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

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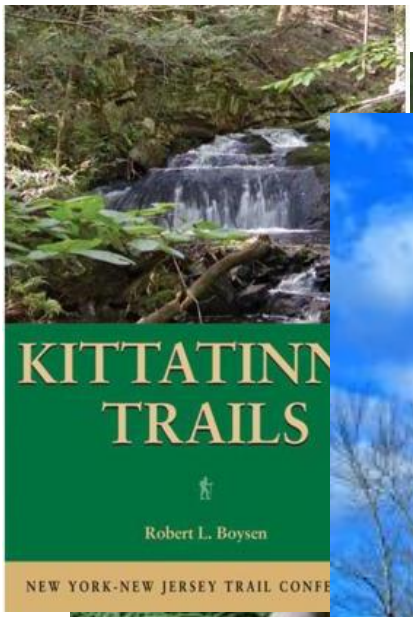
New York-New Jersey Trail Conference

- 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.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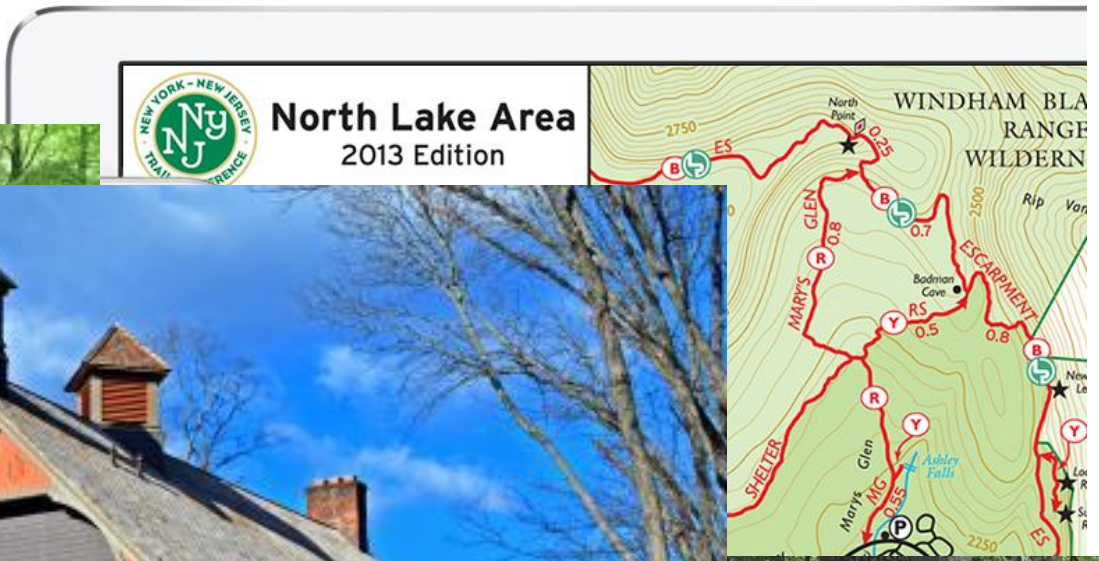
TRAILS
Robert L. Boysen
NEW YORK-NEW JERSEY TRAIL CONFE


North Lake Area
2013 Edition
WINDHAM BLA
RANGE
WILDERN
North Point
2750
ES
0.25
GLEN
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0.7
2500
Rip
Van
MARY'S
Bodman Cave
ESCARPMENT
RS
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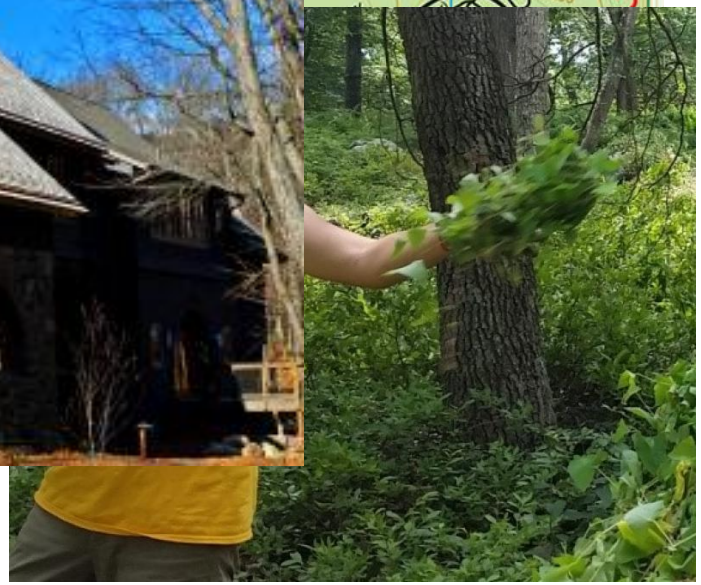
SHELTER
Mary's Glen
Ashley Falls
MG
0.55
2250


TRAIL CONFERENCE



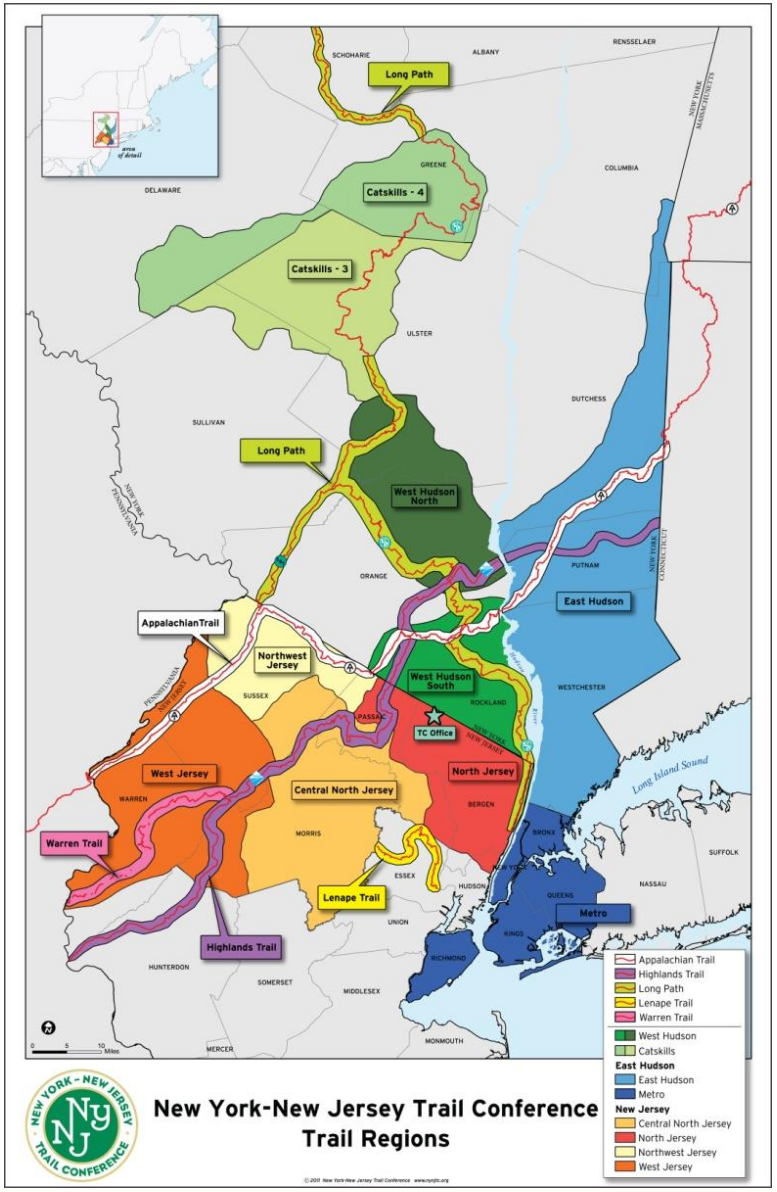
The Trail Conference Today

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,



Agenda

Classroom Presentation

- Sustainability and Accessibility As Concepts
- Design Principles for Sustainable/Accessibile 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

B

What is "Sustainability?"

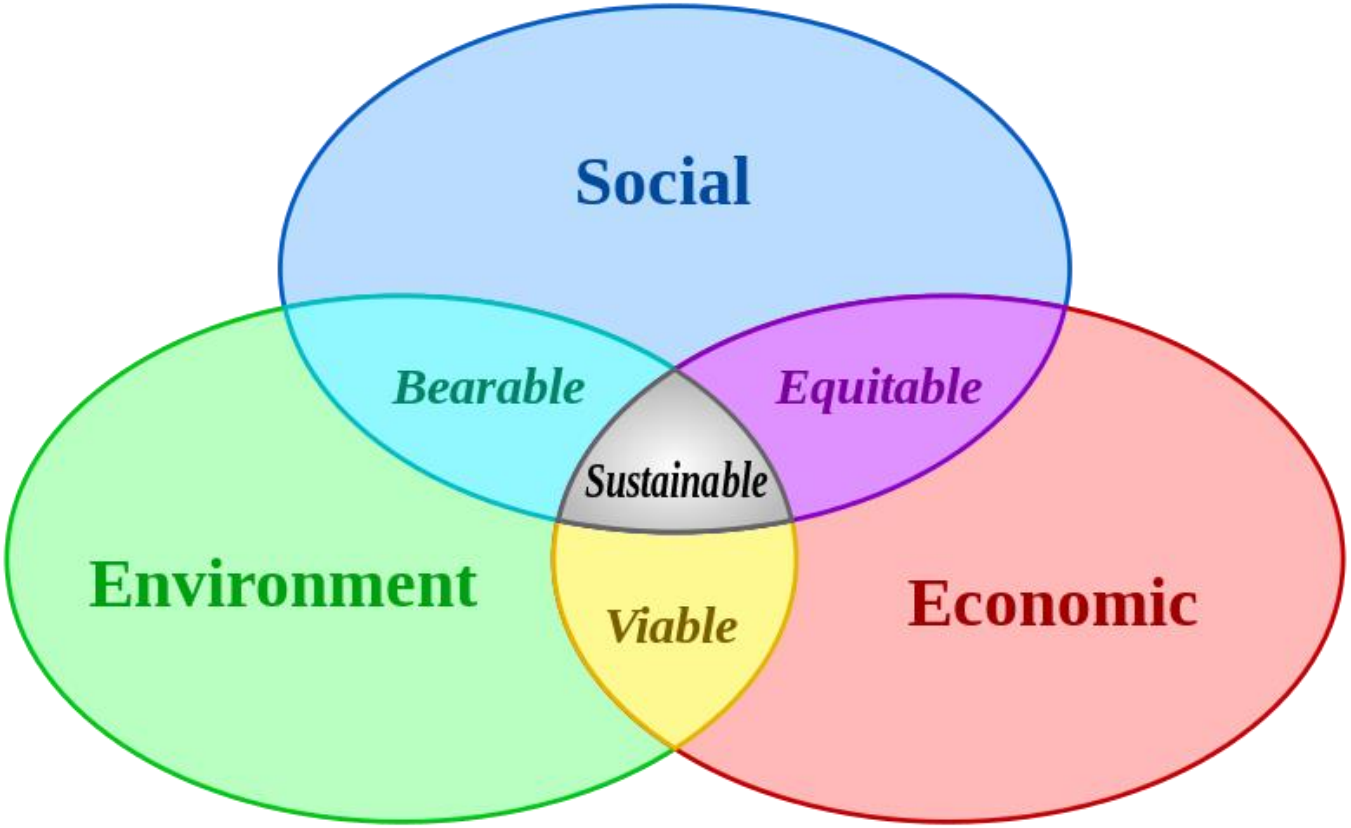
Physical forces/dynamics impacting trails

How they can make a trail unsustainable

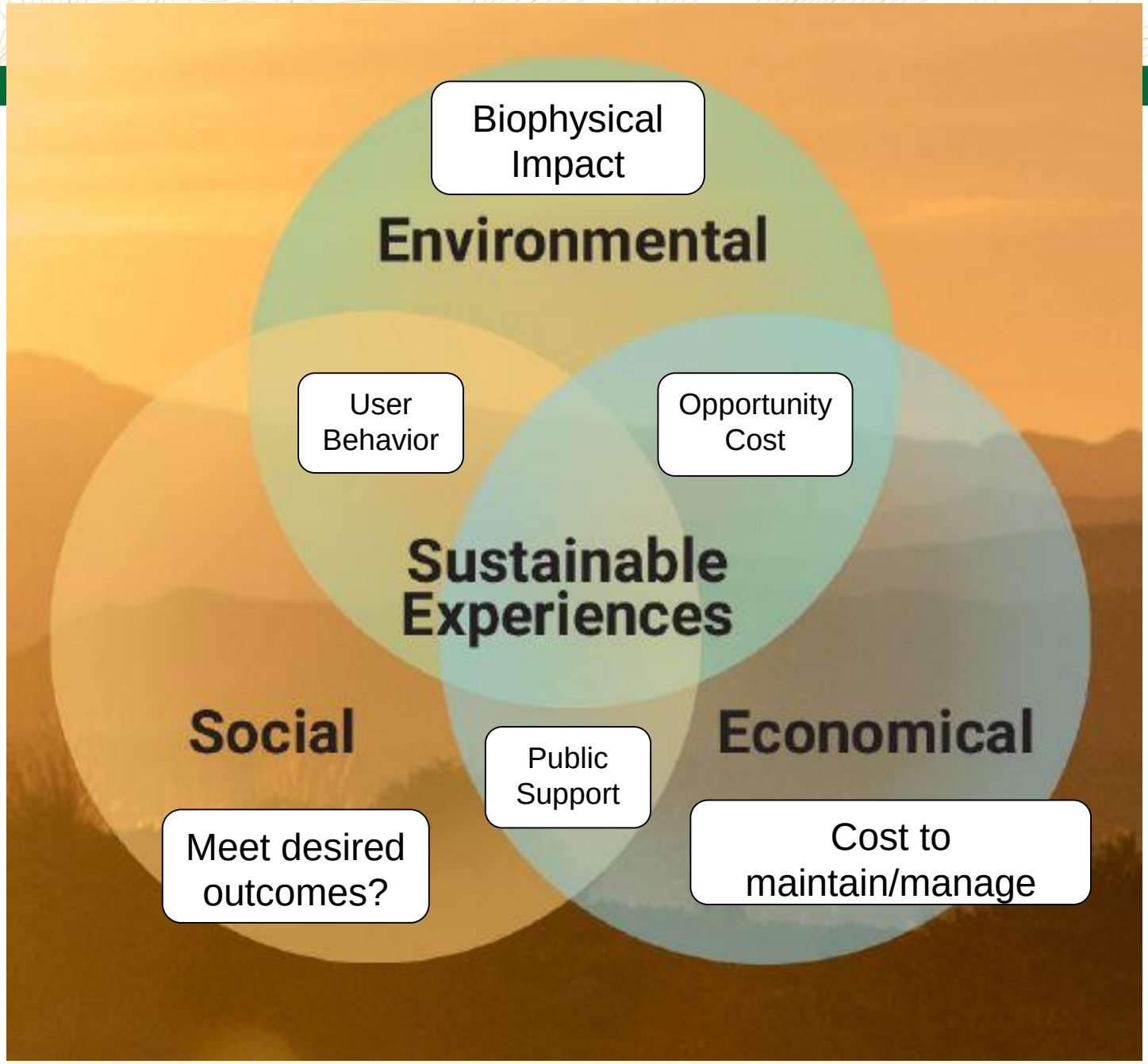
Designing to minimize impact

What is "Sustainable?"

