

Towards a Mountain Trail Sustainability Ethic ...

Interdisciplinary Team
... from Rocky Mountain
National Park (RMNP)
Estes Park, Colorado

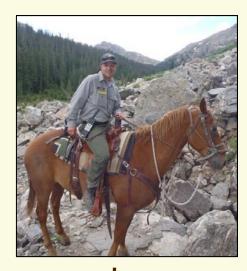
- Ian Brighton
- Danny Basch
- **♦** John Giordanengo
- Greg Seabloom
- Hugh Duffy



John



Danny



lan



Hugh



Webinar 1 – *Foundations* – Key Points

- 1. Overview of the "Sketchbook" process ... emphasizing the entire Trail Project Cycle, not just one cog
- 2. Professional Landscape Architectural Ethics
- 3. Land Management Agency Missions & Policies
- 4. Key Trail Literature / Internet Research
- 5. Paramount & Subordinate landscape architectural criteria
- 6. Successful Tools & Techniques of the application of mountain trail sustainability on the ground
- 7. Gentle Moderate Profile Grades on Gentle Moderate Cross Slopes will result in the most sustainable trail corridor.

Webinar 2 – *Fundamentals* – Key Points

- 1. How a *Mountain Trail Sustainability Ethic* is helping the trails program at Rocky Mountain National Park (RMNP) respond to a natural disaster
 - General Trail Program Overview
 - ◆ Flood of 2013 summary
 - **♦** Flood Recovery Project and case studies
- 2. Interdisciplinary Team Leadership
- 3. Project Formulation Process
- 4. Stakeholder Management ... How to Include Management & Compliance Staff, and the public
- 5. Choosing by Advantages Example
- 6. Trail Planning, Landscape Architectural and Project Management Tools & Techniques Customized for RMNP

Webinar # 3 Towards a Sustainability Ethic ...

- 1. Students will learn the importance of <u>understanding</u> & <u>giving full consideration to</u> all the cogs of the Trail Project Cycle, including a recommendation for a New Cog.
- 2. Students will learn New Tools & Techniques and how these apply to Sustainable Mountain Trail project formulation
- 3. Students will learn how to integrate Ecological Restoration into the Trail Project Cycle
- 4. Students will learn some Lessons Learned & Pitfalls to Avoid
- 5. Students will learn about the Sustainable Mountain Trails Sketchbook / Workbook Training process
- 6. Students will see an overview of Case Studies & Examples which demonstrate adherence to Mountain Trail Sustainability Guidelines
- 7. Students will be issued a challenge: "What Role Will You Play?" Questions? Please note the slide #

Striving ... Towards a Trail Sustainability Ethic ... 1 of 3

- 1. Inspiration ...
 - A. Environmental & Conservation Literature
 - B. Nature Itself, i.e.: go hiking for the purposes of contemplation and enjoyment
- 2. Optimum Investment
 - A. Investments analyzed over the project's life cycle
- 3. Stewardship of a Woodlot
 - A. Will you leave your trail system in better condition than you received it?
 - B. Will you leave your land system in better condition than you received it?
 - C. What will future generations say about your leadership and decision-making?

Striving ... Towards a Trail Sustainability Ethic ... 2 of 3

- 4. Intrinsic Values of Land
 - A. Soil, vegetative communities, aesthetics, water quality, native plants, rare species protection ...
- 5. Fundamentals of Outdoor Recreation
 - A. Recreation, not conquering ... enjoyment of scenery and refreshment ... understanding of ecology and natural history ... build and nurture relationships
- 6. Landscape Architectural Tools & Techniques
 - A. Planning / Design / Implementation / Organizational
 - B. Site Analysis
 - C. Observation
 - D. Note taking / thumbnail sketches / photographs
 - E. Post Construction Evaluation
 - I. Lessons Learned
 - II. Pitfalls to Avoid
 - F.Sharpen these ... easier than you think

Striving ... Towards a Trail Sustainability Ethic ... 3 of 3

- 7. Nonprofit Agency Partnerships
- 8. Training
 - A. Internal
 - B. External
 - C. On-line
 - D. Independent Study
 - E. Obtain a Mentor
- 9. Art & Science
 - A. Art seems like it is on the correct trail ...
 - B. Interdisciplinary Science in advance of trail planning, design and implementation of specific projects is required to advance the Mountain Trail Sustainability Ethic ...

