

How to improve the impact of research (summary)

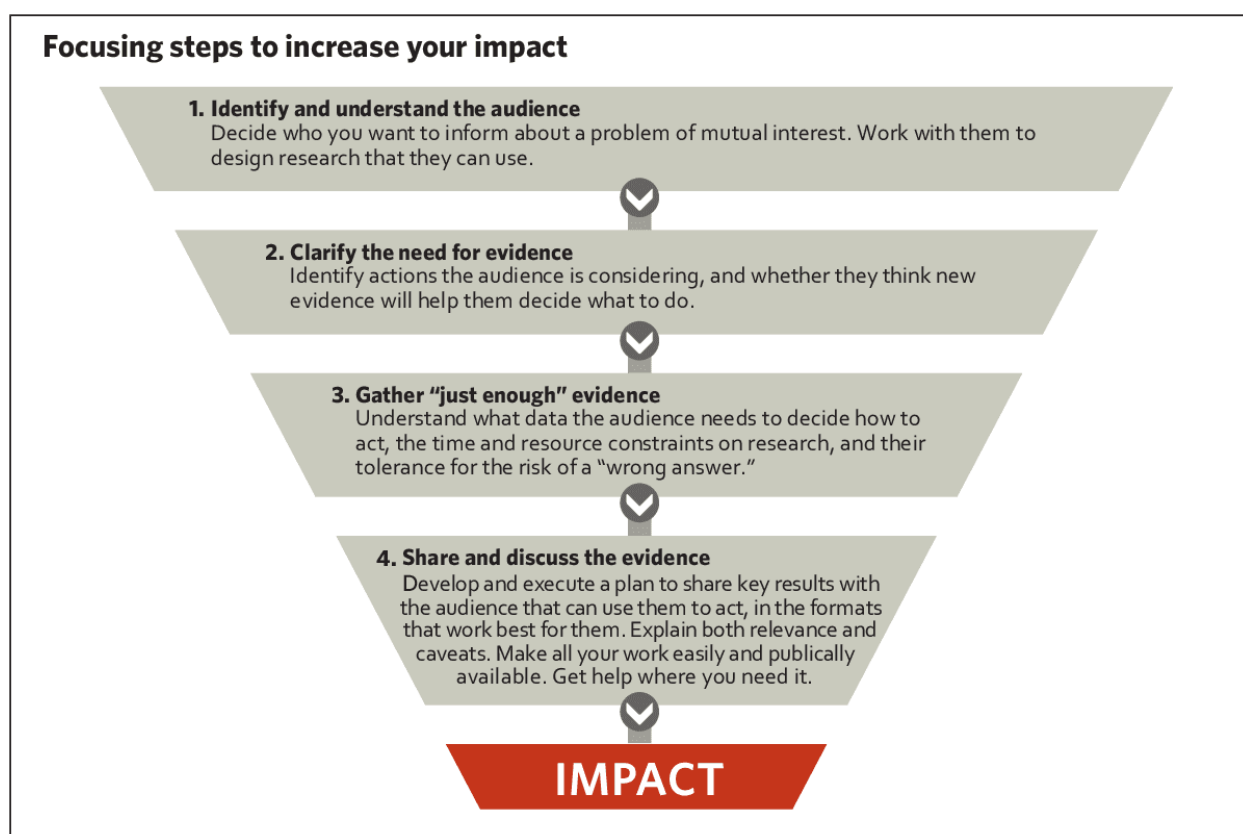
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While the success of impactful research is often partly due to luck and persistence, there are many reasons that research fails to influence decision making. Scientists can improve their odds of impact through following our recommendations to put science into practice (summarized in Figure 1). They are guidelines (not a recipe) for scientists who hope to influence decision making, but who are open on how to achieve it. While based on our experience in conservation, they can apply to other disciplines.

Figure 1. Steps to increase the chances of research influencing decision making. We generally recommend following them in order from Step 1 to 4. For more detail, see Figure 2 in the full paper.



Putting science into practice requires skills like building relationships and communicating with decision makers and other stakeholders. Scientists should get help from colleagues who bring these skills, relationships, and experiences, and work with their intended end users to design research together.

1. Identify and understand your audience. Before starting research, identify and engage the 'audience' (or partners) of the work. The audience should be decision-makers able to act to help solve a problem of mutual interest. Engage in the community working on this problem to learn more about how it is being addressed by other stakeholders. Seek to understand the audience's needs, values and goals, how they see the problem, and whether they think more research is needed (that you could do).

Example: Urban forest managers need to know urban forest conditions and how their actions influence them. Research was done and the i-Tree tool was built to help measure urban forest condition. However, the audience was not clearly defined so it was not used in some target urban settings. The tool did not meet the needs of New York City forest managers, for instance, because the tool couldn't distinguish street trees from urban forest patches (an important distinction for management).

2. Clarify the need for evidence. Often the audience will have potential actions in mind, at specific spatial and temporal scales. Determine the actions being considered, if a lack of evidence is a barrier to deciding how to act, and if so, what evidence would motivate and empower the audience to act. Develop research questions in partnership with the audience, seek to understand the political and economic context, and respect the legitimacy of how the audience makes decisions.

Example: More evidence on the causes of climate change is unnecessary; beliefs about humanity's role haven't shifted much in response. But identifying how to best reduce greenhouse gas (GHG) emissions can help decision makers prioritize which actions to invest in to meet their GHG reduction goals.

3 Gather "just enough" evidence. Research design should reflect the appropriate time, rigor, and approach needed for gathering "just enough" evidence (no more than necessary) to best inform an action or policy. Identify what kind of evidence the audience considers actionable, their timeframe to make decisions (with or without new evidence), their tolerance for risk, and whether adaptive management is an option before choosing a research approach. Resources are wasted when more research is done than necessary to inform action, research fails to meet the quality standards of decision makers to inform action, or research is too slow to be relevant.

Example: When a Brazilian company considered investing in conservation (e.g., reforestation) to improve water quality rather than a new pipeline to a neighboring watershed, we built a high-resolution spatial model on how nature would perform. Later, we found that all the company needed to make a decision was coarser data and a rough estimate of return on investment. By failing to understand the user's needs upfront, we missed a chance to reduce research costs and spend more on implementation.

4. Share and discuss the evidence. Most scientific articles are not read by their targeted or potential audiences. Early in the research process, work with the audience to plan how to share the results, including which styles, formats, and venues to use. This may include written briefs, oral presentations in person or online, and more. Once results are available, develop a clear, compelling message and share it via the communications plan. Explain how the evidence is relevant and what caveats could affect its use. Scientists should get help from communications experts to publish accessible summaries of the research (e.g. blogs), improve their communication skills, promote the work, and have effective in-person meetings with the audience. Share all data and code (not only key results) and remove barriers to access (e.g. via preprint servers and open access).

Example: In developing the paper this summary is based on, we learned that conservation scientists often rely on peer-reviewed articles to inform their work, but due to limited time they are very selective with what to read. Based on their input, we wrote the manuscript with easy to understand language to make it more accessible. We then worked with communications experts to plan how to pique our audience's interest, wrote this summary to accompany the paper, and presented online and in-person to target audiences (e.g., scientific conferences, graduate programs, etc.).

Conclusion: Our hope is that better awareness and use of our recommendations will translate to the more effective use of evidence to inform environmental decisions. For a more in-depth look at why these steps are important and how to practice them, read the (freely available) full paper at:

<https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/csp2.210>