Sustainable and Accessible: Designing Trails for All, Today and Tomorrow

April 7, 2018

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• Developing, building, and maintaining trails since 1920
• Protecting trail lands through support and advocacy
• Educating the public in the responsible use of trails and the natural environment.
The Trail Conference Today

Volunteers and Members:
- 10,000 members
- 100 organizations
- 2,400 volunteers giving over 100,000 hours of their time

2,100+ miles of trails including...
- Appalachian Trail
- Highlands Trail
- Long Path
- Shawangunk Ridge Trail
- 190+ Parks, Nature Preserves, and Areas
Agenda

Classroom Presentation
- Sustainability and Accessibility As Concepts
- Design Principles for Sustainable/Accessible Trails

Field Instruction - Ramapo Valley County Res.
- Examples of Design Principles
- Measuring Grades and Slopes with Clinometer and Level
- Group Trail Layout Exercise
Trail Conference Mission Statement

“The New York-New Jersey Trail Conference is a volunteer-powered organization that builds, maintains, and protects public trails. Together with our partners, we strive to ensure that the trails and natural areas we share are sustainable and accessible for all to enjoy for generations to come.”
Sustainable Trails
What is “Sustainability?”

Physical forces/dynamics impacting trails

How they can make a trail unsustainable

Designing to minimize impact
What is “Sustainable?”

Using a resource so that the resource is not depleted or permanently damaged

https://www.merriam-webster.com/dictionary/sustainable
Sustainable Experiences

Environmental

Biophysical Impact

User Behavior

Opportunity Cost

Social

Meet desired outcomes?

Public Support

Economical

Cost to maintain/manage
What is a Sustainable Trail?

• Minimizes environmental impact

• Minimizes maintenance/reconstruction costs and efforts

• Maximizes the quality of experience for target user groups

...Over the Long Term
Accessible Trail Standards

Sustainable Trail Standards
Physical Forces/Processes Affecting Trails
Compaction

- From downward force of trail users
- Has upper limit
- Affected by soil type/moisture
- Pro: makes soils more durable
- Cons:
  - Reduces vegetative cover
  - Increases water runoff
Displacement

- From:
  - Lateral force of trail users
  - Frost heaves
  - Raindrop impact (splash erosion)
  - Wind
- Limitless
- Difficult to manage
Erosion
Types of Erosion

Sheet Erosion
The removal of a uniform layer of soil from the surface by runoff.

Rill Erosion
The process where numerous small cuts are formed. Rills can be several inches deep.

Gully Erosion
The accumulation of water in narrow cuts which removes the soil to considerable depth. These cuts can be several feet deep.

Channel Erosion
The scouring of streambanks or drainageways by increased water flows.
Water flowing down a hill will follow the path of least resistance, called the **Fall Line**.

Trails located on the fall line will be damaged by flowing water.
Effects of Trail Erosion
• Trail Degradation
• Alteration of local hydrology patterns and habitat
• Increased sediment load/turbidity in waterways
Erosion Kills

**Increased turbidity**
- Decreased sunlight/photosynthesis
- Decreased vegetation, and diatoms
- Decreased oxygen

**Increased Sediment**
- Smoother water bottoms
- Reduced turbulence
- Reduced oxygen
- Possible phosphorus boost

**Increased Organic Matter**
- From turbidity killing plant life
- From direct OM input
- Both feed anaerobes, reducing oxygen
Water Management Principles
Trail Erosion Potential =

Water Volume  +  Speed
- Area drained
- Width of trail tread
- Trail length between drainages
- Trail grade
- Uphill slope
- Tread compaction
- Soil composition
Tread Watersheds

Tread watersheds catch water from the site above the tread plus rain, snow, and seepage landing on the tread itself.

Each tread watershed is assumed to drain through the dip at its lowest end.

Tread watershed height is from the downhill edge of the tread up to the topographic top for drainage.

Length of a tread watershed is the tread length between a local high point (crest) and the next local low point (dip) in the tread. **Crest and dip locations may or may not be tied to site topography.**
Trail Erosion Potential =

Water Volume + Speed
- Area drained
- Width of trail tread
- Trail segment length
- Trail grade
- Uphill slope
- Tread compaction
- Soil composition
Design Solution: Rolling Contour Trail
• ‘Hug’ and ‘Surf’ the Mountain
• Horizontal and Vertical Flow
In short: lower trail grades, and trails more perpendicular to slopes
Lower Grades Slow Water & Keep It Dispersed

\[
\frac{\text{Rise}}{\text{Run}} \times 100 = \text{Average Grade}
\]

\[
\text{Rise/Run} = \frac{30}{428} \times 100 = 7.0\%
\]

An average trail grade of 10 percent or less is a sustainable target. It aids planning, applies to most soil types, allows design flexibility, accommodates undulations, and helps future reroutes.
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Soil Type & Maximum Sustainable Grade

- Rocky or durable soil = higher grades (approx. 15% max)
- Loamy or mixed soil = moderate grades (approx. 10% max)
- Sandy or fragile soil = low grades (approx. 5% max)
“Half Rule” of Sustainable Trailbuilding

Slope of the trail should be no more than half of the prevailing slope.
Keep grades below 15%, averaging 10% or less (5-7 for MTB)

Why <15%?
Average 10%?
The Half “Rule” is a “guideline” for layout of running grades

**Half Rule =**
**Running grade = < Fallline/2**

This guideline forces a contour layout and construction or a “sidehill” or “bench cut” trail
What should the grade be if the fall line is 42%?

