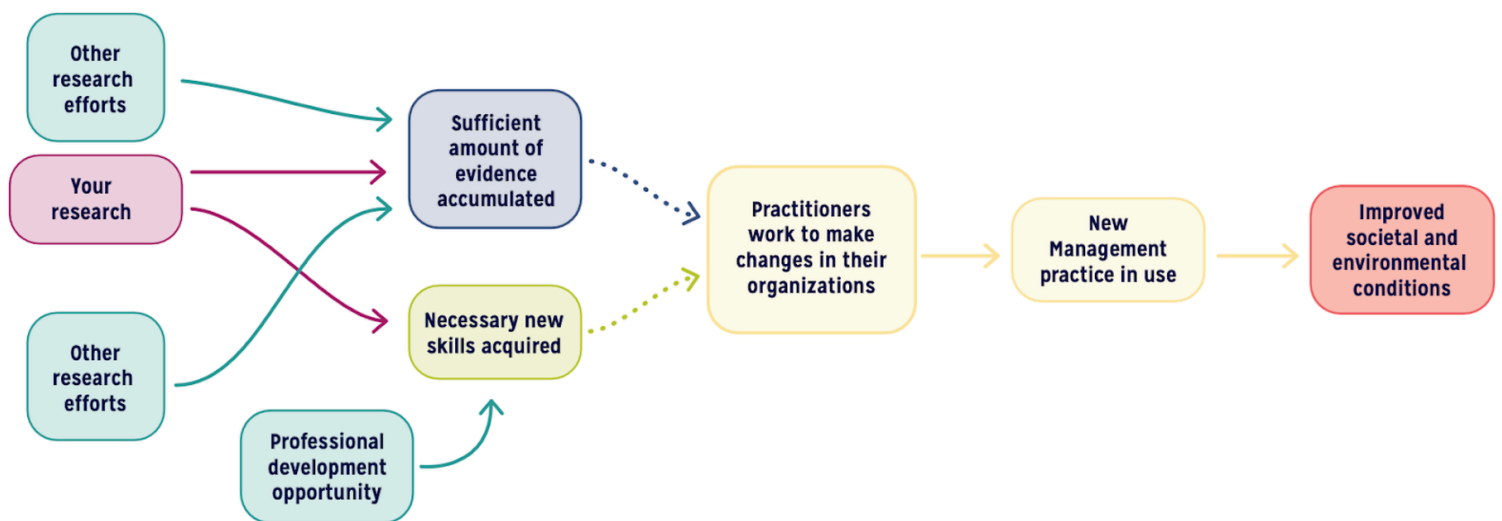


Figure 1. Schematic of how an individual's or team's research (pink box) can result in improved societal or environmental conditions through multiple steps that may be measured in an evaluation framework. Figure from Meadow and Owen (2021, p. 17).

Meadow and Owen (2021) note that research in evaluation, policy studies, and other disciplines (Weiss 1973; Pelz 1978; Walter et al. 2003; Meagher et al. 2008; Spaapan and van Drooge 2011; Ford et al. 2013; Meagher and Martin 2017) has resulted in different categories of indicators that are relevant to climate adaptation-related research, including the following: instrumental impacts, conceptual impacts, capacity-building impacts, mobilization of support, wider influence, enduring connectivity, attitude or cultural change, productive



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interactions, useability of research, economic benefits, and environmental benefits. These categories are differentiated as:

- Instrumental impacts are direct, when part of the research is used in a management or policy decision or to help solve a specific problem;
- Conceptual impacts are complex and indirect, when societal partners or users expand their knowledge, broaden their understanding, or change their attitudes as a result of the research process or outputs;
- Capacity-building impacts use the research process or findings to enhance the workforce (e.g., to build skills, knowledge exchange, etc.) or climate resilience efforts (e.g., to translate research to community actions) through trainings or collaborative actions;
- Mobilization of support refers to the use of research output to persuade individuals or organizations to support specific activities or policies;
- Wider influence broadens the impacts from a specific societal partner to a larger audience;
- Enduring connectivity reflects the evolution of long-lived relationships among researchers and societal partners;
- Attitude or cultural change demonstrates a willingness for knowledge exchange by individuals, agencies, or organizations;
- Productive interactions include direct (e.g., face-to-face, videoconferencing), indirect (e.g., via fact sheet, video), or financial (e.g., funding) interactions between researchers and societal partners;
- Useability of research highlights whether the research output advances decision making and is pertinent, of sufficient quality, and timely for the decision maker;
- Economic benefits, in this context, typically refer to the actual or potential reduction of costs that results from the research (e.g., through averted current or future impacts from climate change); and
- Environmental benefits recognize that the research can lead to better outcomes for biodiversity, habitat conservation, wildlife health and well being, etc.

Our *Actionable Research Program* will apply indicators from these categories, as well as traditional metrics such as peer-reviewed publications or presentations to a disciplinary audience.

Table 1 is a portfolio of proposed evaluation indicators (or metrics) with examples of preferred and problematic practices related to the associated indicator. These indicators are based on those outlined in the literature on actionable science (Wall et al. 2017; Meadow and Owen 2021; Bamzai-Dodson and McPherson 2022) or were highlighted in the evaluation of our Tribal Engagement Program (Bray et al. 2024). Some projects are small in scope and only a few evaluation indicators may be appropriate. Multi-jurisdiction, multi-discipline, or large-scale projects may incorporate many of the indicators to evaluate success.

Depending on the research, key decision points during the actionable science process may include one or more of the following (from Wall et al. 2017): vision, problem definition, research question articulation, research design, data collection, data analysis, knowledge/meaning making, testing results, and dissemination of knowledge. These may be viable times when evaluation of process, output, or impacts can be conducted.



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Table 1. Proposed Indicators for the *Actionable Research Program*.

Proposed indicators (or metrics) for the South Central CASC’s *Actionable Research Program*, with examples of preferred and problematic practices to demonstrate a portion of the spectrum of practices related to the indicator. “Partners” refers to societal partners, including natural and cultural resource managers, who researchers work directly with through actionable science approaches to develop decision-relevant products. “Users” benefit from products that researchers develop but are not partners for the product of interest. Specific users may be partners on other products or research, and vice versa.

The evaluation indicators described herein are under development and will be finalized in collaboration with the Program Evaluator. Also, these indicators may change during the Host Agreement as a result of recent literature on the evaluation of actionable science, results of the cross-CASC evaluation community-of-practice, input from USGS regional or national CASC leadership and staff, or similar. Example indicators are provided to guide the Research Process, Research Output, and Research Impact.

Research Process		
Evaluation Indicator	Preferred	Problematic
CASC staff/investigators responded to an identified need of a CASC partner	Information producers listened to partner needs prior to working to address them	Information producers defined their project goals first, then found user needs that supported them
Project is supported by higher-level administrators	Tribal council, state agency head, or similar has approved project and contributed tangibly to project	Tribal council, state agency head, or similar is unaware of project
Project applied appropriate methods and analysis techniques at appropriate scale(s) to address question/problem	Team discussed pros & cons from portfolio of methods/techniques as related to partner needs, budget, etc.	Team used their preferred method/technique regardless of how it may affect partner or bias research results
Partner worked with CASC staff/investigators with sufficient time to make an informed decision or influence the objectives of a project of interest/value to the partner	Engagement began prior to making decision or writing proposal; contingency plans were made in case project deliverables were delayed	Engagement began after making decision or project developed results
CASC staff/investigators engaged partner frequently prior to key decision points (e.g., problem definition, data/product selection, analysis, creation of output product)	Following a co-designed communication plan, early and ongoing interactions occurred during the work and partner deemed this engagement effective	Late or infrequent interactions and no communication plan reduced the effectiveness



