READING LANDSCAPE CHANGE: APPLIED GEOMORPHOLOGY IN THE PUBLIC INTEREST

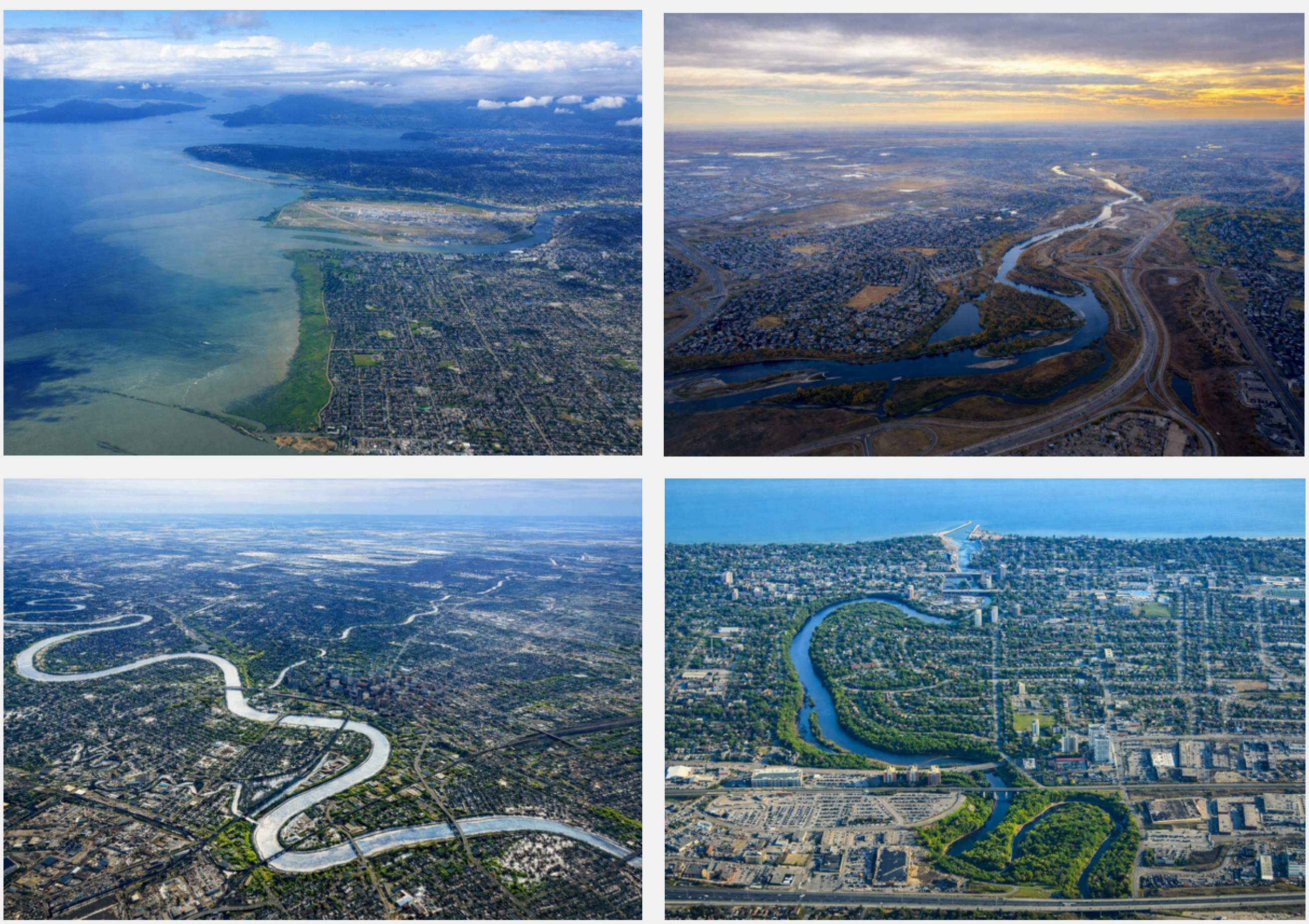
Making responsible decisions in changing landscapes

Written by Roger Phillips, Ph.D., P.Geo., FGC

Saugeen River glacial bluffs near Walkerton, Ontario

Geomorphology plays a foundational role in understanding how landscapes change and how those changes affect people, infrastructure, and the environment. While sometimes operating in the background of planning and design decisions, geomorphological insight consistently informs safer land use, hazard management, and long-term environmental stewardship.

