

A full-page background image showing a mountain biker in mid-air, jumping over a dirt jump. The scene is set in a dense forest of tall evergreen trees. The ground is a mix of dirt and rocks, with some green plants and purple flowers in the foreground.

Dirt Meets Data: How Digital Tools are Transforming Trail Planning and Design

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Trail planning used to start with a topo map, a compass, and countless hours of hiking. You would head into the woods, scribble notes in the rain, try to connect the dots later in the office, and hope your hand-drawn sketches lined up with reality.

Fast forward to today, and things look very different. Thanks to GIS, LiDAR, GPS, and a suite of other digital tools, trail and outdoor recreation planners can design smarter, move faster, and make stronger cases to regulators, funders, and communities. Dirt still matters, boots on the ground are essential, but data is now riding as a co-pilot.

In a world where efficiency, transparency, and innovation are reshaping every corner of planning, trail systems are no exception. Here's how digital transformation is changing the way we carve new lines through the landscape.

From Topo Lines to LiDAR: Seeing the Forest and the Trees

At its core, trail planning is about working with terrain. Planners need to know where the steep slopes are, where water flows, and which

areas are too sensitive to disturb. Traditionally, that meant poring over contour maps and doing a lot of field scouting.

Enter LiDAR (Light Detection and Ranging). LiDAR scans the earth's surface with laser pulses, generating incredibly detailed elevation models. For trail planners, it's like switching from blurry vision to high-definition glasses. Suddenly, subtle ridgelines, old logging roads, and natural benches pop off the screen. You can spot potential alignments from your desk before even setting foot on site.

In British Columbia, where glacial valleys and steep mountain faces define much of the terrain, LiDAR has been a game-changer. It allows planners to "see through" the tree canopy, identify areas prone to erosion, and avoid sensitive wetlands, all long before a flag line is set in the ground.

GIS: The Digital Trail Map Behind the Scenes

Geographic Information Systems (GIS) are the backbone of modern trail planning. Think of GIS as the Swiss Army knife of spatial data: you can layer topography, land ownership, habitat data, existing trails, cultural sites, and more, all in one digital map.

Need to know if your proposed singletrack crosses a watershed boundary? GIS has you covered. Want to check whether that new trailhead is too close to critical habitat? Just add the layer. Beyond analysis, GIS also helps with storytelling. A map showing proposed trails overlaid on aerial imagery is worth a thousand words in a council chamber. Funders and decision-makers do not just want to hear about recreation opportunities, they want to see how the plan fits into the bigger picture. With GIS, that visual argument is clear, professional, and compelling.

GPS: Ground-Truthing the Dream

All the desktop analysis in the world cannot replace boots on the ground. That's where GPS comes in. Field crews equipped with GPS devices (or even just smartphones with high-accuracy apps) can record existing informal routes, flag new alignments, and tag environmental features in real time.

That data flows back into the GIS system, where it can be refined, compared, and tested against the broader landscape. Instead of coming home with soggy notebooks and rough sketches, planners now return with digital data points that drop neatly into the master plan.

The loop between GIS and GPS - desktop analysis to field verification and back again - is what allows modern trail planning to move quickly without losing accuracy.

Building Efficiency Into the Process

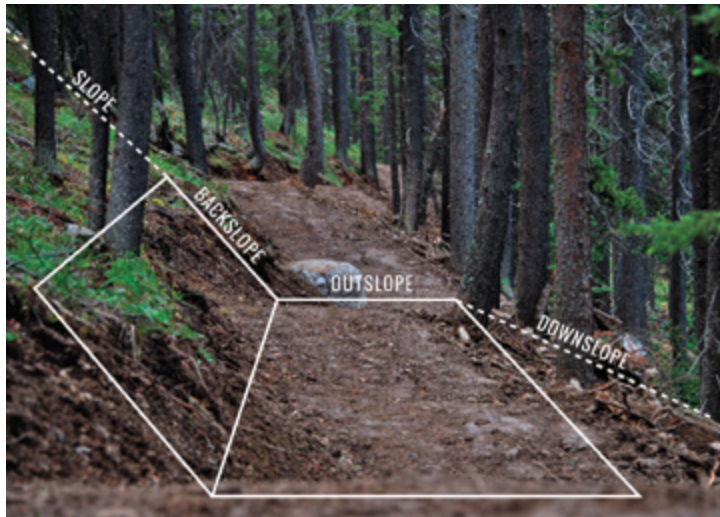
Planning trails is not just about finding the best line on the ground. It's also about navigating the approval gauntlet: environmental reviews, interest holder consultations, regulatory permits. Here, digital tools are helping planners move faster and smarter.