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



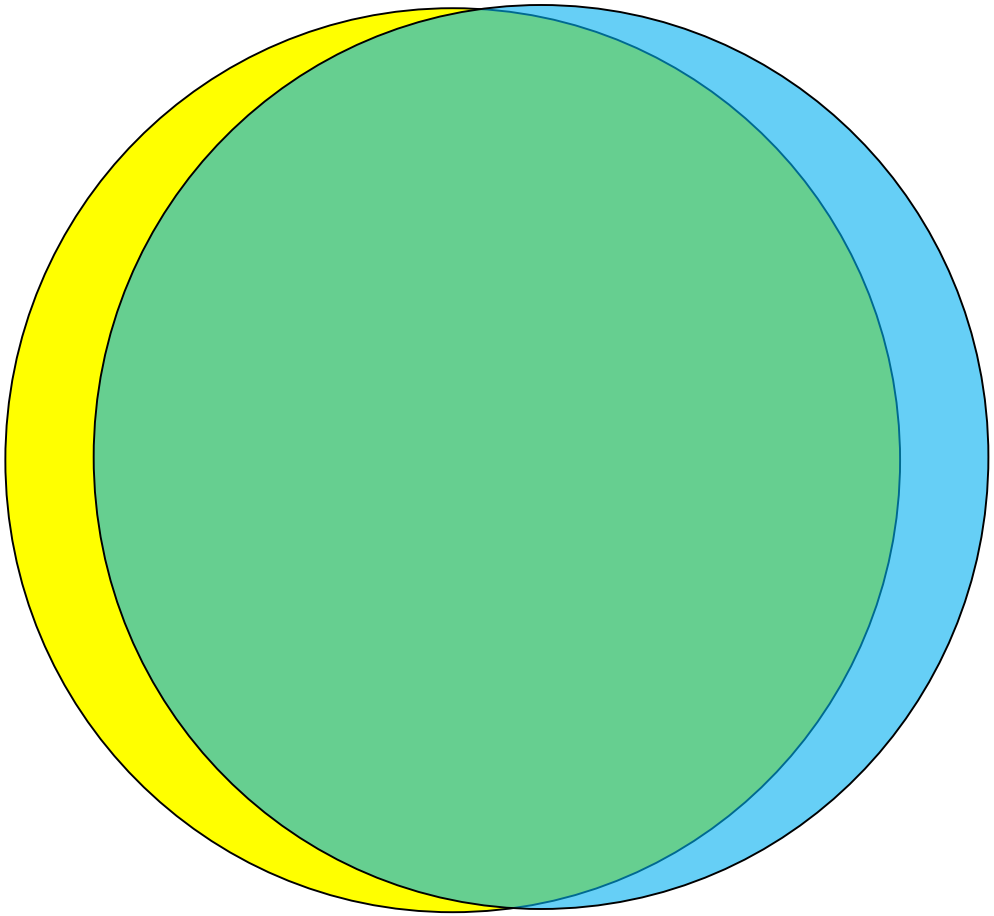
https://www.merriam-webster.com/dictionary/sustainable


Biophysical Impact
Environmental
User Behavior
Opportunity Cost
Sustainable Experiences
Social
Public Support
Economical
Meet desired outcomes?
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

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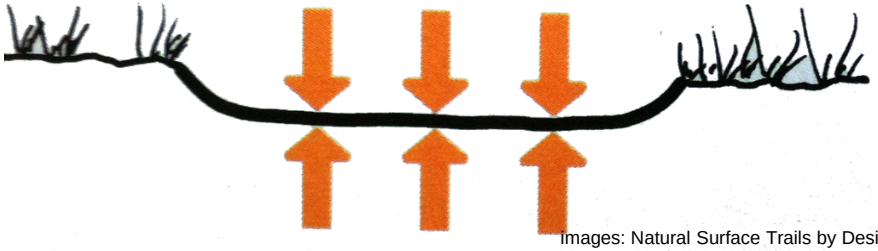
Compaction



Images: Natural Surface Trails by Design (natureshape.com)

- 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

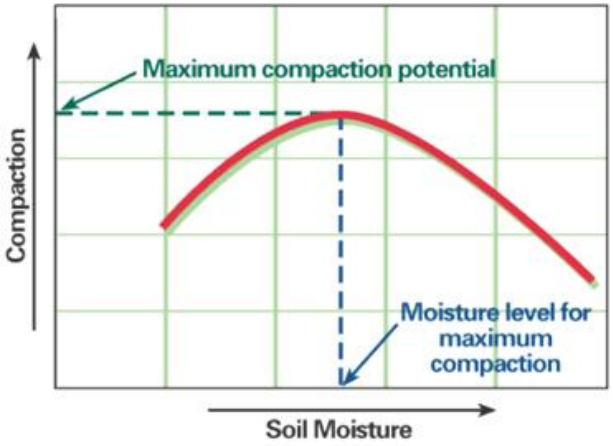
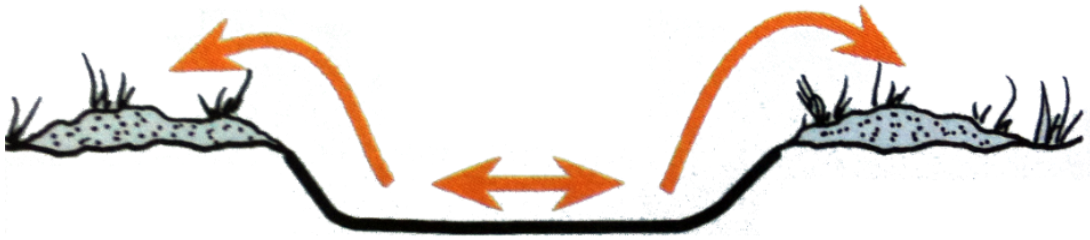


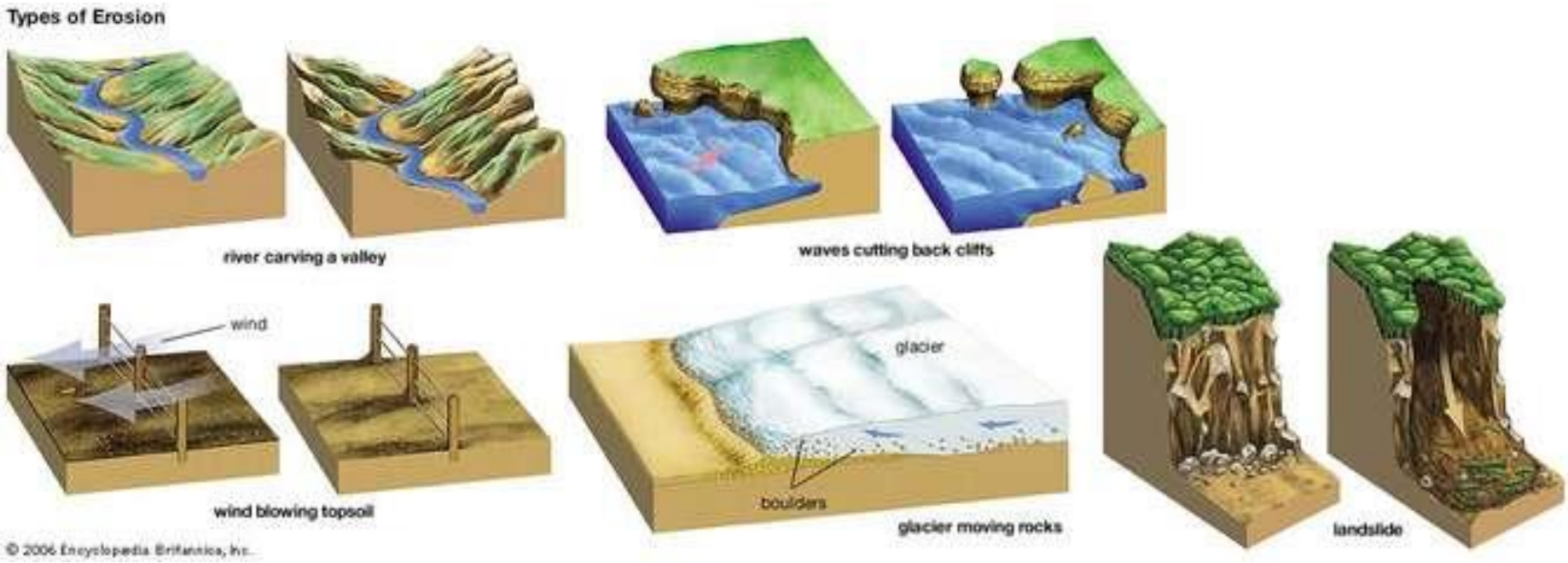
image: Iowa State University (crops.extension.iastate.edu/)

Displacement

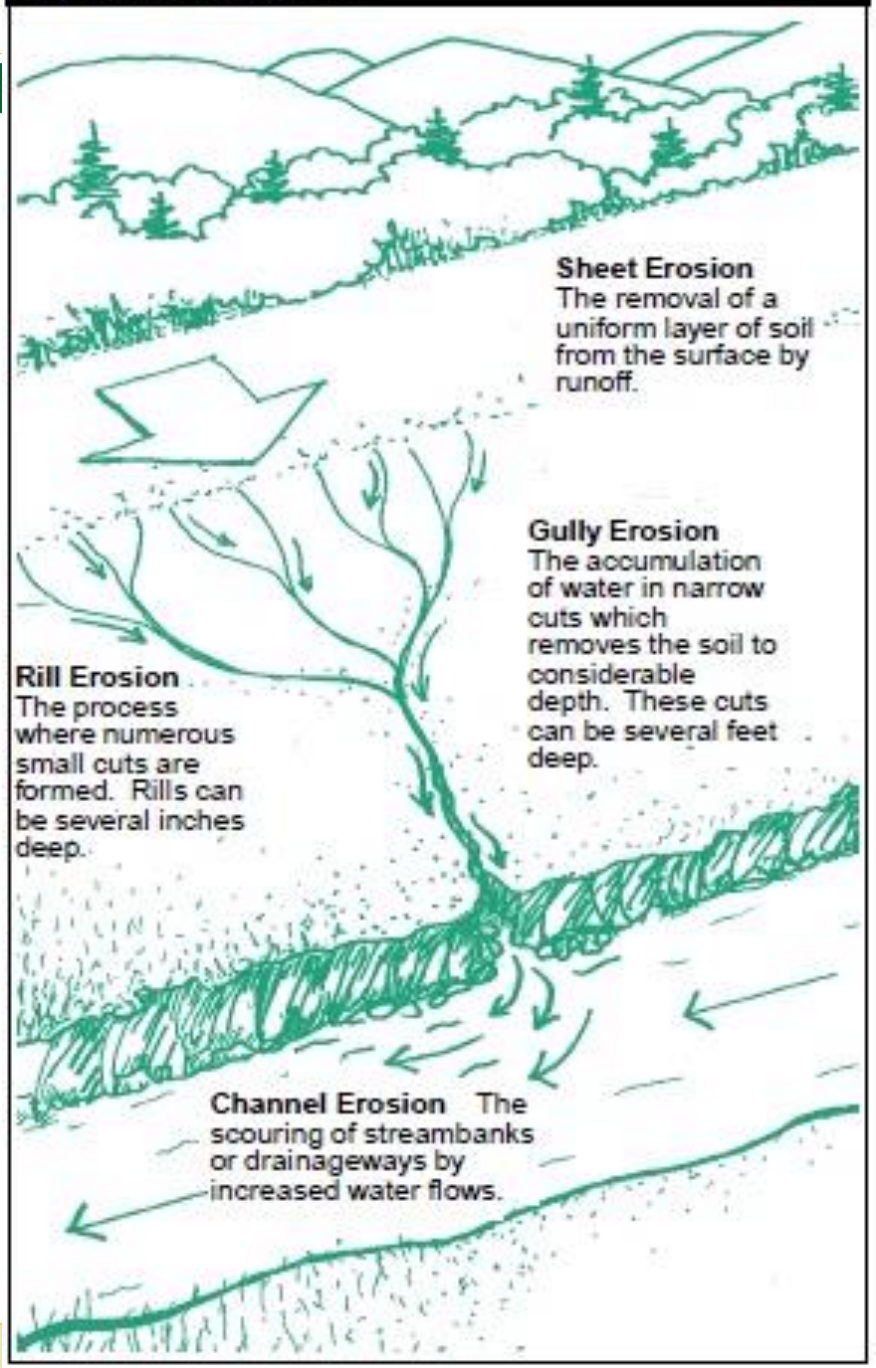


- **From:**
  - **Lateral force of trail users**
  - **Frost heaves**
  - **Raindrop impact (splash erosion)**
  - **Wind**
- **Limitless**
- **Difficult to manage**