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Research Process		
Evaluation Indicator	Preferred	Problematic
Partner felt that engagement of and communication with CASC staff/investigators was of high quality (e.g., timely, efficient, valuable, trusting, transparent)	Engagement focused primarily on the needs of the partner and considered their limited time and valuable input	Engagement used to only extract information from the partner for benefit of investigator/staff member
CASC staff/investigators appropriately infused the culture, values, and expertise of the partner into project (e.g., Indigenous and local knowledges, agency requirements)	All collaborators contributed to shared understanding of working practices	Project ran only according to the working practices and culture of investigators
CASC staff/investigators worked to find project elements that are mutually beneficial to partners (i.e., principle of reciprocity, Austin et al. 2024)	Partner received compensation, career development, and project results for their participation	Partner provided information but does not hear back from investigator during or after research
Partner and CASC staff/investigators discussed who else needs to be included in planning, implementation, reviewing, etc. (e.g., social scientists, managers) before work was initiated	Variety of perspectives, expertise, and experiences related to problem and solutions were established from project start	Only 1-2 elements of team composition was considered (e.g., career stage)
Partner and CASC staff/investigators expressed their aspirations, expectations, or objectives for the project to one another	Aspirations, expectations, or objectives were defined and communicated early and revisited as needed	No exchange of understanding occurred during the project
Partner/user and CASC staff/investigators analyzed existing power dynamics to eliminate undesired bias and build shared principles (Reed et al. 2024)	Power dynamics were discussed openly, leading to shared project-team principles (e.g., humility, transparency)	Researchers with funding determined how relationship was to work and determined project principles
Partner and CASC staff/investigators recognized that language is an important element of how people experience the world	Partners and investigators developed a shared glossary of important terms	Researchers assumed that their academic terminology/jargon was understood by partners
CASC staff/investigators worked with partner to assess project processes, budget, institutional impacts, effects on lives, etc. at project end	Together, team celebrated project completion, reflected on project successes and challenges, and documented lessons learned	Team disbanded without closing out project together



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Research Process		
Evaluation Indicator	Preferred	Problematic
Project evaluator engaged CASC leadership and project team, including partners and staff/investigators, in evaluation process	Project evaluator discussed goal(s) of evaluation, co-developed methods, and reviewed evaluation result with leadership, researchers, and partners prior to finalization of evaluation report	Project evaluator conducted evaluation as fully “external,” with limited interactions with leadership, researchers, and partners
Lessons learned, evaluation findings, project storylines, and other helpful assessment information were infused, as appropriate, into future CASC strategic plans, guidance documents, proposal solicitations, etc.	CASC leadership discussed assessment information annually and determined what and how to infuse it into future processes	CASC leadership accepted assessment information as completed project component without reading or further discussion
Field, laboratory, and office safety protocols were designed and clearly communicated to all project personnel	Project team created shared protocols to ensure safety of project personnel and those they interact with, with particular attention to those at higher risk	No safety protocols were established
Project team reviewed and followed ethical and legal choices in research process	Team received IRB or IACUC approval (as needed) and discussed potential consequences of research connected to at-risk or frontline communities	Team assumed their research did not involve ethical or legal issues
Research Output		
Evaluation Indicator	Preferred	Problematic
CASC staff/investigators supplied useable data/information (e.g., training, projections, summary documents, newsletters) to partner/user	Tangible output was provided to partner/user with appropriate documentation for use	Tangible output was produced but not shared with partner/user
Partner/user used CASC product/knowledge to identify, evaluate, or select possible adaptation strategies to cope with climate impacts	Output was offered with enough detail and context for the partner/user to implement one or more adaptation strategies	Only a basic output was provided, with no context to help partner consider adaptation strategies