Inspiration from "A Sand County Almanac," 1953

"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."

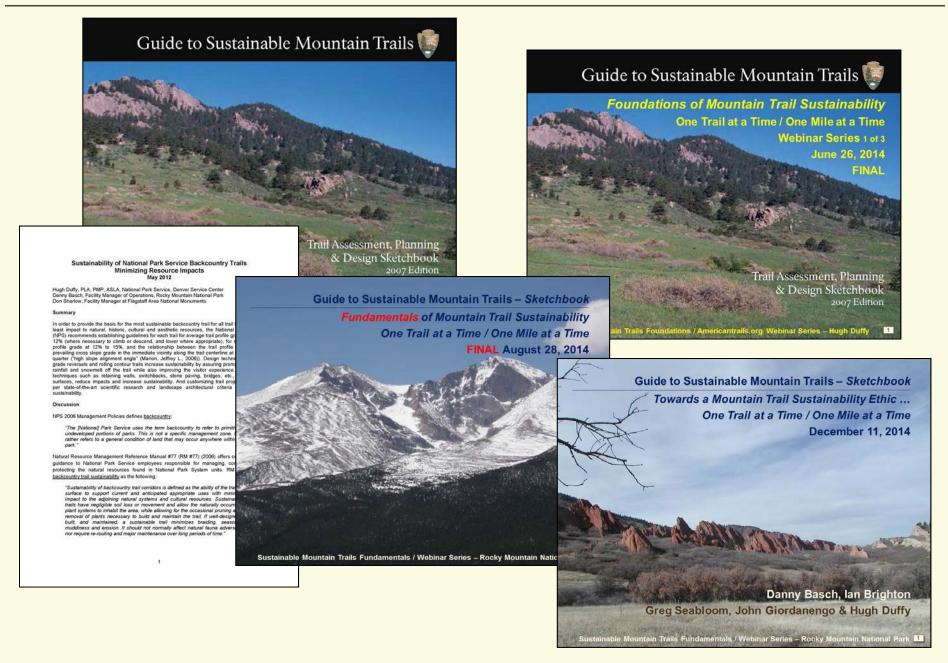
"Conservation is a state of harmony between man and land."

"... stability depends upon integrity ... "