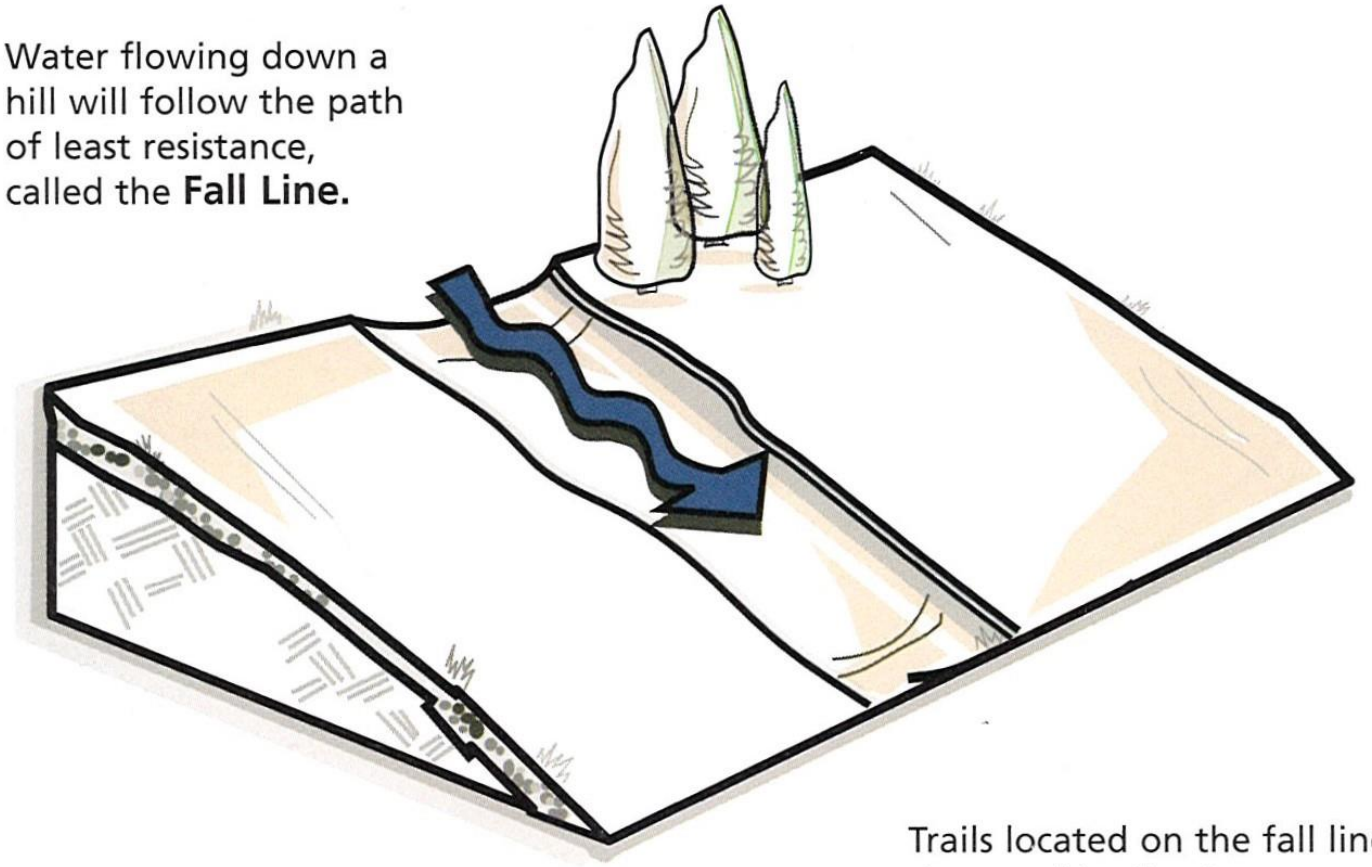
Erosion


Types of Erosion
river carving a valley
waves cutting back cliffs
wind
wind blowing topsoil
glacier
boulders
glacier moving rocks
landslide
© 2006 Encyclopædia Britannica, Inc.

Types of Erosion



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

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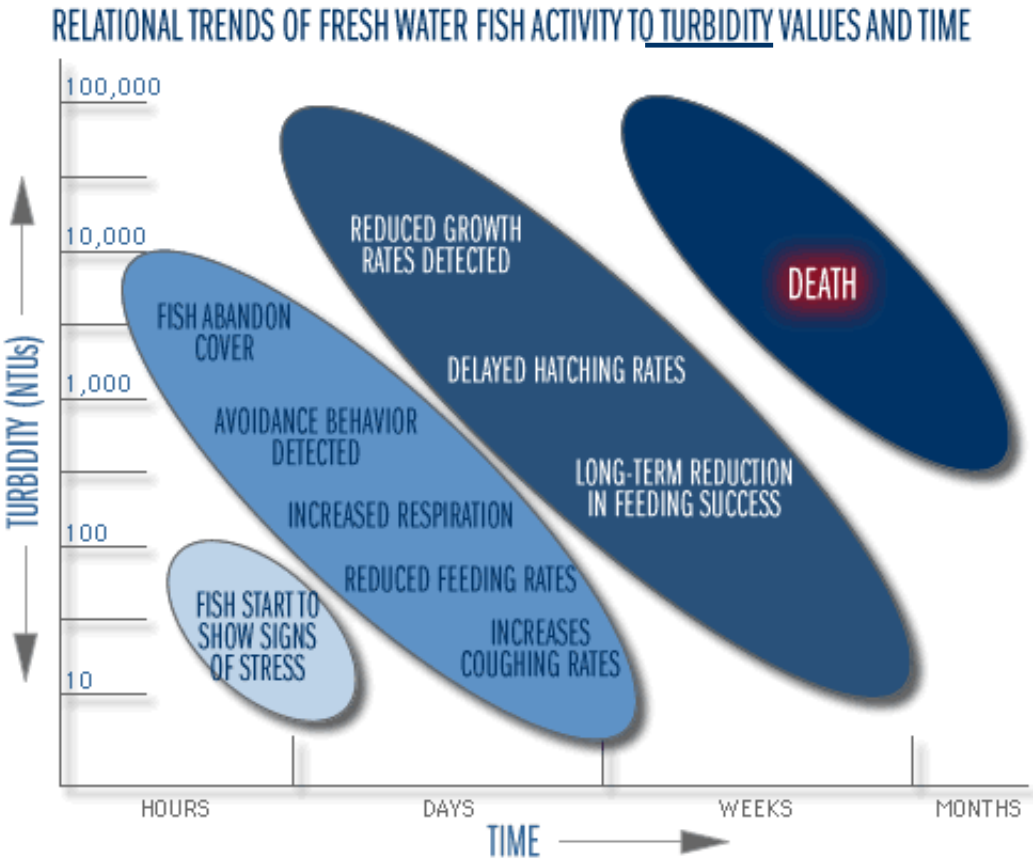
- Trail Degradation
- Alteration of local hydrology patterns and habitat
- Increased sediment load/turbidity in waterways

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

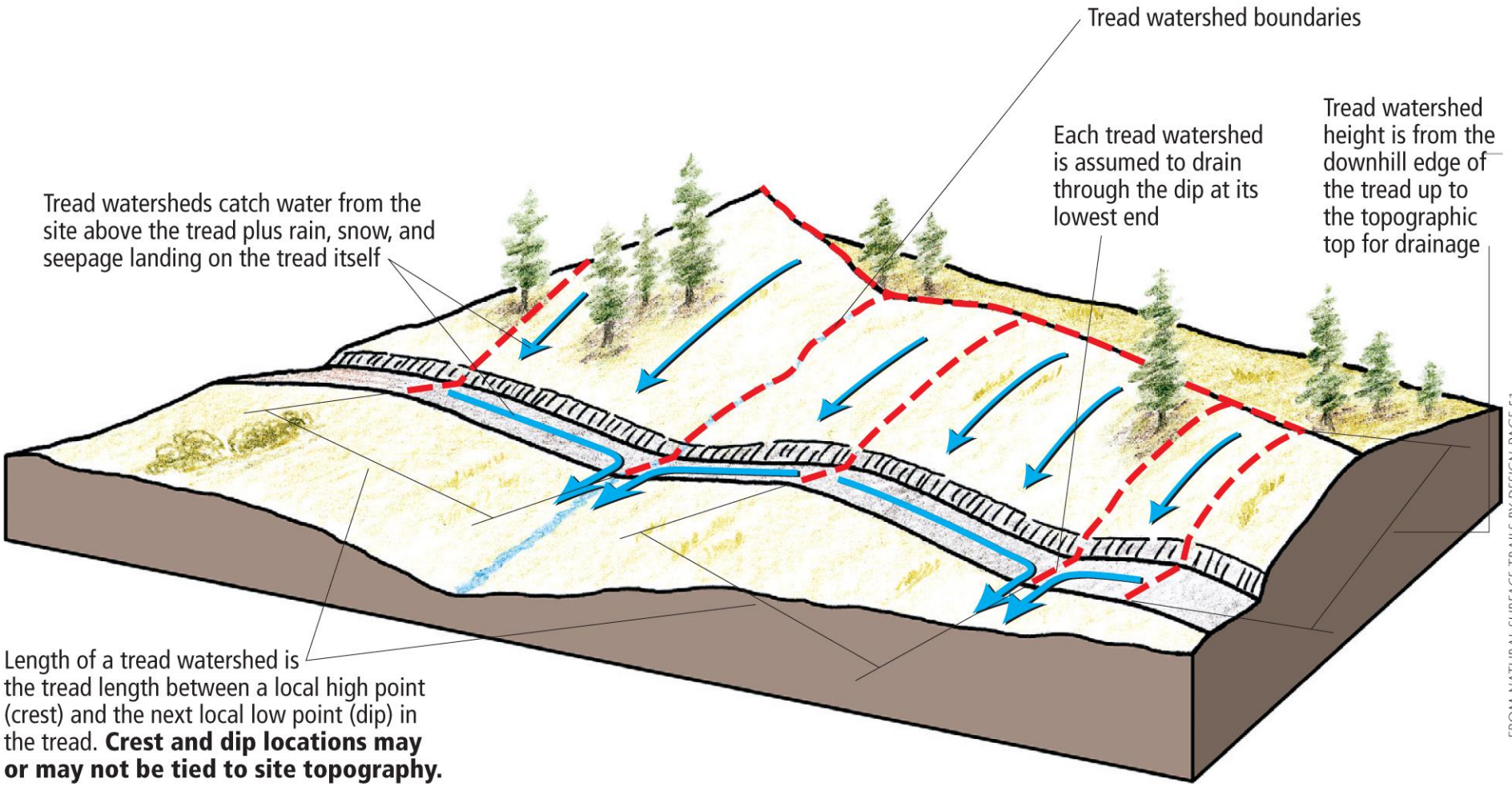
- Area drained
- Width of trail tread
- Trail length between drainages

+

Speed

- Trail grade
- Uphill slope
- Tread compaction
- Soil composition

Tread Watersheds



FROM *NATURAL SURFACE TRAILS BY DESIGN*, PAGE 51

Trail Erosion Potential =

Water Volume

- Area drained
- Width of trail tread
- Trail segment length

+

Speed

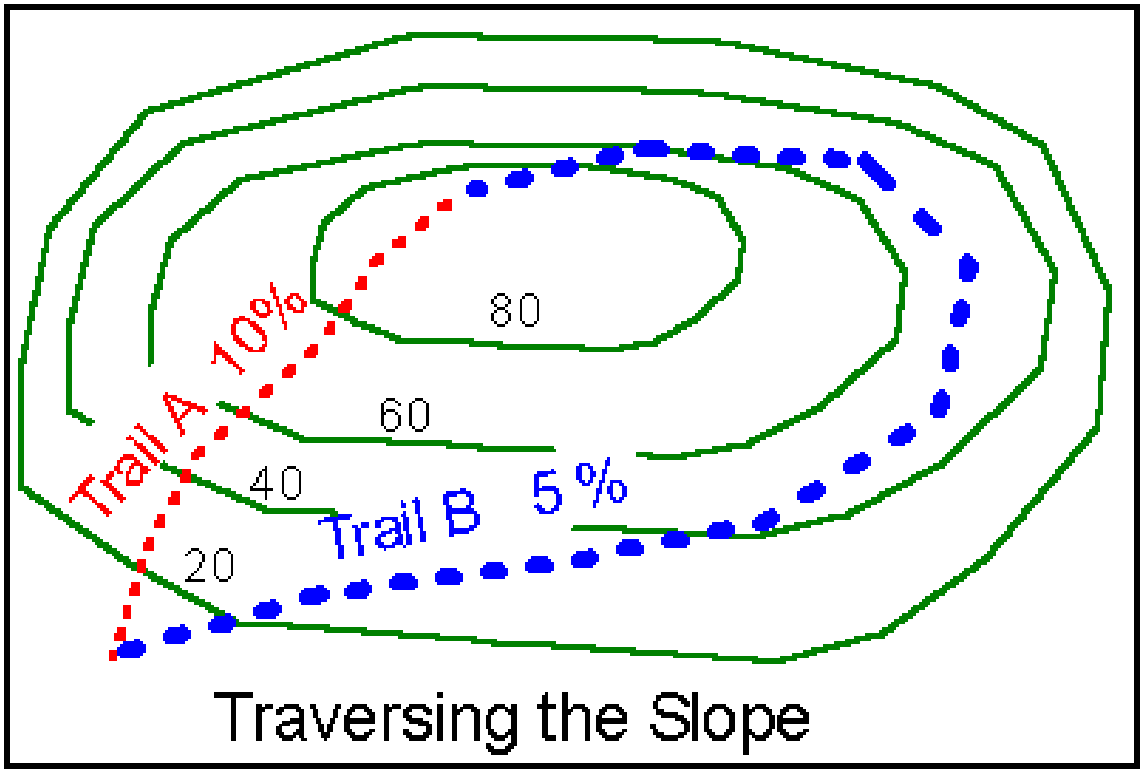
- Trail grade
- Uphill slope
- Tread compaction
- Soil composition