21% or 15% or less?

What considerations might change the answer?
Tread Outslope

Outslope helps water sheet across and off the trail.

Images Source: IMBA
When water drains in thin, dispersed sheets, dirt stays on the trail.
Putting the “Roll” In Rolling Contour Trail
Outslope is Not Enough

Well-used trails eventually form a berm, defeating outslope drainage.
Compaction and erosion cause “cupping,” channeling water flow on trail tread.

images: Natural Surface Trails by Design (natureshape.com)
About Waterbars

Drawbacks:

- Require regular maintenance
- Must meet specific requirements to work correctly
- Reduce Accessibility
- Most don’t like steps
- Doesn’t feel “Natural”

Solution: Peaks & Dips

- No maintenance
- Work better
- Feel more natural
- Easier to construct
Dips (drains) + Crests = Grade Reversals
- “Aligned by design” INTO layout

images: Natural Surface Trails by Design (natureshape.com)
Align dips and crests into layout (or divide a watershed by installing dips and crests post construction)

- A fix for poorly aligned trails
- A fix to correct compaction, displacement, and erosion
- Best on trails over 10%
Align dips and crests into layout (or divide a watershed by installing dips and crests post construction)

- A fix for poorly aligned trails
- A fix to correct compaction, displacement, and erosion
- Not ideal for trails over 10%
The Effect of Proper Trail Design
What's Happening Here? How Would You Fix It?

15% grade, angular crushed stone sand
Other Ways to Improve Sustainability

- Tread Hardening
- Limiting Use Type
Trail Accessibility
What it means and why it matters
Accessibility vs. Sustainability
Components of Accessible Design
Accessible Trail Design

Does not just mean “wheelchair accessible.”

Means designing in a way which excludes the minimum amount of people.

Alternative Terms:
- Inclusive Design
- Universal Design
- “Trails for All”
Why the focus on accessibility?
According to CDC

- Adults unable to easily walk a quarter mile: 17.2 million

- Adults with vision trouble: 20.6 million

- Adults with any physical functioning disability: 35.2 million

- Adults with at least one basic actions difficulty or complex activity limitation: 74.6 million
Disability often comes with aging
Disability also affects family and friends

Take the numbers from before, and multiply several times over to account for people affected by disabilities.
**ADA (State): Americans with Disabilities Act**
Programs and facilities are not to exclude a qualified person just because they have a disability.

**ABA (Federal): Architectural Barriers Act**
Buildings/facilities are to be comply with the applicable accessibility requirements if they are designed, constructed, altered, or leased by, for, or on behalf of a Federal agency, or with funds from a Federal agency.
ODAAG: Outdoor Developed Areas Accessibility Guidelines
“ [...] technical requirements for camping facilities, picnic facilities, viewing areas, trails, and beach access routes constructed or altered by or on behalf of federal agencies. The final rule ensures that these facilities are readily accessible to and usable by individuals with disabilities.”

FSTAG: Forest Service Trail Accessibility Guidelines
“ [...] accessibility guidelines to provide guidance for the agency to maximize accessibility while at the same time recognizing and protecting the unique characteristics of the natural setting of outdoor recreation areas and hiker/pedestrian trails.”
In short, if building a trail...

The ADA prohibits discrimination based on ability. To guarantee you’re not unintentionally discriminating based on ability, the ABA provides design standards. Within this set of design standards, trailbuilders follow those outlined in the FSTAG (or ODAAG, when accessing developed areas).
Each design aspect or structure along a trail can potentially serve as a “filter” to keep people from passing

- Water bar in the trail can filter out a person using a wheelchair
- Scramble over loose rock can filter out somebody with impaired balance
- Pinch in the trail can filter out ATVs
- Goal: *Maximize utility for target demographics*
Accessibility and Sustainability

Do accessible trails need to be large and paved, with high environmental impact?
Let’s look at some of the established best practices both have in common…
Accessible Outslopes (A)

A trail tread slightly outsloped but close to level (around 5%), is a comfortable walking surface for most people.

Source: IMBA
Accessible Grades

Lower grades permit more people to access trail destinations

* Not always possible or desirable to lower a trail's grade—depends on a number of factors
Accessible Surfaces

- Stable
- Firm

These surfaces permit use by those with balance and joint problems, and those with impaired mobility.

They are also more resistant to displacement and erosion.
Minimal Barriers

Ruggedness/Obstructions

Structures
Summary

Accessible and sustainable design provide for better user experiences long-term, and often go hand in hand.

These concepts are employed on a *spectrum* depending on site/target user experience - not all trails are the same.

“Trails for All” does not mean all trails are appropriate for all users.
Info On Trail U and Volunteering
QUESTIONS?