In this Q&A, Roger Phillips, Ph.D., P.Geo., FGC, reflects on what applied geomorphology looks like in professional practice, from judgment and technical responsibility to supervision and mentorship. While grounded in geomorphology, the themes explored here are relevant across geoscience and environmental management disciplines, particularly where uncertainty, public protection, and long-term decision-making intersect.



Communities and infrastructure built around river systems in Canada: Fraser River in Richmond near Vancouver, British Columbia (upper left); Bow River in Calgary, Alberta (upper right); Red River in Winnipeg, Manitoba (lower left); and Sixteen Mile Creek in Oakville near Toronto, Ontario (lower right, Image Credit).

Question 1: In your experience, why does geomorphology matter to people, communities, and those making land-use and infrastructure decisions?

I think geomorphology matters because it contributes an important geoscience perspective that often sits in the background of decision-making, even when it isn't explicitly recognized. The landscapes we live in are not static, although we often plan and build as if they are. Rivers migrate, slopes adjust, permafrost thaws and erosion or flooding tends to happen on time scales that are easy to ignore—especially as climates shift—right up until something goes wrong. When homes, roads, or other infrastructure are placed close to those systems, the consequences of landscape change become very real for people and communities.

A lot of public concern is driven by visible change. An eroding bank, a slumping slope, a tree falling into a creek. People often respond in practical ways with the tools and materials they have available. In some places I've worked, that has included lining eroding banks with scrap material, and even some old cars, as a kind of improvised armour. It's an understandable reaction to watching land disappear, but it rarely holds up once the river adjusts around it.

One of the key roles of geomorphology, as a branch of applied geoscience, is helping to distinguish between natural, low-risk processes and situations where there is a credible threat to public safety, property or critical infrastructure. That distinction matters and it doesn't come automatically. It's something that's learned over time, through experience, supervision, and seeing how different decisions play out on the ground. It shapes whether we intervene, how much we intervene, or whether the most responsible decision is to step back and monitor rather than build something that may ultimately create more problems than it solves.

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I've worked on studies where large areas were initially flagged as erosion concerns at a planning level, which created pressure to act everywhere. When we looked more closely at how the valley and channel were actually behaving, and over what time scales, it became clear that much of the system was functioning naturally. The focus shifted to a smaller number of genuinely high-risk locations, and in some cases the most defensible approach was targeted monitoring rather than construction. That kind of outcome can reduce environmental disturbance, avoid unnecessary costs, and still meet public protection objectives.

At the same time, there are places where geomorphology clearly points to the need for action. I've also worked in river systems where erosion, slope instability, and flooding pose ongoing risks to homes, infrastructure, and culturally important sites. In those settings, intuitive or local fixes often don't last because they don't account for how the river or valley behaves as a system. Geomorphology provides the broader geoscience context needed to understand why those measures fail, and what kinds of responses are more likely to be effective over the long term.

What geomorphology offers decision-makers is not precise prediction, but perspective. That distinction isn't about devaluing precision: it's about understanding where precision is meaningful, and where broader system behaviour, time scales, and uncertainty need to be part of the conversation. It helps define reasonable ranges of outcomes, relevant time scales, and the consequences of different choices. Being transparent about uncertainty is part of that. From a geoscience perspective, acknowledging what we don't know is often just as important as explaining what we do know, because it supports better, more defensible decisions.

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When I explain geomorphology in plain language, I describe it as learning to read the stories written in the landscape. Rivers and slopes carry a record of how they've changed in the past, and that record tells us a lot about how they may change again. In many places, Indigenous communities have been reading those stories for generations, through close relationships with land and water that recognize long time scales, change, and consequence. Understanding those stories can help communities in Canada plan more safely, use land more responsibly, and avoid repeating mistakes that are already written into the landscape. And once you start to see those stories written in everyday places, they're hard to unsee.

Question 2: What does good geomorphological practice look like in applied settings, particularly when it comes to professional judgment, data quality, and the use of modern tools?

Good geomorphological practice starts with judgment, because the most important decisions are often made before any tools are turned on. The tools matter, and they've become much more powerful over the years, but they don't replace the need to think carefully about scale, context, and what the data can realistically support. In applied work, especially where public safety or major investments are involved, the first responsibility is to be clear about what questions we're actually trying to answer.

Highland Creek sewer protection in Toronto, Ontario

One of the challenges in applied geomorphology is that decisions often outlive the projects themselves. Work is revisited, relied on, and built upon years later, sometimes by people who weren't part of the original study. That's why strong technical review and oversight matter: not as a formality, but because they depend on senior technical specialists who are responsible for how assumptions are tested, decisions are framed, and work is carried forward beyond a single project or team.

