Cooperative Institute for Research in Environmental Sciences
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ESIIL Team Productivity Framework

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Suggested pre-reads

- Ward, K. (2025, October 7). ESIIL Team Science Workshop: How to Assess Team Effectiveness Beyond 'Productivity'. Zenodo. https://doi.org/10.5281/zenodo.17468885
- Ward, K. (2025, October 7). [Video] ESIIL Team Science Workshop: How to Assess Team Effectiveness Beyond 'Productivity'. Zenodo. https://doi.org/10.5281/zenodo.17716442

Short summary

In team science, productivity is often equated with visible outputs like papers, citations, and grants. While these are easy to count, they don't capture what truly makes teams effective, how people work together, share credit, and translate their work into broader impacts. The ESIIL Team Science Productivity Framework challenges the idea that "more is better" and instead emphasizes the *quality* of collaboration.

Effective teams balance outputs, processes, and impacts. They produce meaningful work, foster communication and equity, and create benefits that extend beyond academia. As shown in the ESIIL workshop scenarios, teams that publish less may still drive long-term innovation through trust-building, shared platforms, and community partnerships.

Beyond Productivity: Rethinking Team Effectiveness in SciTS

In the science of team science (SciTS), productivity is often equated with quantifiable outputs such as publications, citations, grants, and patents (NASEM, 2025). These metrics offer a convenient shorthand for accountability and return on investment, yet they fail to capture what makes teams genuinely effective: how people collaborate, share credit, and translate knowledge into broader impacts. As team science has matured, it has become increasingly clear that productivity alone cannot account for the full range of outcomes teams generate.

The ESIIL Team Science Productivity Framework challenges the assumption that "more is better" by emphasizing the quality of collaboration rather than the quantity of outputs. Effective teams balance what they produce with how they work and the impacts they create. They generate meaningful scholarship, cultivate trust and equity, and contribute benefits that extend beyond academia (Bozeman and Youtie, 2018).

The Limits of Counting Outputs

Traditional productivity metrics assume that higher output signals greater effectiveness. This

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assumption overlooks the complexity of knowledge co-production and obscures whose labor is recognized (Cummings and Kiesler, 2005). High publication counts can mask uneven contributions, reinforce hierarchical credit structures, and marginalize essential but less visible work such as data stewardship, mentoring, coordination, and public engagement. These metrics also privilege disciplines with rapid publication cycles and well-resourced infrastructures, while undervaluing slower, integrative collaborations needed to address complex environmental challenges.

The "Powerhouse" scenario from the ESIIL Team Science Workshop illustrates this tension. Although the team produces numerous high-impact publications and is externally celebrated, internal members raise concerns about uncredited labor and inequitable recognition. This disconnect between external visibility and internal experience highlights how narrowly defined productivity can fail to capture equity, inclusion, and team well-being. As prior SciTS research emphasizes, effective collaboration relies on trust, transparent decision-making, and shared norms (SESYNC, 2019).

Productivity as Process and Practice

A growing body of SciTS scholarship argues for evaluating how teams work, not just what they produce (Börner et al., 2010; Bennett et al., 2018; Parker, 2026). Process-oriented perspectives emphasize communication quality, role clarity, leadership practices, and psychological safety as foundations of team effectiveness (Salazar et al., 2012). Teams that foster inclusive decision-making and open communication often demonstrate higher satisfaction, creativity, and problem-solving capacity, even when immediate outputs are modest.

The "Turtle" scenario demonstrates this principle. While the team produced only one publication over three years, it developed a shared data platform later adopted by municipal partners. The slower pace reflected the deliberate work of integrating diverse expertise, building common frameworks, and cultivating stakeholder trust. Although such achievements may appear limited through traditional metrics, they represent durable and impactful forms of collaborative productivity.

These contributions are frequently undervalued because they resist standardization. Integrative models, shared infrastructures, and participatory processes are difficult to count or rank, yet they form the scaffolding for long-term innovation. Capturing this dimension of effectiveness requires mixed-method evaluation approaches that combine bibliometric indicators with qualitative assessments of team processes, such as surveys, interviews, or reflective exercises (Hoffman et al., 2022).

The Hidden Costs of Hyper-Productivity

At the opposite extreme, teams that appear maximally productive may rely on unsustainable practices. The "Overtaxed" scenario highlights how high output can coexist with burnout, strained

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partnerships, and performative engagement with stakeholders. These dynamics mirror broader SciTS findings showing that when workload equity, psychological safety, and authentic collaboration are neglected, short-term productivity can undermine long-term innovation and team resilience (Lotrecchiano and Misra, 2018).