Design Solution: Rolling Contour Trail

E

- ‘Hug’ and ‘Surf’ the Mountain
- Horizontal and Vertical Flow

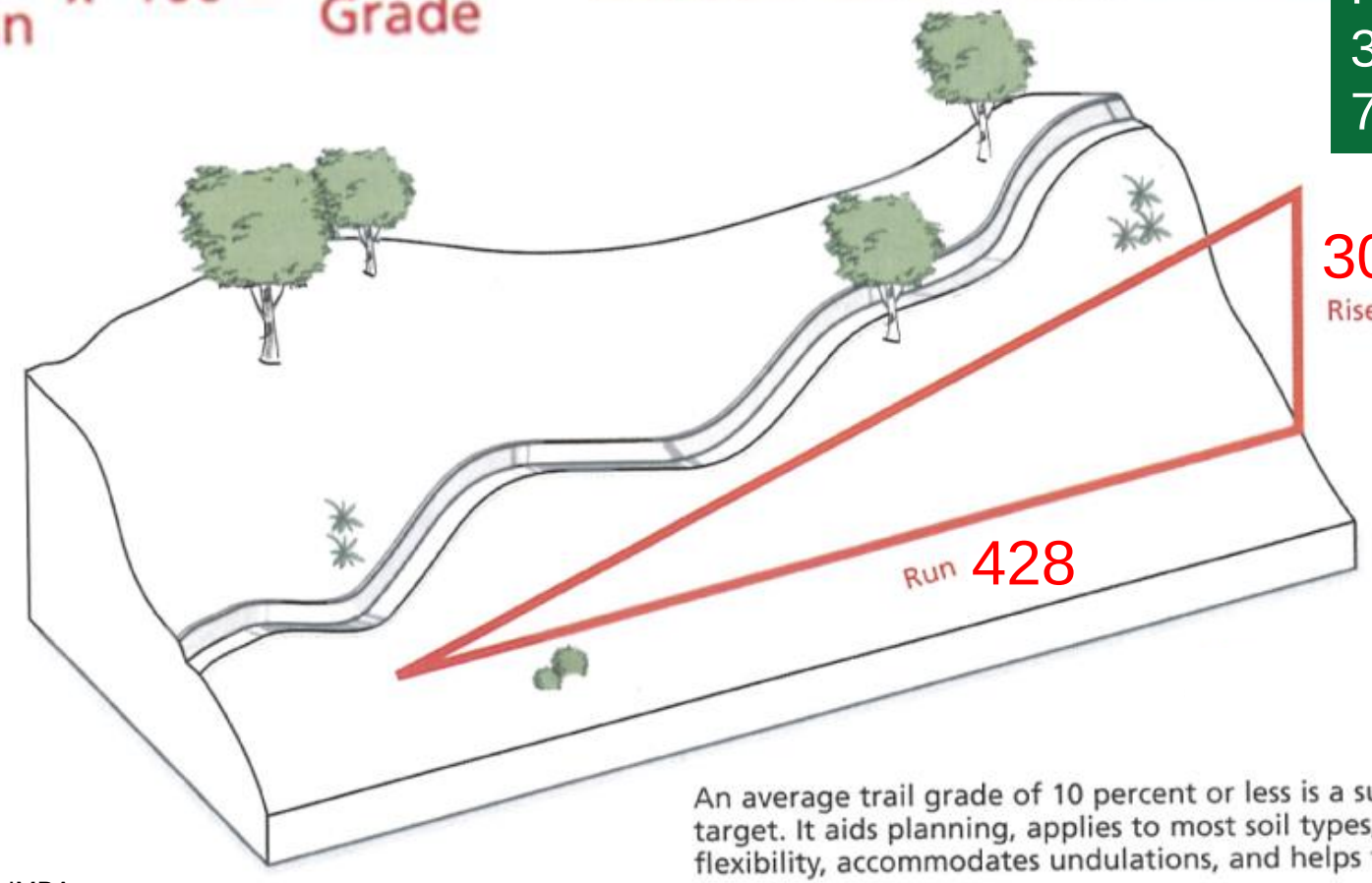
In short: lower trail grades, and trails more perpendicular to slopes



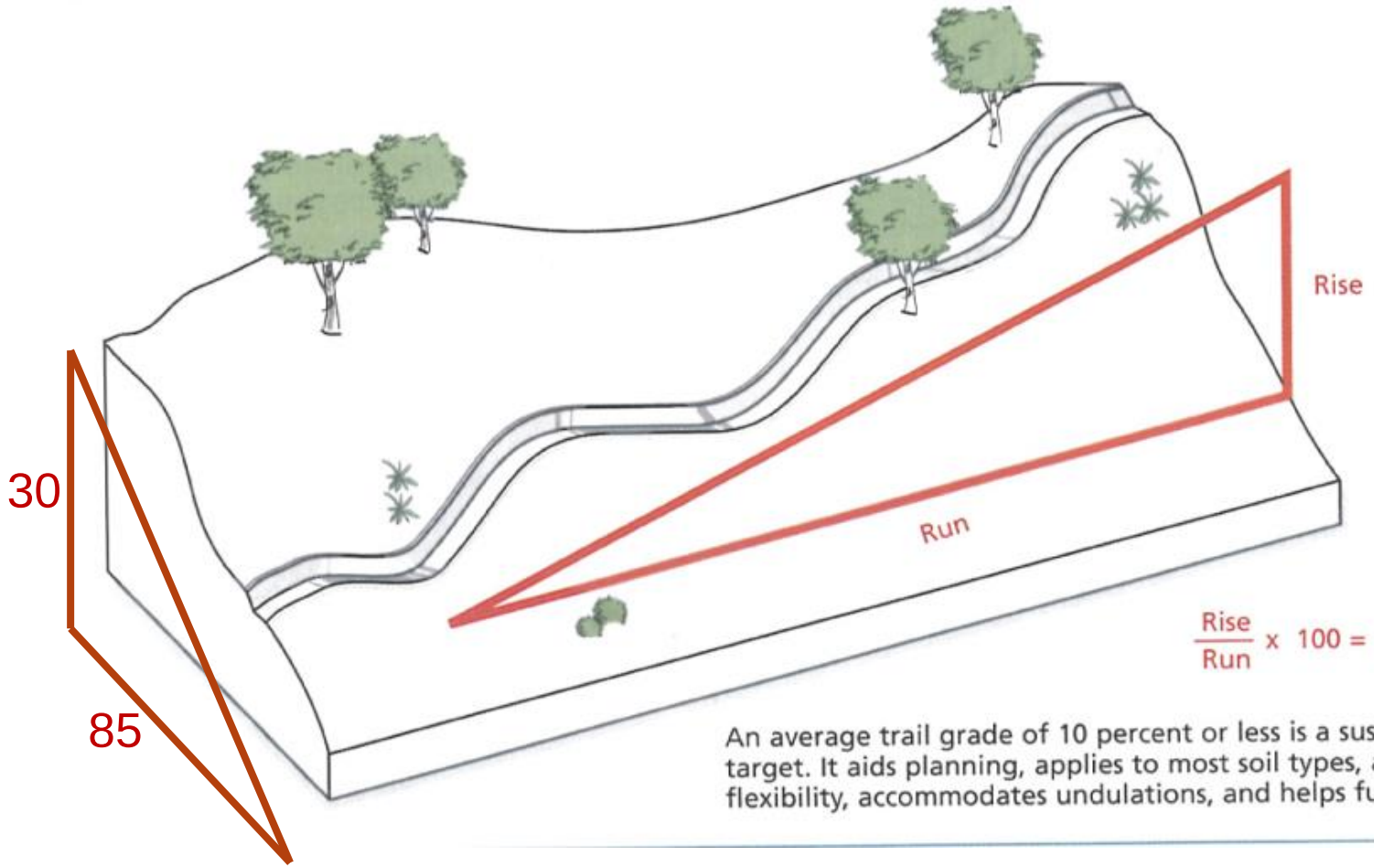
Lower Grades Slow Water & Keep It Dispersed

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

Rise/Run = 30/428 x 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.



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

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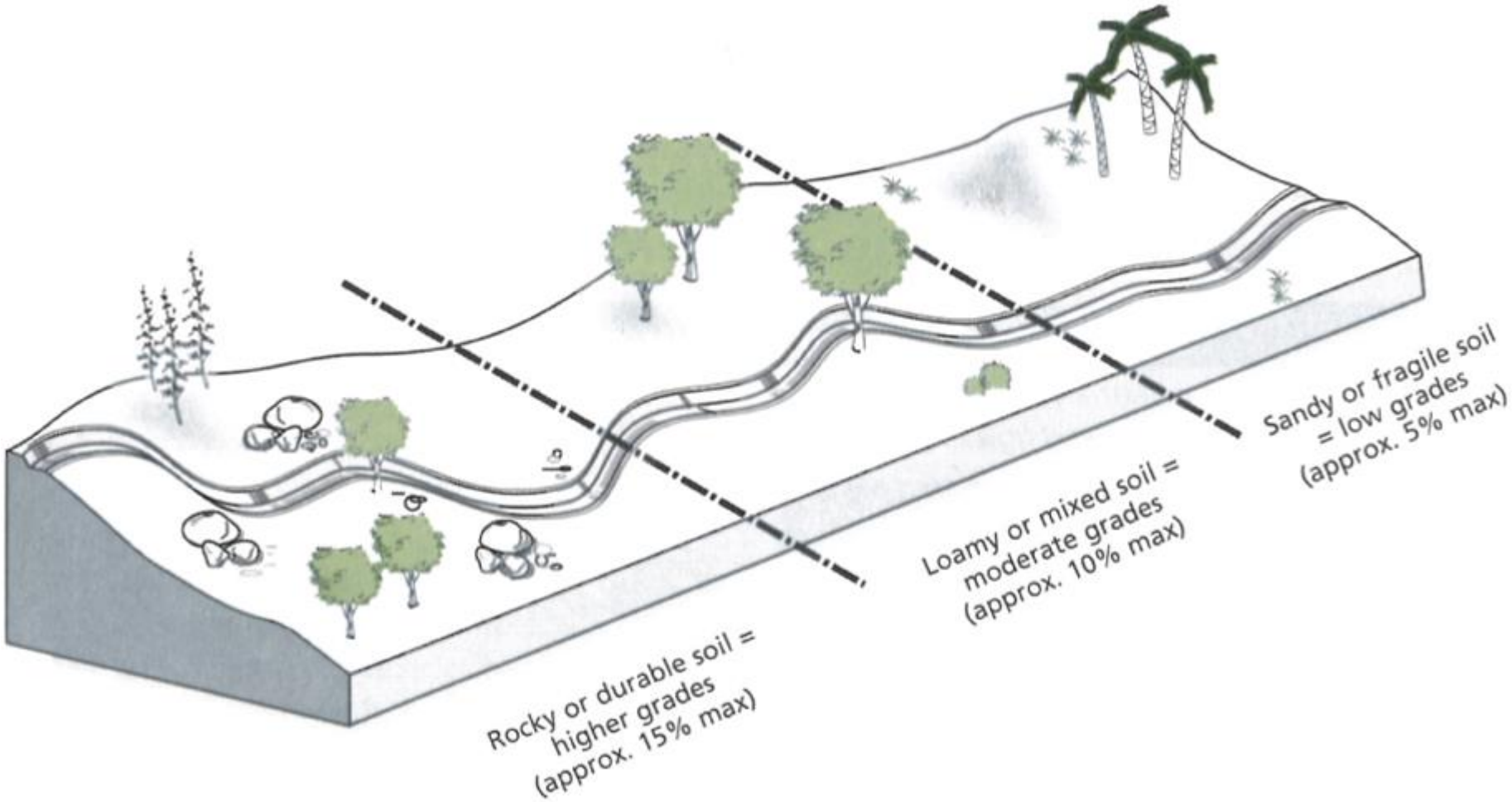
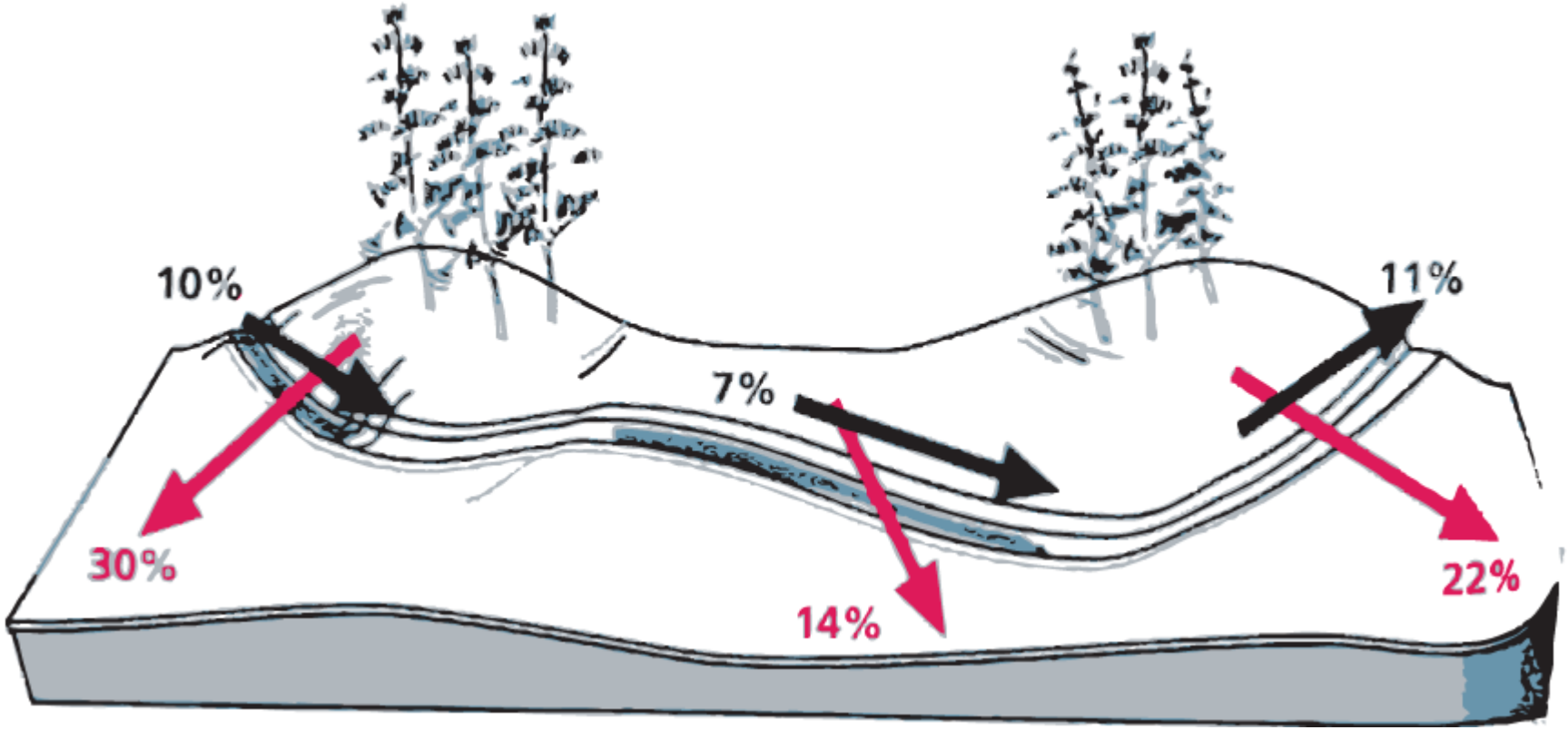
Soil Type & Maximum Sustainable Grade