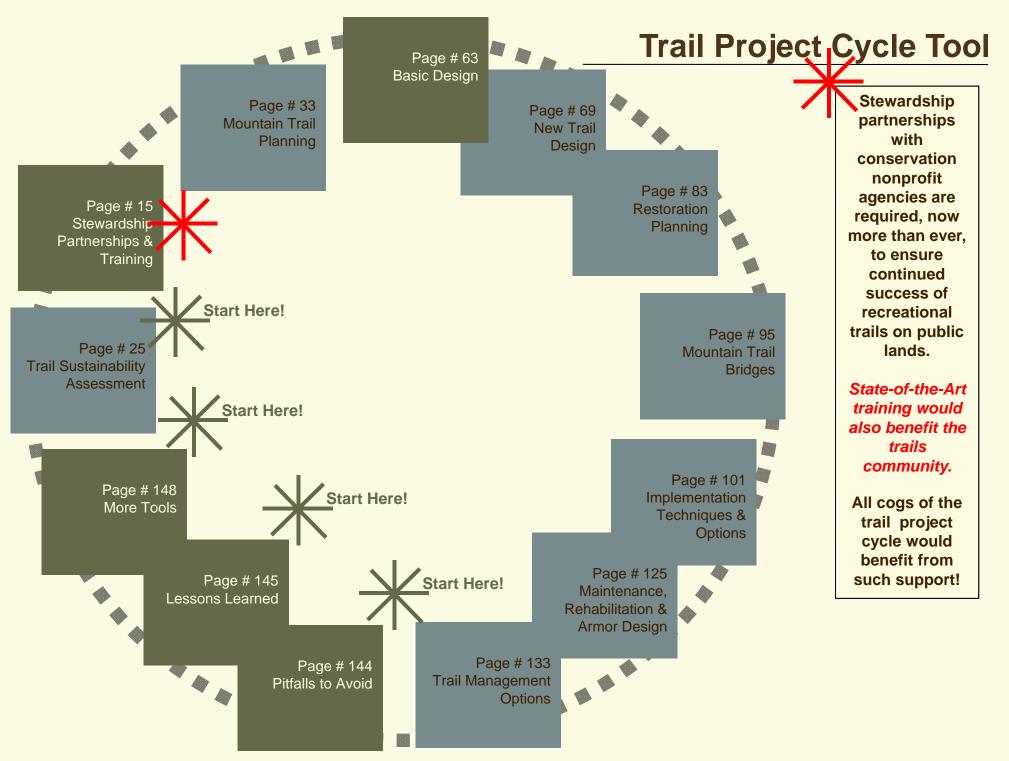
"Recreation development is a job not of building roads into lovely country, but of building receptivity into the still unlovely human mind."

"In these higher aspirations the important thing is not to achieve but to strive."

Overview Sketchbook & Following Documents



All Webinars Build on the Sketchbook!



Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...

Pitfalls to Avoid

- 1. Not forming an appropriate interdisciplinary team
- 2. Not including management / compliance reviews
- 3. Using inappropriate sustainability criteria
- 4. Not considering the planning context before designing
- 5. Not planning Ecological Restoration activities from the outset, maybe several years in advance

Lessons Learned

- 1. Having patience and not undertaking too-ambitious of a project one mile per trail per year may be sufficient!
- 2. Not exceeding recommended profile and cross slope grades minimizes erosion
- 3. Carrying out Ecological Restoration activities with Trail Implementation
- 4. Preparing and conducting Training activities strengthen the overall trails' program
- 5. Et al.

More Tools

Alberta Parks and Recreation

1988 Cross Country Ski Trails. Edmonton, Alberta.

Appalachian Mountain Club

1998 The Complete Guide to Trail Building and Maintenance, 3rd Edition. (Carl Demrow and David Salisbury). Boston, MA.

Appalachian Trail Conference

2003 Appalachian Trail Fieldbook; Maintenance and Rehabilitation Guidelines for Volunteers, 2nd Edition. Harpers Ferry, WV. 2000 Appalachian Trail; Design, Construction, and Maintenance, 2nd Edition. (William Birchard, Jr. and Robert Proudman). Harpers Ferry,

1981 Trail Design, Construction and Maintenance. Harpers Ferry, WV.

Arizona State Parks

1992 Public Trail Access: A Guide to the Protection of Arizona's Trails. Phoenix, AZ.

1975 Trail Construction. Washington, D.C.: The Park Practice Program of the National Park Service (October 1975).

Bay Area Ridge Trail Council

1993 In Support of Trails: A Guide to Successful Trail Advocacy. San Francisco, CA.

Beneficial Designs

Berry, Wenc

1981 The

Binnewies,

2001 Palis

University Pr

Universal Trail Assessment Process. http://www.beneficialdesigns. com/trails/utap.html (accessed 2/7/2007).

2005 Lightly on the Land, The SCA Trail-Building and Maintenance Manual, 2nd Edition. Seattle, WA: Mountaineers.

Wilderness By Design: Landscape Architecture & the National Park Service. Lincoln, NE: University of Nebraska Press.