Modern tools like LiDAR, GIS, and numerical models have transformed geomorphology, particularly in our ability to see patterns and change over larger areas and longer time scales. Artificial intelligence is further accelerating this trend, as we speak. But these tools can also create a false sense of precision if they're pushed beyond what the data supports. I've been in situations where there was pressure to stretch analyses further than was defensible, at times by comparison to work done elsewhere. Good practice means being clear about what the tools can and cannot do, and sometimes slowing things down to develop an approach that is innovative without overpromising.

Ethical practice in geomorphology tends to show up in these moments. It's about knowing when to say that a result is uncertain, when to recommend additional work, and when to explain that a simpler or more conservative approach is actually the more responsible choice. That can be uncomfortable in consulting environments driven by schedules and budgets, but it's central to maintaining professional credibility and protecting the public interest.

In consulting environments, this kind of judgment depends on experienced technical specialists who are given the agency not only to question scope and push back on unrealistic expectations, but also to shape how work is done, support the development of the teams delivering it, and take responsibility for how geoscience is applied over time—not just how individual projects are completed.

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Ultimately, good geomorphological practice is about providing perspective rather than certainty. It's about integrating multiple lines of evidence, documenting how conclusions were reached, and communicating risks and limitations clearly. In that sense, good practice is a bit like setting survey control across a landscape: it doesn't stop things from moving, but it gives future decisions something solid to reference.

Question 3: How do you think about professional responsibility and supervision in geomorphology, especially when decisions involve uncertainty and real consequences?

Professional responsibility in geomorphology doesn't end with producing a technically sound report. It extends to owning how the work was approached, how conclusions were reached, and how those conclusions are understood and used by others once the report leaves your desk. Because geomorphological decisions often involve uncertainty and long time scales, the consequences can show up years later, sometimes in ways that weren't anticipated at the time. That's what makes supervision and professional judgment inseparable—decisions echo long after the immediate work is done.

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In practice, that often means spending time walking team members through decisions that don't have a single "correct" answer such as why a particular scale of analysis was chosen, why uncertainty was handled one way rather than another, or why a more conservative approach may be warranted even if the data could support something more aggressive. Those conversations are where judgment is built, through dialogue, debate, and reflection, and they're difficult to replace with standardized review templates and forms.

Property and infrastructure above valley slopes of Sixteen Mile Creek in Oakville, Ontario

This is where mentorship becomes essential, not as an informal add-on, but as part of the infrastructure of professional practice. Judgment in geomorphology is learned through experience, exposure, and reflection. It develops by seeing how rivers adjust after an intervention, how slopes respond over time, or how earlier decisions either hold up or unravel under changing conditions. Without deliberate mentorship and supervision, that knowledge doesn’t transfer reliably from one generation of practitioners to the next.

I’ve seen this most clearly on complex, multidisciplinary projects, where early-career staff may be responsible for collecting and analyzing data, but the real challenge lies in how that information is integrated, communicated, and used. Supporting those individuals within project teams means more than technical review; it means helping them understand how their work fits into a broader decision-making context shaped by regulatory expectations, environmental protections, constructability, and public safety.

There’s also an institutional dimension to this. In geomorphology, professional pathways are not always straightforward, and many practitioners come from diverse academic backgrounds. That makes supervision and mentorship especially important early in a career, both to support developing professionals as they work toward professional registration and to build a shared understanding of ethical responsibility. It also highlights the value of outreach and curriculum development earlier along educational pathways, like at the high school and undergraduate level, to strengthen geoscience literacy and make environmental careers, including geomorphology, more visible and accessible.

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Ultimately, supervision and mentorship are about continuity of judgment, standards, and institutional memory. They help ensure that geoscience practice remains grounded in evidence, assessment, and public protection, rather than driven solely by tools or short-term project demands. Investing in that continuity through experienced technical leadership, clear expectations, and deliberate mentorship is not just good professional practice. For organizations working in environmental management, it is a long-term responsibility and incentive that reduces risk, strengthens credibility, and helps ensure today's decisions will still stand up when they are revisited years down the line.

Teaching in the field, East Humber River near Kleinburg, Ontario

About the Author

Roger Phillips, Ph.D., P.Geo., FGC, is a senior geoscientist specializing in geomorphology, river systems, and geohazards. He has more than 20 years of experience applying geoscience to infrastructure planning, environmental assessment, and hazard management across Canada. Roger's work is grounded in evidence-based decision-making, risk communication, and the integration of geomorphology with engineering and environmental management. He has also taught geomorphology at the University of Toronto for the last 15 years and is actively involved in mentoring emerging professionals and strengthening professional pathways in geoscience.