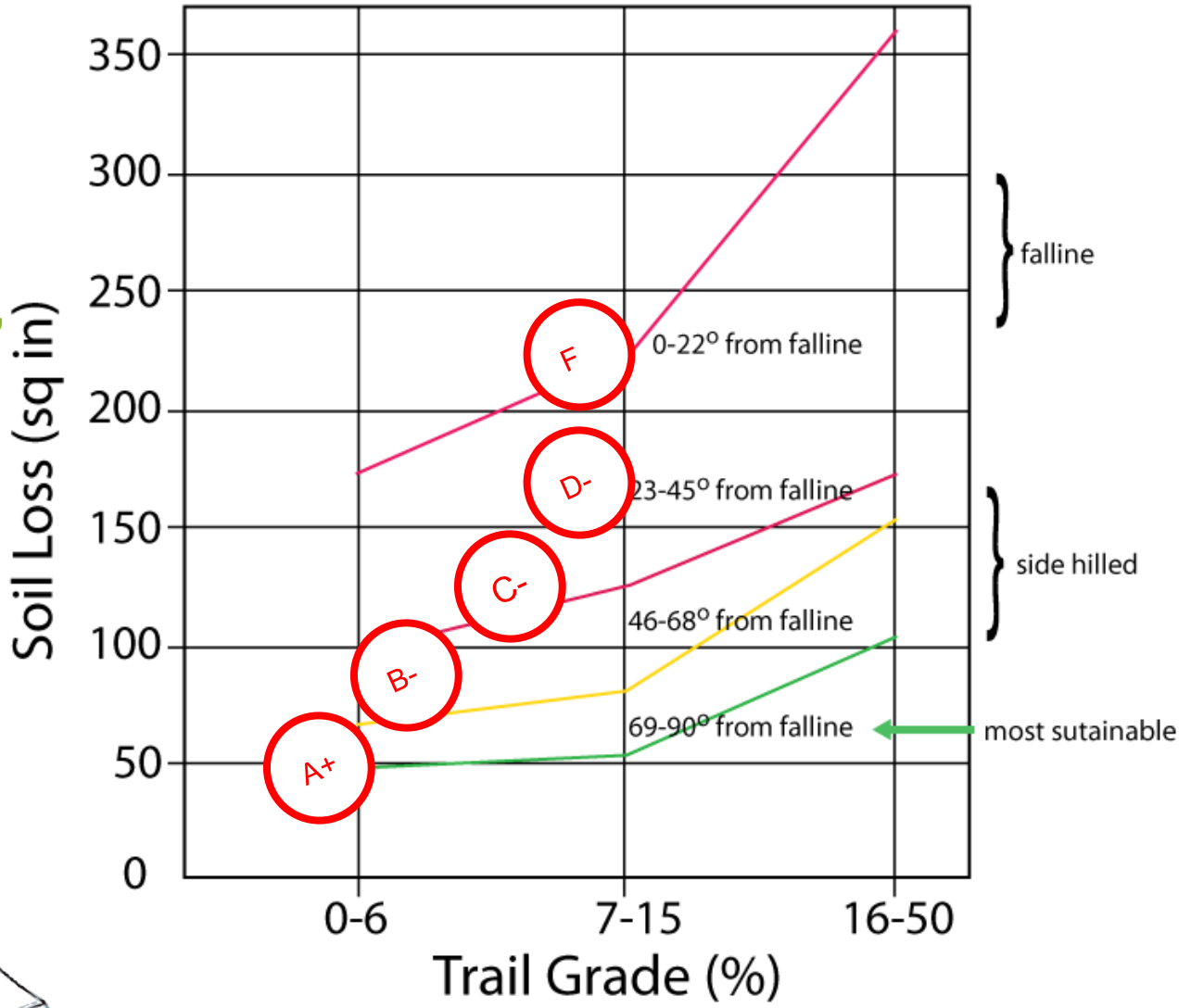
"Half Rule" of Sustainable Trailbuilding

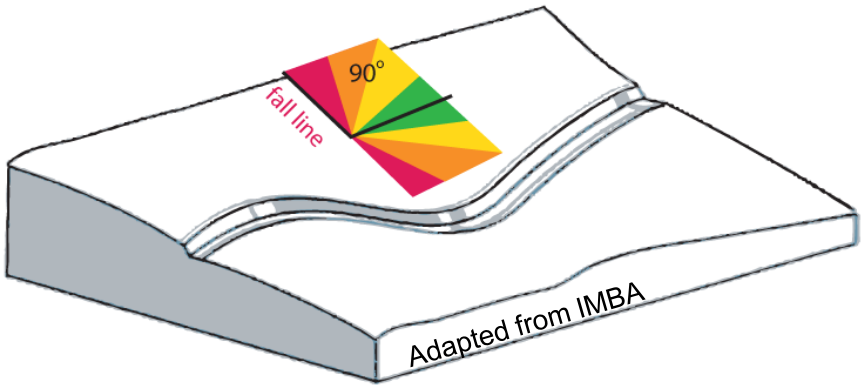
Slope of the trail should be no more than half of the prevailing slope.



Keep grades below 15%, averaging 10% or less (5-7 for MTB)

Why <15%?
Average10%?



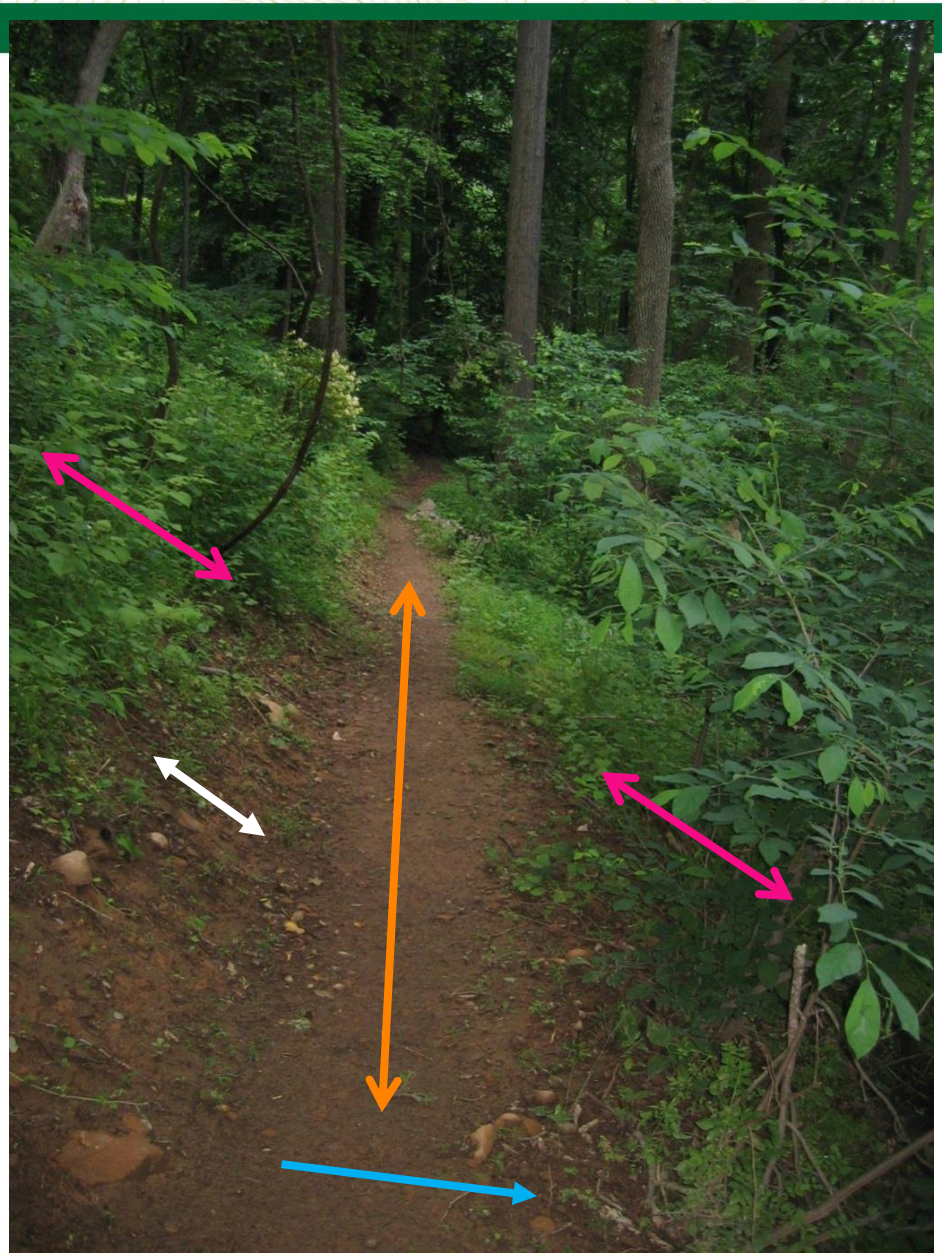


http://www.pwrc.usgs.gov/prodabs/pubpdfs/6612_Marion.pdf

The Half “Rule” is a “guideline” for layout of running grades

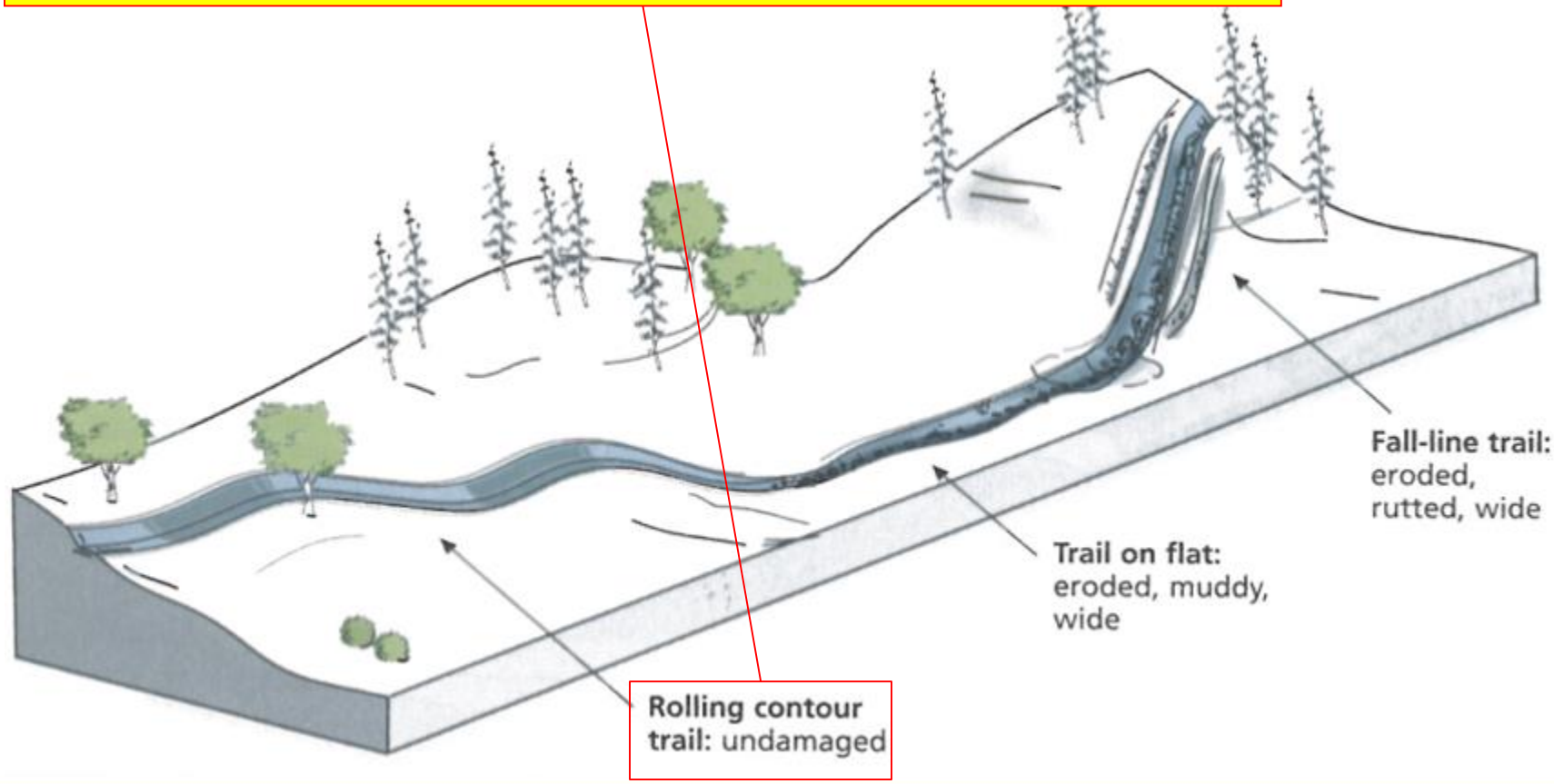
Half Rule =
Running grade = < Falline/2

This guideline forces a contour layout and construction or a “sidehill” or “bench cut” trail

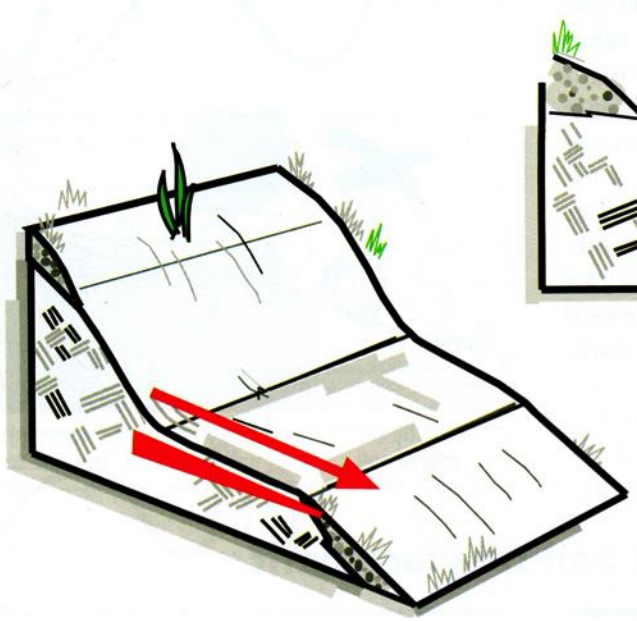


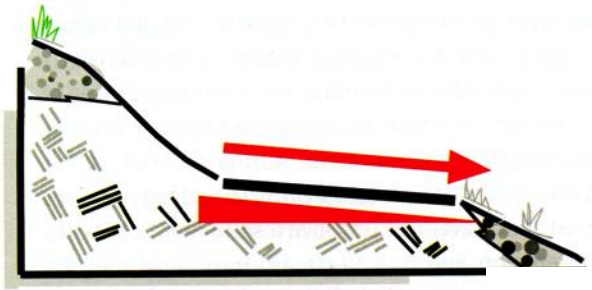
21% or 15% or less?
What considerations might change the answer?