Colorado Outdoor Training Initiative (COTI)

2006 COTI Instructor's Guide to Teaching Crew Leadership for Trails.

2004 Standard Terminology for Trails. Denver, CO.

Colorado State Forest Service

1998 Colorado Forest Stewardship Guidelines to Protect Water Quality. Fort Collins, CO.

Countryside Commission

1989 Footbridges in the Countryside, 2nd Edition. Scotland Hall Blyth Partnership.

1990 Design for Mountain Communities: A Landscape and Architectural Guide. New York, NY: Van Nostrand Reinhol

Duffy, Hugh, Kim Frederick & Lois Bachensky 1991 Sustainable Mountain Trail Corridors. Denver, CO: State Trails Newsletter.

Flink, Charles A. Kristine Olka, and Robert M. Searns 2001 Trails for the Twenty-First Century, and Edition, P.

Years of Forestry in America. Bethesda, sters.

liam Ascher

evelopment and Environmental Policy.

Press.

ind Charles L. Tracy olunteers, 2nd Edition. Boston, MA:

John C. Frederick

cier, The Natural History Colorado and the CO: Johnson Books.

Neiger, Michael A.

The Wilderness Tripper's Portal. Trail Design, Building, and Maintenance. http://therucksack.tripod.com/trailbuilding.htm

(accessed 2/7/2007).

Olmsted, Frederick Law

1993 Yosemite and the Mariposa Grove: A Preliminary Report, 1865.

Yosemite National Park, CA.

2004 Natural Surface Trails by Design. Boulder, CO: Natureshape.

1978 Trails Manual. Ottawa, Canada.

Gobster, Paul H. and R. Bruce Hull

2000 Restoring Nature. Washington, D.C.: Island Press.

1999 Park & Recreation Structures. New York, NY: Princeton Architectural Press, Inc.

1975 Form, Function and Design. New York, NY: Dover Publications.

State Parks.

Kirk, Stephen J., and Kent F. Spreckelmeyer 1998 Enhancing Value in Design Decisions.

Kirschbaum, Julie B.

2001 Designing Sidewalks and Trails for Access - Part II of II, Best Practices Design Guide. Washington, D.C.: Federal Highway Administration.

LaGro, James A.

2001 Site Analysis, Linking Program and Concept in Land Planning and Design. New York, NY: John Wiley and Sons.

Leopold, Aldo

1966 Sand County Almanac, Oxford University Press.

2005 The Forest Service and The Greatest Good, A Centennial History.

Durham, NC: Forest History Society.

1990 Greenways for America. Baltimore, MD: Johns Hopkins University Press.

1984 Site Planning, 3rd Edition. Boston, MA: MIT Press.

Time. New Haven, CT: Yale University 1960 The Image of the City. Boston, MA: MIT Press.

and Robert L. Ryan

licycling Association)

ington, D.C.: Island Press.

n and Jim Pojar

e Principles of Landscape Architecture.

Conference Proceedings (pp. 213-216).

ce & U.S.D.I. National Park Service

ng and Maintenance - For National, Managing Agencies. Sequoia Natural

fe in Mind: A Handbook for Trail

ide to Building Sweet Singletrack.

ins. Renton, WA: Lone Pine

tation and Preservation of the

2006 Assessing and Understanding Trail Degradation: Results from Big South Fork National River and Recreation Area. Blacksburg, VA: United State Geological Survey.

McClelland, Linda Flint

1993 Presenting Nature: The Historic Landscape Design of the National Park Service. Washington, D.C.: National Park Service. 1998 Building the National Parks. Baltimore, MD: Johns Hopkins

University Press.

McRayen, Charles

1997 Stonework / Techniques and Projects. Pownal, Vermont: Storey Communications.

149

See Pages 148-151 of the Sketchbook.