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Research Output		
Evaluation Indicator	Preferred	Problematic
Output was developed that better informed partner/user to make decision or influence policy (i.e., instrumental use of information)	Partner infused CASC-related information directly into decision/policy document or action	Information was in wrong format, too abstract/complicated, or otherwise not useful for decision making
Work between resulted in dissemination of results (e.g., peer-reviewed publication, presentation, training, social media) that acknowledged the partner	Partner was a co-author on pub/presentation/etc. and had adequate opportunity to add & review content	Partner was noted in acknowledgements section/slide and wasn't given opportunity to review
Work connected partner with a larger network/cohort of professionals working on climate-related challenges	CASC staff/researchers hosted events (e.g., workshops) that engaged partner in active discussions with others who had similar interests	CASC staff/researchers sheltered partner from others so they could have more control over relationship
Data and results were publicly available (except in cases with Tribal data sovereignty)	Tribal data sovereignty honored; all other data shared as open access (e.g., ScienceBase)	Tribal data sovereignty not discussed; other data only shared within research team
Project findings were provided in formats typically used by partners/users and their peers	Findings were reported in multiple forms (e.g., talking points, storylines, videos)	Findings were written only as peer-reviewed manuscripts
Project findings were distributed through communication channels typically used by partners/users and their peers	Findings were reported through different sources (e.g., trade journals, social media, local meetings)	Findings were published in peer-reviewed scholarly journals only
Project materials followed accessibility guidelines	CASC staff helped researchers create materials that adhere to POUR (Perceivable, Operable, Understandable, and Robust) or similar principles	Materials were not accessible to individuals with visual impairments, hearing difficulties, or motor-skill limitations



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Research Impact		
Evaluation Indicator	Preferred	Problematic
Partner/user became more aware of climate change, impacts, adaptation, datasets, or models	Pre- & post-tests measured increase in awareness	No measurement was taken
Partner/user gained new knowledge about climate change, impacts, adaptation, datasets, or models	Pre- & post-tests measured increase in knowledge	No measurement was taken
Partner/user gained expertise or improved a skill	Partner/user reported an increase in expertise or skill improvement	No increase in expertise or skill improvement observed
Partner/user felt satisfied with their interactions with CASC staff/investigators	Interactions earned high satisfaction scores on evaluation	No measurement was taken
Partner/user trusted the information provided	Partner/user indicated that they trusted the information	Partner/user indicated they sought confirmation from other experts before using CASC information
Partner established or strengthened their partnership with CASC staff/investigators	The CASC or its investigators became part of partner's "go to" network for issues related to climate extremes	Partner saw no need to work with the CASC or investigators in the future
CASC staff/investigators valued what the partner brought to the research product or process	CASC staff/investigators continued to seek future relationships with partners because they valued these relationships	CASC staff/investigators indicated that they did not see any role for the partner in the future
Products were relevant to the goals/needs of the partner/user	Partner/user stated that product served a purpose or helped achieve a goal	Partner/user stated that product did not serve a purpose or help achieve a goal
Products were useable by the partner/user	Partner/user stated that product was easy to use and accessible	Partner/user stated that product was too confusing to use or hard to find/access
Products were used by the partner/user (or others) as a direct application of project findings/output	Partner/user stated that product was actively being employed	Partner/user stated that product was not used for any decision or activity



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Research Impact		
Evaluation Indicator	Preferred	Problematic
Perspectives of partner was amplified within institutional spaces of CASC staff/investigators (e.g., their needs/priorities were communicated to a larger group of scientists)	CASC staff/investigators repeated or restated views of partners that they've built close relationships with at meetings where those partners were not represented but their perspectives would be helpful or important	CASC staff/investigators only offered their own views of an issue or decision point
CASC staff/investigators removed a barrier (e.g., inadequate resources, lack of time, inability to access appropriate datasets, gap in understanding, bureaucratic hurdle) that constrained partner/user from moving forward	CASC staff/investigators used their power or resources to remove a barrier of a partner	CASC staff/investigators used their power or resources to serve themselves only
Implementation of project findings/output in a decision resulted in decreased costs, increased resilience, or other socio-ecological benefit to the partner/user or their organization/community/jurisdiction	Partner/user listed one or more benefits that resulted from a CASC product or research findings	Partner/user could not articulate any benefits from a CASC product or findings



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