What should the grade be if the fall line is 42%?

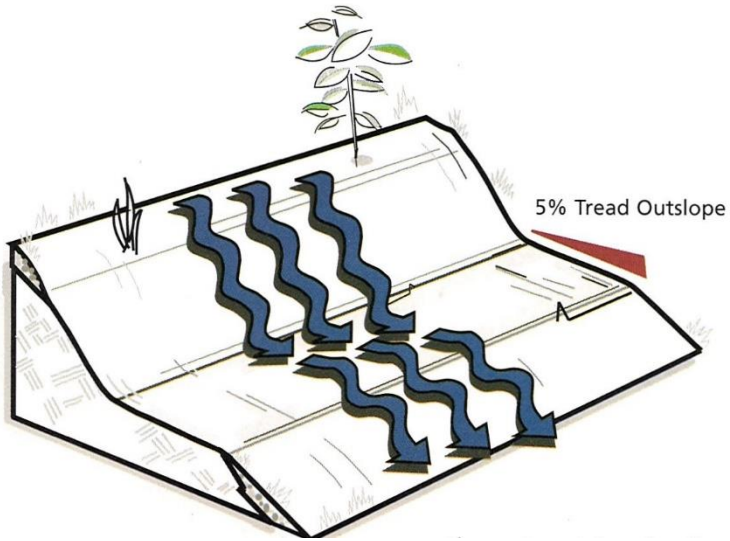


Tread Outslope



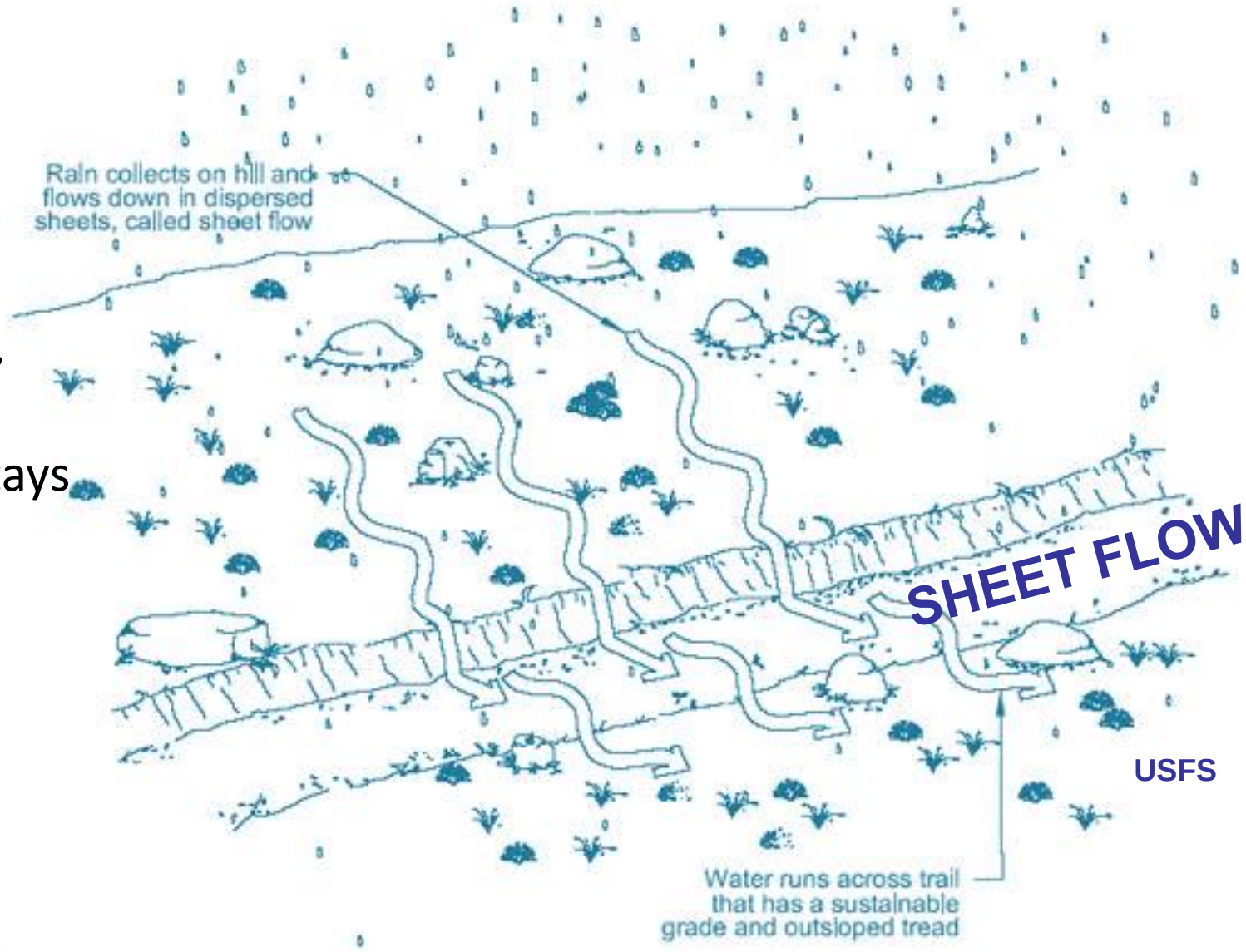


Outslope helps water sheet across and off the trail.



Images Source: IMBA

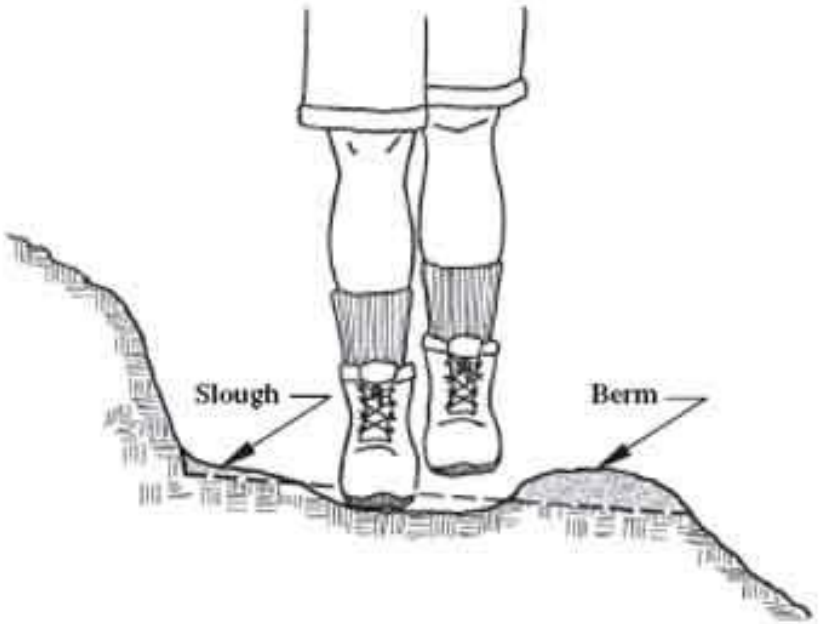
When water drains in thin, dispersed sheets, dirt stays on the trail.



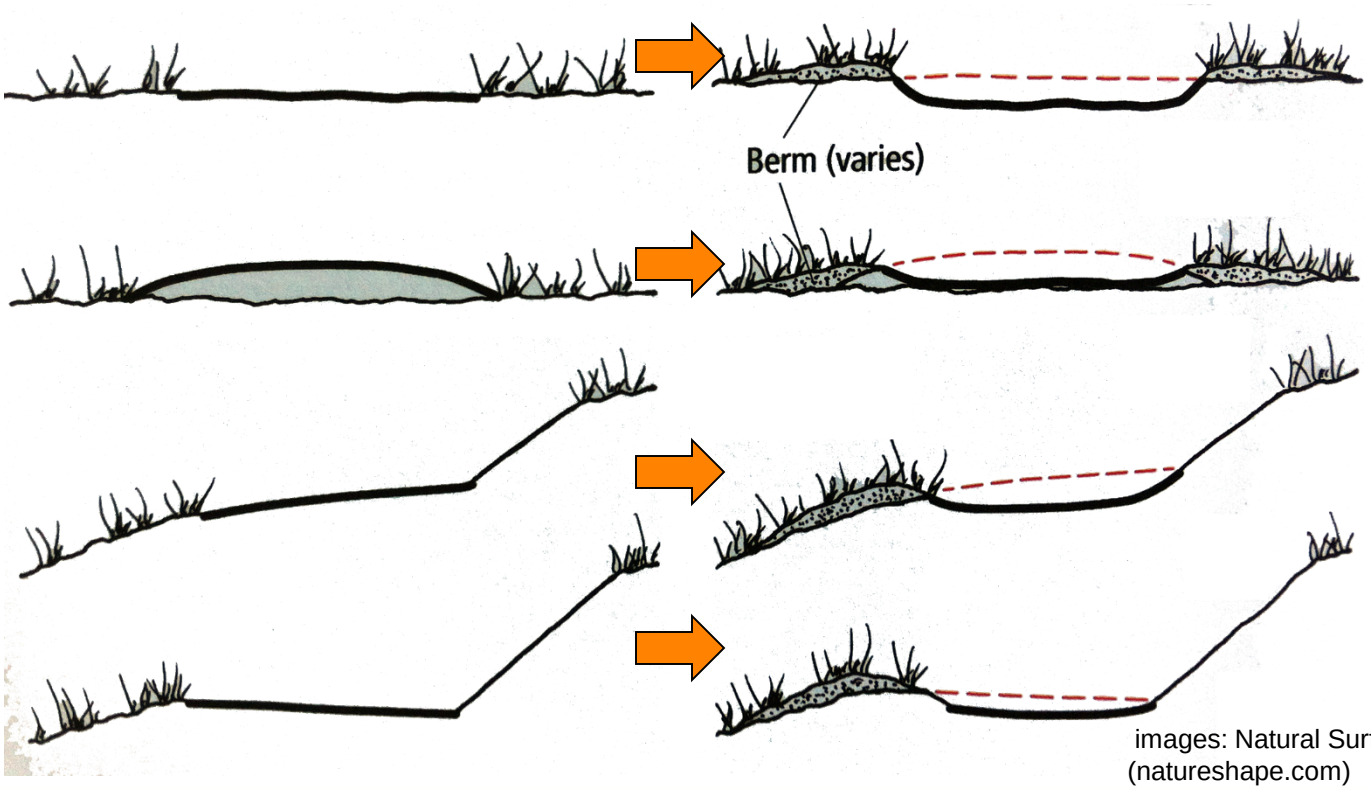
Putting the "Roll" In Rolling Contour Trail

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)

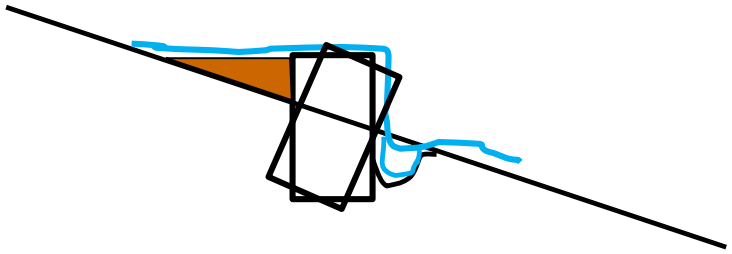
About Waterbars

Drawbacks:

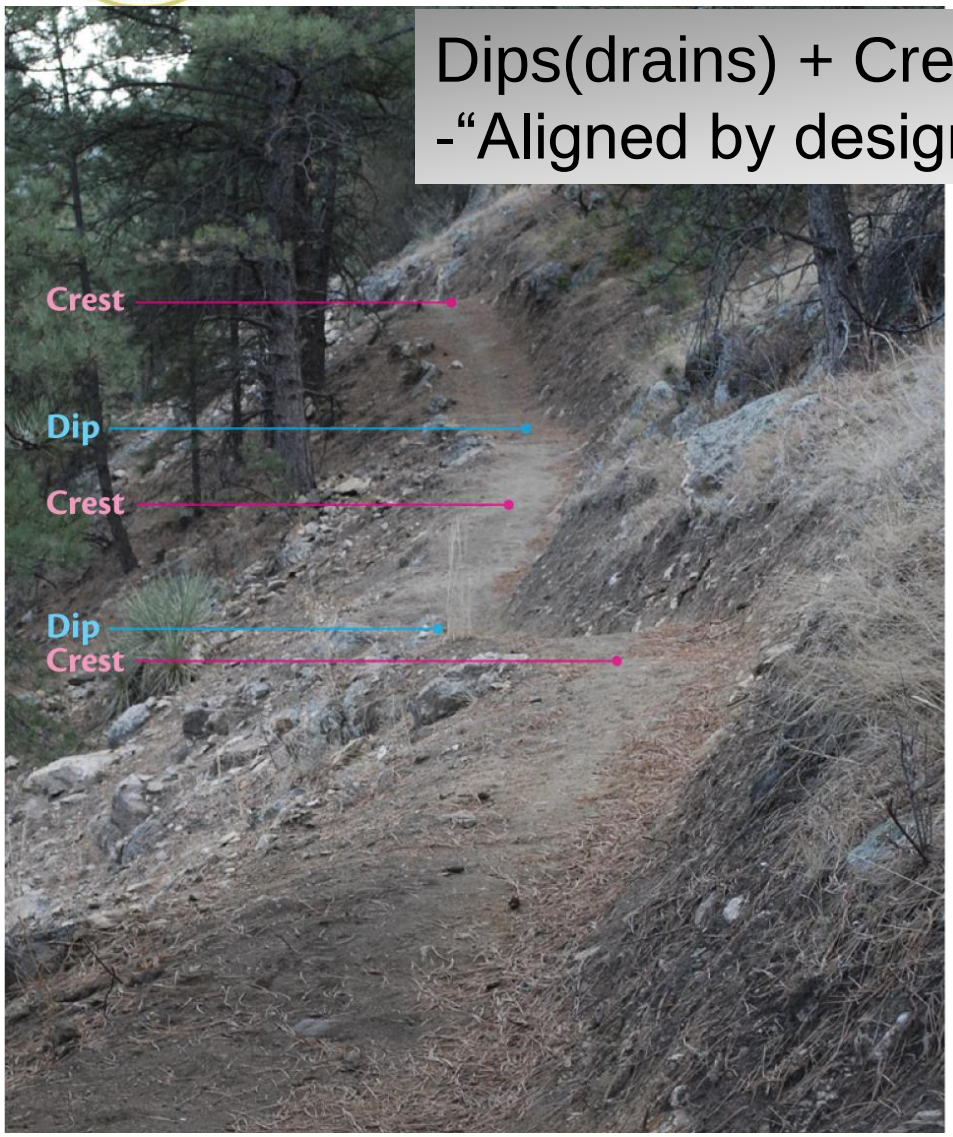
- Require regular maintenance
- Must meet specific requirements to work correctly
- Reduce Accessibility
- Most don't like steps
- Doesn't feel "Natural"