1998 Landscape Architecture, 3rd Edition. New York, NY: McGraw Hill Companies.

2001 In the Company of Stone. New York, NY: Artisan.

Steinholtz, Robert T.

2001 Wetland Trail Design. Missoula, MT: U.S.D.A. Forest Service.

Thompson, J. William and Kim Sorvig

2000 Sustainable Landscape Construction. Washington, D.C.: Island Press.

Trapp, Suzanne, Michael Gross and Ron Zimmerman

1991 Signs, Trails, and Wayside Exhibits. Stevens Points, WI: University of Wisconsin-SP Foundation Press, Inc.

Forest Library. Trail Planning, Construction, and Maintenance. http://forestry.lib.umn.edu/bib/trls.phtml (accessed 2/8/2007).

Weaver, Tad Donn Dale and E. Hartley

1979 Guidelines for the Rehabilitation and Preservation of the Appalachian Trail System Using the Principles of Landscape Architecture. Recreational Impact on Wildlands: Conference Proceedings (pp. 94-100). Seattle, WA: U.S.D.A. Forest Service, Pacific Northwest Forest and Range Experiment Station and U.S.D.I. National Park Service.

2006 Planning and Managing Environmentally Friendly Mountain Bike Trails. Phoenix, AZ: Arizona State University.

U.S.D.A. Forest Service

2004 Trail Construction and Maintenance Notebook, 2004 Edition. Missoula, MT.

1995 Landscape Aesthetics, A Handbook for Scenery Management. Washington, D.C.

1994 Forest Service Manual, 2600-Wildlife, Fish and Sensitive Plant Habitat Management, Region 2.

National Forest Landscape Management, Volume 2, Chapter 8: Recreation. Agriculture Handbook No. 666. Washington, D.C.

Trail Construction Manual. Washington, D.C. Standard Specifications for Construction of Trails (Publication

Number EM 7720-102). Washington, D.C. Forest Landscape Management Volume 1. Washington, D.C.

Forest Trail Handbook. Washington, D.C. Trail Construction on the National Forests. Washington, D.C. Trail Construction on the National Forests. Washington, D.C.

1982 Trails Manual, 2nd Edition. Sylmar, CA: Equestrian Trails.

Wisconsin Division of Tourism

1978 Wisconsin Cross Country Ski Trail Development Guidelines. Madison, WI.

Whittaker, P.L., and S.P. Bratton

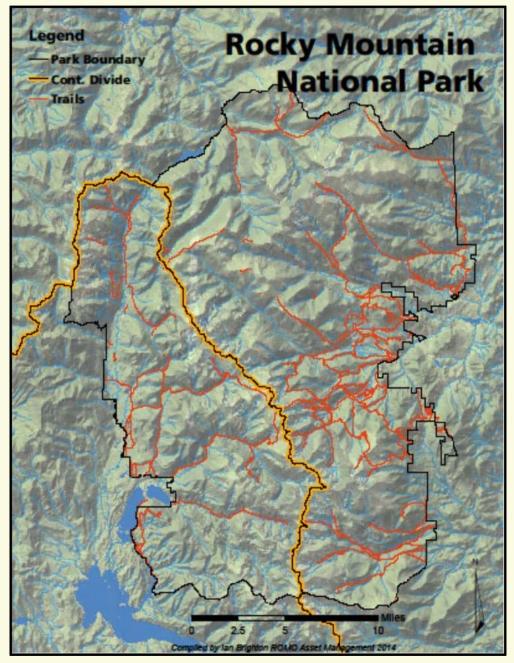
1978 Comparison of surface impact by hiking and horseback riding in the Great Smoky Mountains National Park (Research / Resource Management Report No. 24). Gatlinburg, TN: National Park Service.







RMNP – Trail Program Overview



- 355 miles of official (system) trails
- Average over 3 million visitors per year
- ◆ Elevations range from approximately ~8000' to over 14,000'
- Ecosystems range from Montane to Sub-Alpine
- 25 Liveries (commercial horse tour operations) operate in the park
- The Trails Program consists of 4 permanent, 10 term and 35 seasonal employees.
- Approximately \$1 million annual budget for the Trails Program.