By tapping into open government datasets and layering our ideas into GIS before submission, we can reduce the number of questions regulators need to ask. The data puts us a step ahead and we can anticipate concerns and provide answers before reviewers even realize they have them. That means fewer rounds of back-and-forth, more confidence in the submission, and a smoother path to approval.

Digital tools do not just make the process quicker, they make it more transparent and evidence-based. Instead of reacting to issues late in the game, planners are proactively addressing them with clear, defensible data that speaks the regulator's language.



Blending boots-on-the-ground with GPS precision: trail planning in action.



Trail geometry made simple:
a field sketch to align
planners and contractors.

Transparency and Trust: Showing Your Work

Public trust matters in trail planning. Communities want to see that planners are listening, balancing recreation with conservation, and respecting cultural values. Digital tools make that easier.

Interactive web maps allow residents to explore proposed alignments from home, zoom in on their neighborhood, and leave comments tied to specific locations. Instead of broad statements of support or opposition, planners gain the kind of small, detailed insights that often surface during informal conversations around a paper map. These observations about how people already use the land, whether it is a favorite view, a children's play spot, or an informal route, help refine plans in meaningful ways.

Shared GIS platforms also provide Indigenous partners with a clear way to review alignments against cultural and heritage data. While this does not replace relationship building, it adds clarity and accessibility that ensures everyone is looking at the same information and can raise concerns early in the process.

Innovation in Action: Importing the Bigger Picture

Modern trail plans are never created in isolation. They need to connect with existing recreation infrastructure such as trailheads, bike parks, ski resorts, campgrounds, and transit hubs.

GIS makes this integration seamless. By importing existing datasets, whether municipal park inventories, provincial recreation sites, or crowdsourced platforms like Trailforks and Strava, planners can see how new alignments connect to the wider network.

The real power comes from the database itself. By entering trail classifications into a central system, algorithms can quickly generate inventories by type and location, eliminating

repetitive manual work. This approach highlights the bigger picture: Are there missing links? Redundant overlaps? Opportunities to create loops that distribute use more evenly across the system?

When data layers communicate with one another, planners can apply true network thinking. The result is trail systems that are not only smarter and more connected but also more efficient in how they deliver public benefit and use resources.

The Human Element Still Matters

For all the tech, it is worth remembering that trails are ultimately about human experience. Data can tell you where a trail can go, but it cannot tell you what it feels like to ride through an old-growth cedar grove or crest a ridge with a sweeping view.

That is why digital tools do not replace fieldwork, but they make it more intentional. Instead of wandering the forest with no clear direction, planners arrive on-site already knowing the likely corridors. Then they can focus on the details that data cannot capture: the flow of the line, the quality of the soil, the joy of the ride or hike.

The Future: From Digital Twins to AI

The next frontier in trail planning is the use of digital twins and artificial intelligence (AI).

A digital twin of a trail network is a dynamic, data-rich model that not only simulates user flows and forecasts environmental impacts but also provides a powerful platform for asset management. By integrating trail infrastructure and condition data into one system, planners and managers can track every bridge, sign, and section of trail, and use the model to guide proactive maintenance programs. This ensures resources are spent where they are needed most, extending the life of assets and keeping networks safe and reliable.

When artificial intelligence is layered onto this foundation, the opportunities grow even further. AI can analyze patterns in how people use trails, identify the most popular routes, and suggest where similar experiences could be created in new areas. It can also predict future maintenance needs and optimize alignments for both user experience and environmental resilience.

We are not there yet, but the direction is clear. Trail planning is becoming more data-driven, more predictive, and more effective at managing assets while delivering resilient, connected, and inspiring outdoor experiences.

Dirt + Data = Better Trails

Trail planning will always be rooted in the land. You cannot build a great trail without feeling the soil under your boots and the slope under your feet. But digital tools are changing the way we get there.

GIS, LiDAR, and GPS are helping planners see more clearly, work more efficiently, and build trust with communities. They're making approvals faster, networks smarter, and outcomes better.

Digital transformation does not take away from the art of trail planning, it brings it into sharper focus. It allows us to pair the thrill of discovery with the rigor of data, ensuring that when dirt meets data, the result is trails that are not only fun to ride or hike, but also resilient, connected, and sustainable for generations to come.

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