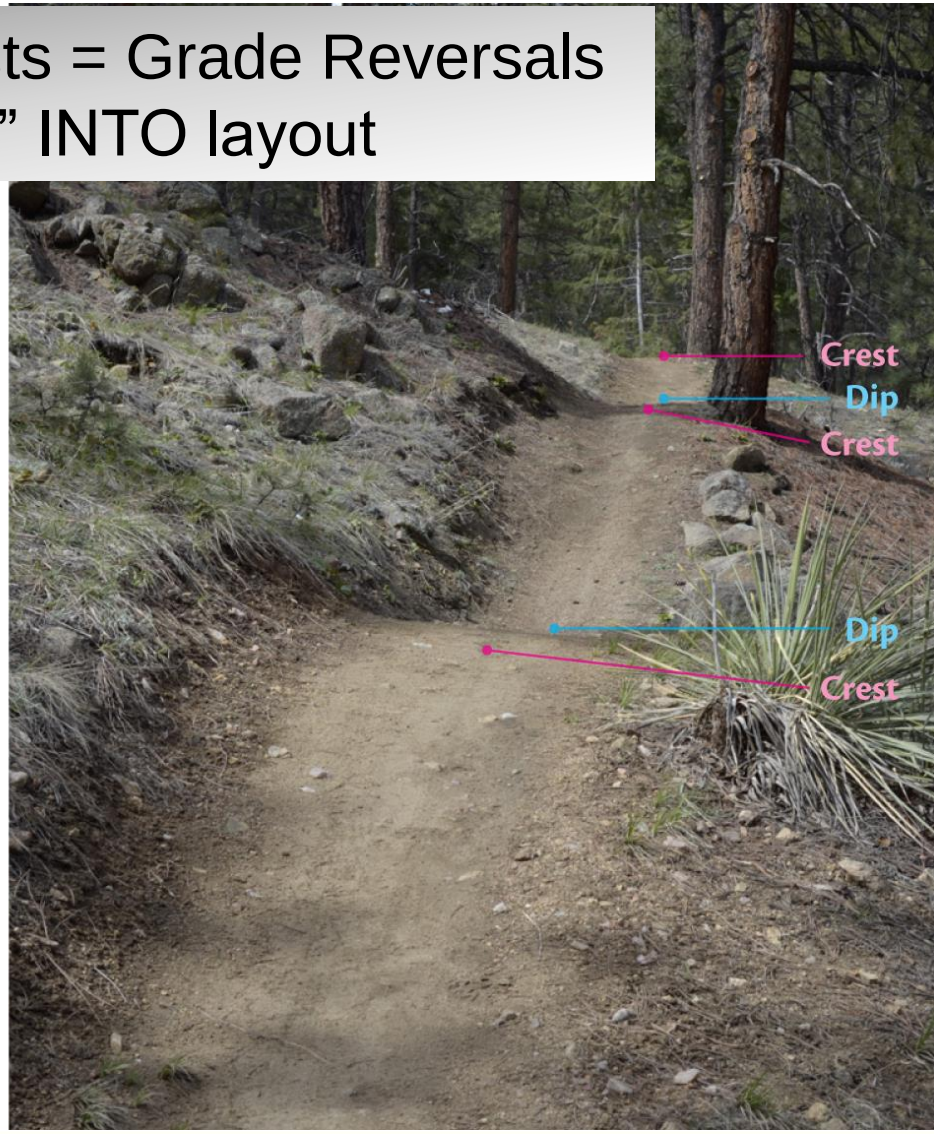
Solution: Peaks & Dips

- No maintenance
- Work better
- Feel more natural
- Easier to construct



Dips(drains) + Crests = Grade Reversals -“Aligned by design” INTO layout

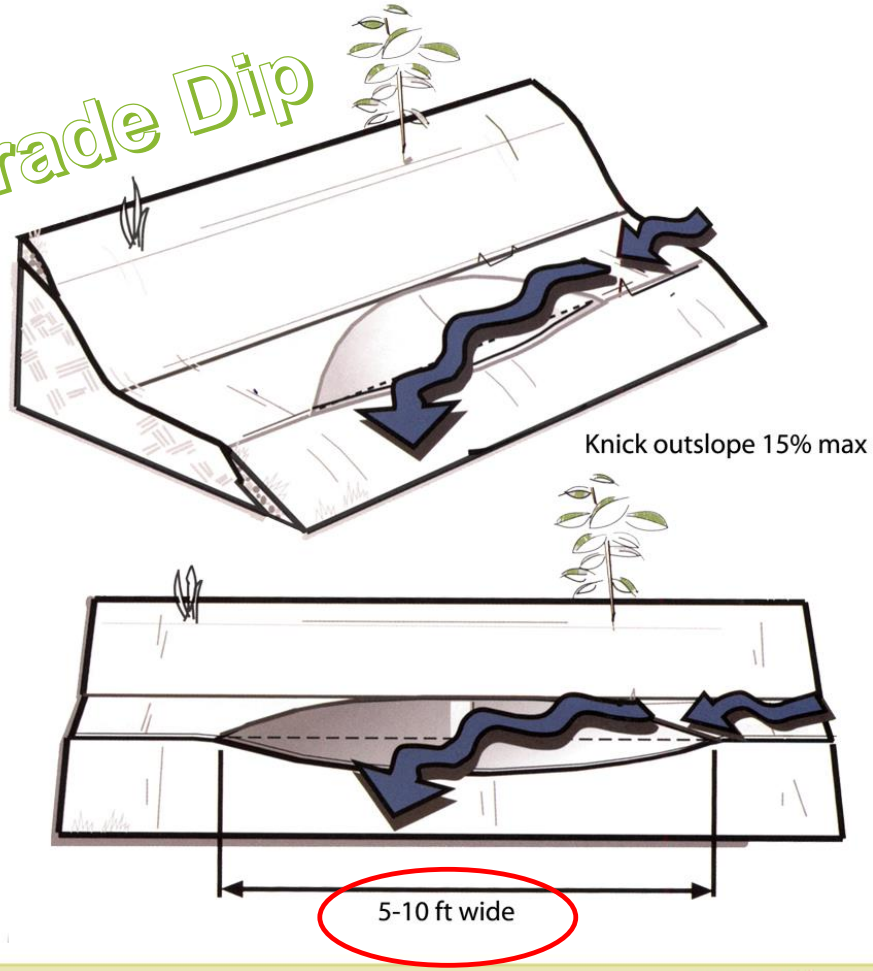




images: Natural Surface Trails by Design (natureshape.com)

Align dips and crests into layout (or divide a watershed by installing dips and crests post construction)

Knick or Grade Dip



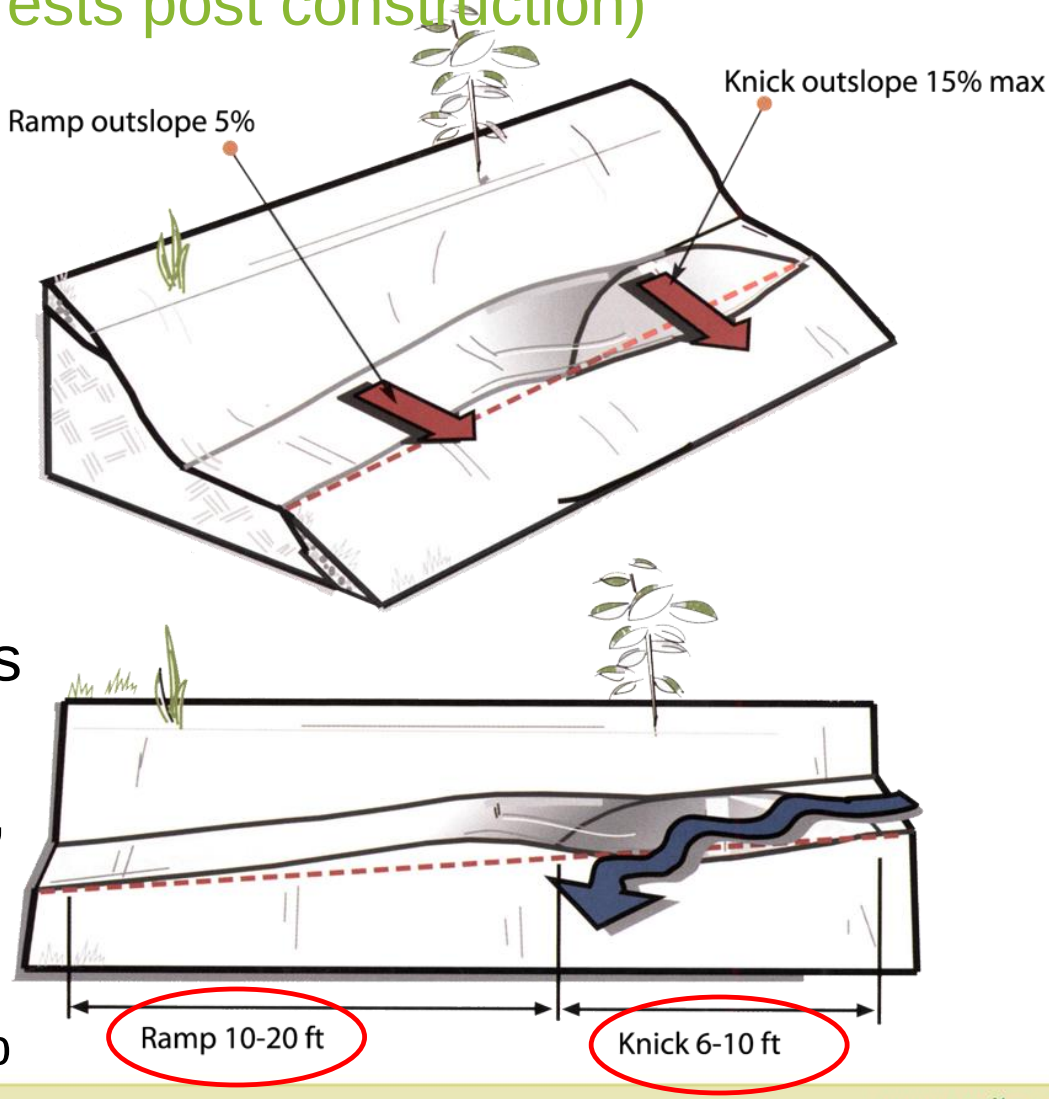
- A fix for poorly aligned trails

- 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)

Rolling grade dip = knick + ramp

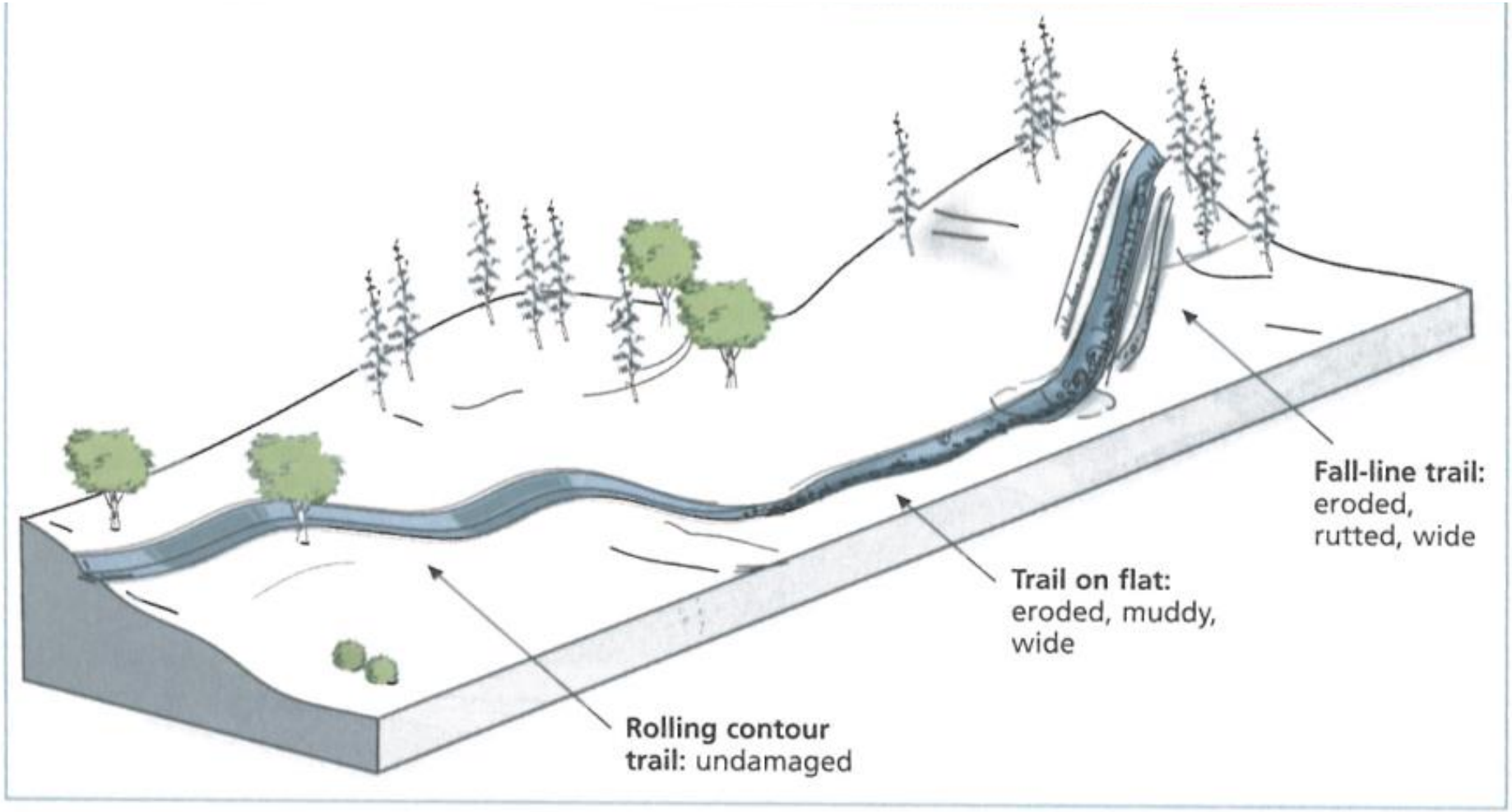


- A fix for poorly aligned trails

- 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.