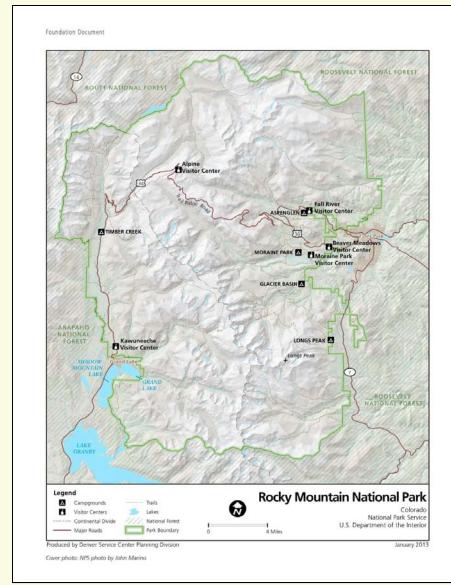


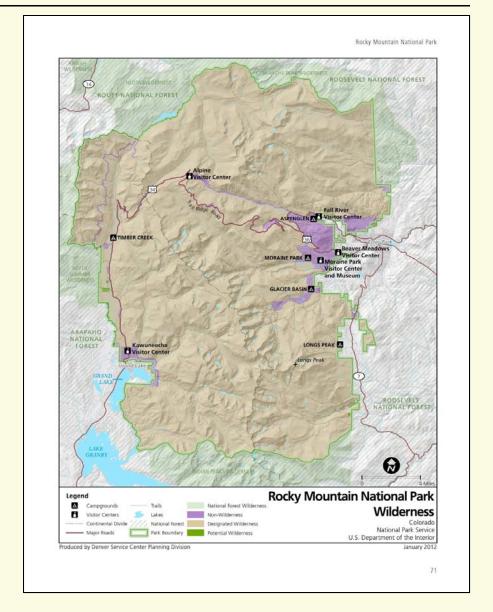
Rocky Mountain National Park Purpose Statement

The Purpose of Rocky Mountain National Park is to preserve the high-elevation ecosystems and wilderness character of the southern Rocky Mountains within its borders and to provide the freest recreational use of and access to the park's scenic beauties, wildlife, natural features and processes, and cultural objects



Rocky Mountain National Park - Wilderness Act 1 of 3







Rocky Mountain National Park – Wilderness Act 2 of 3

"In 2009, Congress designated the Rocky Mountain National Park Wilderness Area, covering about 252,085 acres, or about 95% of the park."

"Wilderness designation protects the land's wilderness character, natural, untrammeled and undeveloped conditions, opportunities for solitude and primitive recreation, and scientific, educational, and historical values."

Rocky Mountain National Park Foundation Document, 2013

... Minimum Task / Minimum Tool Guideline ...



- On September 12th, major flooding occurred in the mountains and foothills northwest of Denver, CO
- ◆ 13.15" of rain fell during the storm in Allenspark, CO
- Major roads and infrastructure washed away and many communities and towns were devastated
- Access was cut-off for many people creating a serious emergency and a major evacuation effort by air





Flood Impacts at Rocky Mountain National Park



Unprecedented damage ...