This tension aligns with calls to reorient research cultures around values of care, justice, and sustainability. When productivity metrics incentivize speed and volume, they may erode the conditions needed for transformative science. An effective team, therefore, is not defined solely by output quantity, but by whether its practices are ethical, inclusive, and sustainable.

A Holistic Framework: Outputs, Processes, and Impacts

A more comprehensive approach situates productivity within a triadic framework of outputs, processes, and impacts. Outputs include tangible products such as publications, datasets, tools, and reports. Processes capture the relational dimensions of collaboration, including communication, leadership distribution, equity in authorship, and mentoring. Impacts reflect how team efforts benefit communities, practitioners, or policy systems beyond the academy.

This framework reframes productivity as multidimensional. For example, an interdisciplinary water governance team may publish few academic papers but produce open data repositories, training workshops, and decision-support tools that strengthen public transparency and local capacity. Such contributions exemplify science that serves society, even when they fall outside conventional metrics.

Operationalizing this framework can draw on emerging SciTS tools that assess communication quality, role clarity, and trust. These approaches help teams reflect on internal dynamics while recognizing that effectiveness evolves over time: early stages may prioritize coordination and trust-building, while later phases emphasize dissemination and impact.

Reimagining Productivity Cultures

Broadening how productivity is defined is not only an evaluative shift but a cultural one. Institutions and funders must recognize the full range of contributions that sustain collaborative science, from data stewardship and mentoring to community engagement and infrastructure design. The goal is not to abandon metrics, but to embed them within richer narratives of effectiveness. As the ESIIL workshop scenarios illustrate, productivity becomes meaningful only when interpreted alongside lived experiences of collaboration. By attending to quieter contributions and relational labor, the science of team science can model a more equitable, humane, and impactful research culture. In this case, productivity then reflects how teams co-create knowledge, share power, and generate benefits that extend far beyond academia.

Workshop Scenarios

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See our previous presentation and recording for more information on the following scenarios:

Scenario 1: Powerhouse
▶ A cross-disciplinary team produces 10 papers in three years, all in mid- to high-impact journals. Their citation counts are good, and one paper was even featured on the cover of *Science.* Their college dean praises the group for raising the visibility of the environmental engineering department, and at the annual department cook-out, Drs. Evian and Voss proudly thank their students and collaborators for making the work possible. ▶ But not everyone shares this enthusiasm. Dr. Geyser remarks to a colleague that their graduate student mentee received little credit despite doing most of the data analysis. A on-looking junior faculty member adds that they left the group mid-year after their geological insights were sidelined. Colleen, a former student of the project, notes that none of her environmental assessments made it into the final publications. ▶ Even as the team is celebrated for its productivity by the dean, quieter voices suggest that much of the intellectual and collaborative labor has gone unrecognized.
Scenario 2: Turtle
▶ In parallel, Dr. Geyser has been leading a different interdisciplinary team the past three years on developing a shared data platform and integrative framework for better environmental assessments. Progress has been slow, with only one paper published in the same period. ▶ At the cook-out, Colleen compliments the group for capturing negative externalities often excluded from such assessments. Dr. Fiji, a co-PI, proudly describes how the platform is being adopted by the city and is under consideration by a major real estate developer. Despite their positive relationships within the local government, Dr. Geyser worries that the impacts of these adoptions are hard to track. Dr. Geyser confides in Dr. Fiji that without more publications, their grant renewal may be at risk and that they need to think about their more junior member, Dr. Gateau, who will be up for tenure soon.
Scenario 3: Overtaxed
▶ Drs. Evian, Voss, and Geyser's other colleagues have also been exceptionally busy. Dr. Spring, the previous department chair, has been co-leading a team on alternatives to current waste to energy (WTE) technology. In the past 5 years, the team has published 15 papers in respected journals, renewed their grant, and have a widely used open dataset on WTE pollution that's been praised at their annual conference. At the cook-out, the current chair jokes with Dr. Spring that the team seems to spend more time on airplanes than in the lab, given their constant stream of talks. ▶ Graduate students Kevin and Erin proudly describe their authorship on two high-profile publications. But near the cooler, postdocs Yingjie and Kim worry about 50–60 hour weeks becoming the norm. Dr. Gateau, Kim's mentor, overhears and asks why they haven't spoken up sooner. Yingjie explains that at their current pace, if one person leaves, the whole project could stall. Meanwhile, Dr. Spring's industry partner, Sky Chemicals, quietly tells Dr. Voss that their involvement sometimes feels more symbolic, despite frequent mentions of "stakeholder engagement" in proposals. ▶ Even as Dr. Spring's team is celebrated, the quiet worries of overworked postdocs and skeptical partners raise questions about whether productivity has come at too high a cost.

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