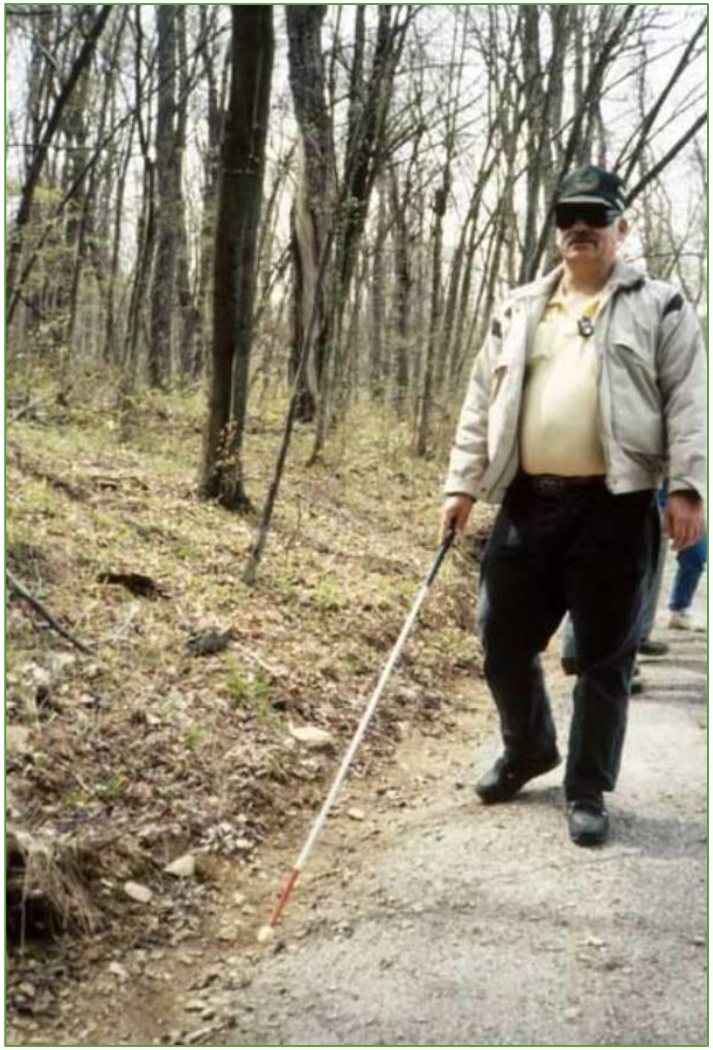
Alternative Terms:

- 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…

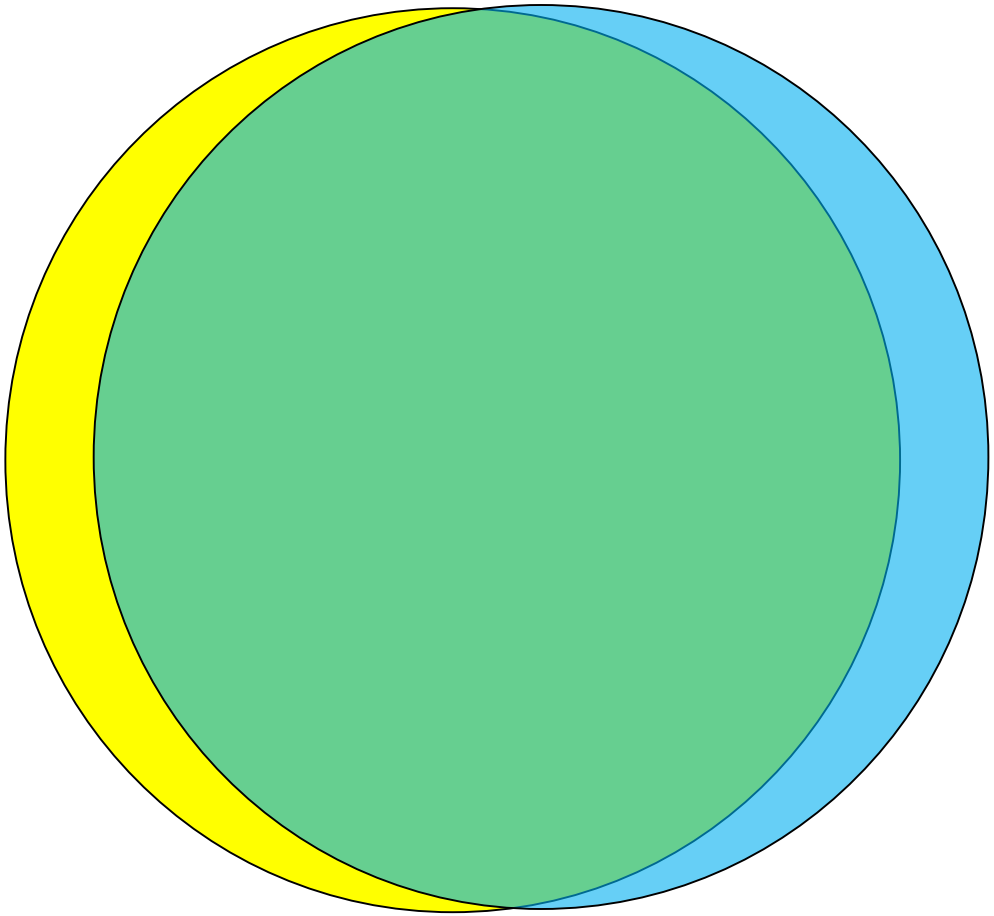
The **ADA** prohibits discrimination based on ability. To guarantee you're not unintentionally discriminating based on ability, the **ABA** provides design standards. Within this set of design standards, trailbuilders follow those outlined in the **FSTAG** (or **ODAAG**, when accessing developed areas).

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?



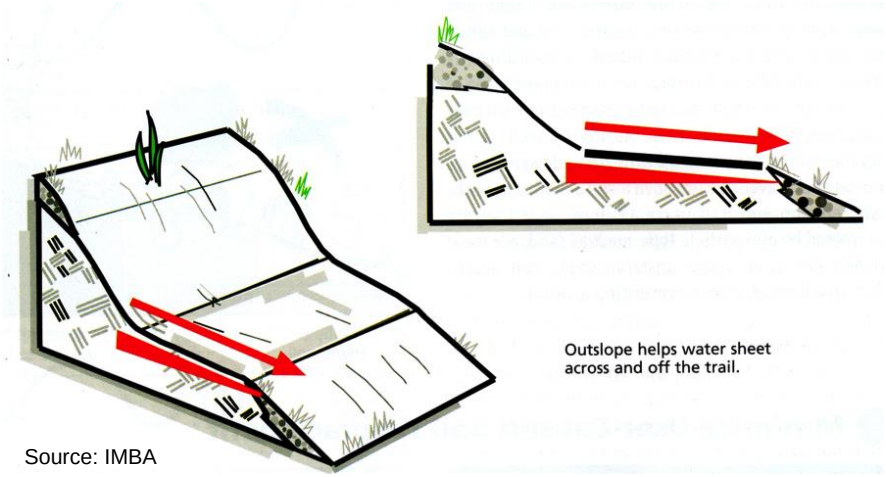
Accessible Trail Standards

Sustainable Trail Standards

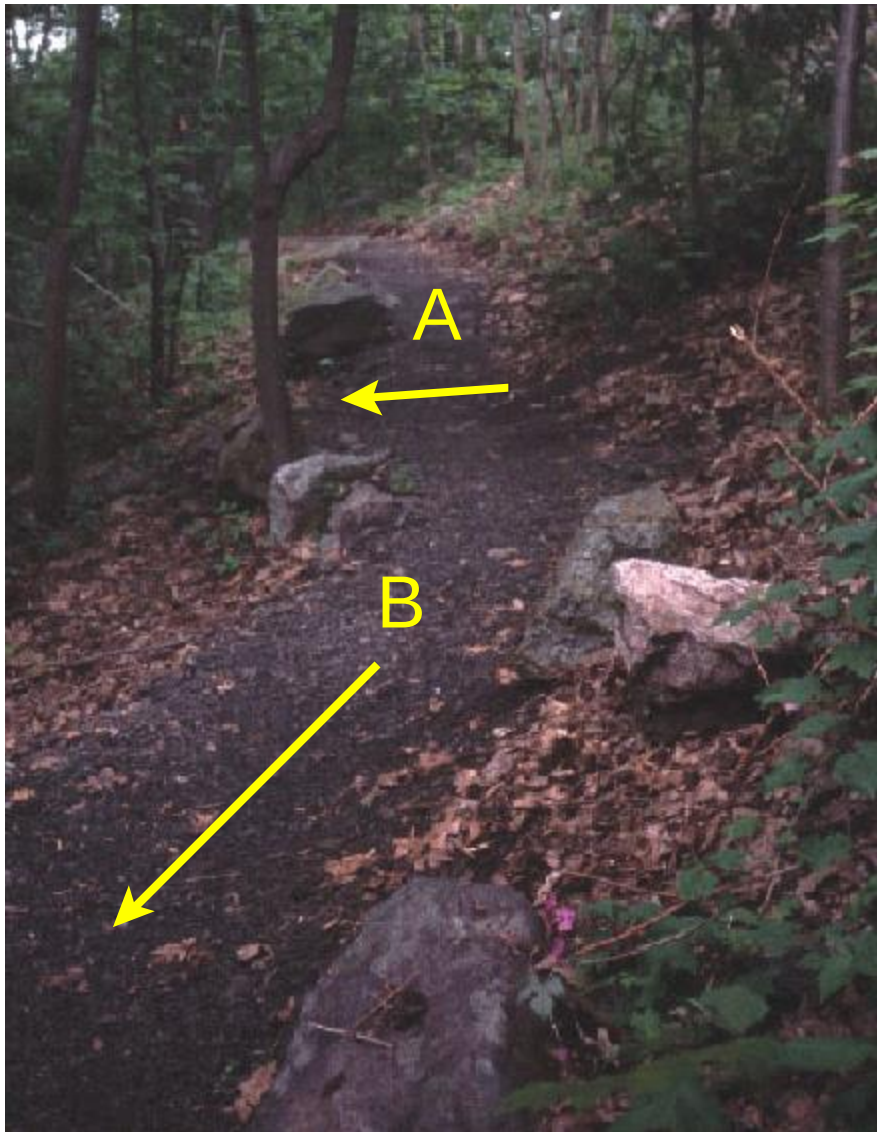
Let's look at some of the established best practices both have in common…

Accessible Outslope (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

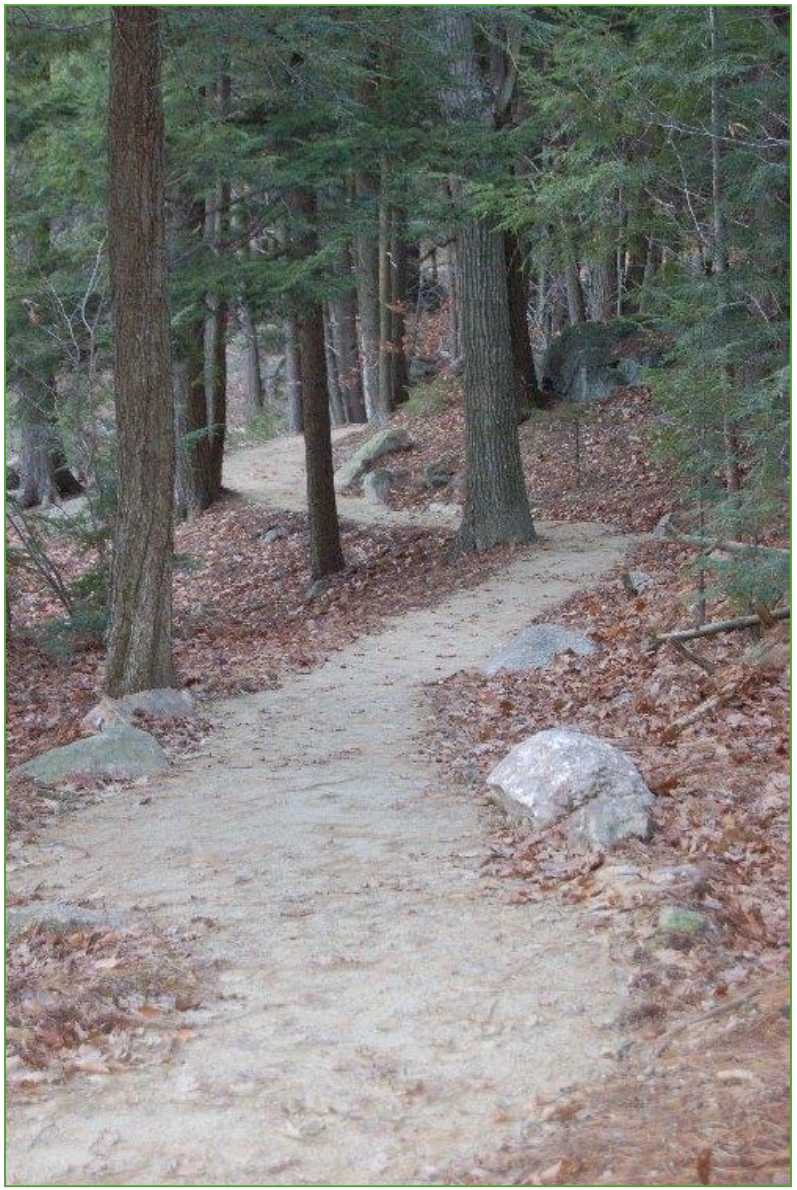
* Not always possible or desirable to lower a trail's grade- depends on a number of factors

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

All

QUESTIONS?