RMNP Trail Damage Inventory

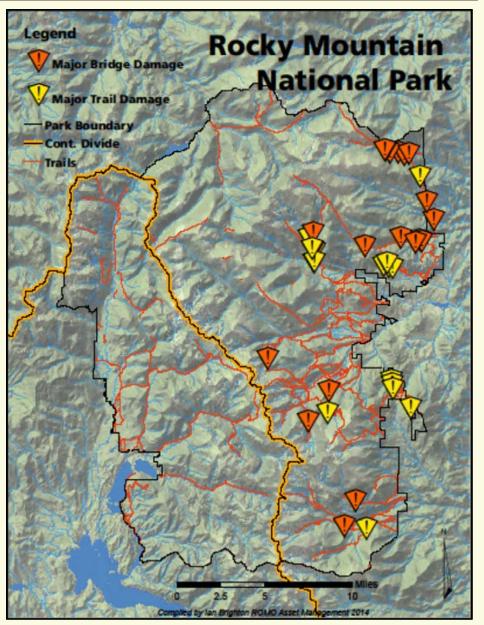
5 Rapid Assessment Teams were deployed to survey all flood impacted trails in a three week period

What we found ...

- ◆ 15 bridges washed out.
- Portions of 6 trails destroyed by landslides.
- Portions of 4 trails destroyed by riverbank failure.
- Large portions of the trail system subjected to severe erosion in general.
- However ... some of the most popular areas lightly impacted (yeah!)

GIS linked photos can be found here:

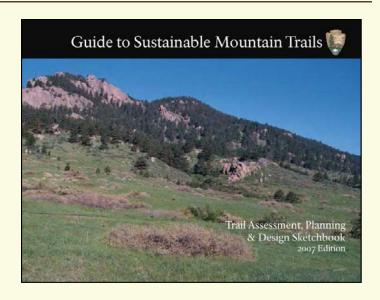
http://www.nps.gov/romo/planyourvisit/map-showing-flood-impacts.htm





Trail design after a major disaster

How should we rebuild?
Start from a solid conceptual foundation based on Trail
Sustainability principles found on page 22 of the NPS Trails
Sketchbook.



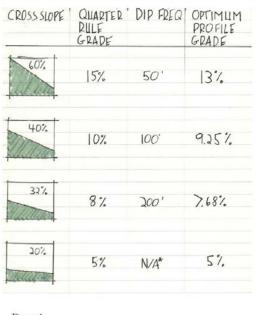
Does the trail ...

- Support current and anticipated uses?
- Have minimal impact to adjoining natural systems and cultural resources?
- Adversely effect natural fauna?
- Have minimal braiding, muddiness and erosion?
- Require rerouting and major maintenance over long periods of time?



RMNP Recovery Plan – Design Parameters

Design parameters

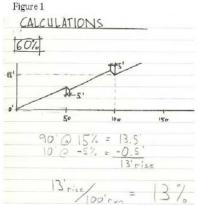


Optimum profile grade incorporates grade dips at various intervals and is therefore slightly less than the Quarter Grade Guideline (see figure 1). After the trail corridor is established and approved, grade dips can be added when construction notes are generated.

*Grade dips are ineffective at such low crosslope grades.

Compiled Trail Profile Grade

Guidelines:

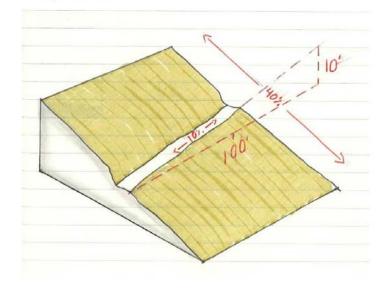


Less-than-Ideal X Slope Cond. Ideal Cond. 13% 60%< 10% 55% 12% 9% 50% 11% 8% 45% 10% 7% 40% 9% 6% 35% 8% 5% 30% 7% 4% 25% 6% 3% 20%> 5% 2%

PRINCIPLES OF OPTIMUM TRAIL GRADES FOR NATURAL SURFACE TRAILS

- In ideal conditions, optimum trail grade is achieved by adhering to the quarter guideline (trail profile grade is 1/4 of prevailing cross slope) while incorporating periodic grade dips to facilitate natural drainage.
- Factors that contribute to an increase in the erosion potential of the natural tread surface (fryable soil, poor drainage, northern aspects, heavy visitor use, adverse climate, etc.) may require a reduction in grade and the use of structures.

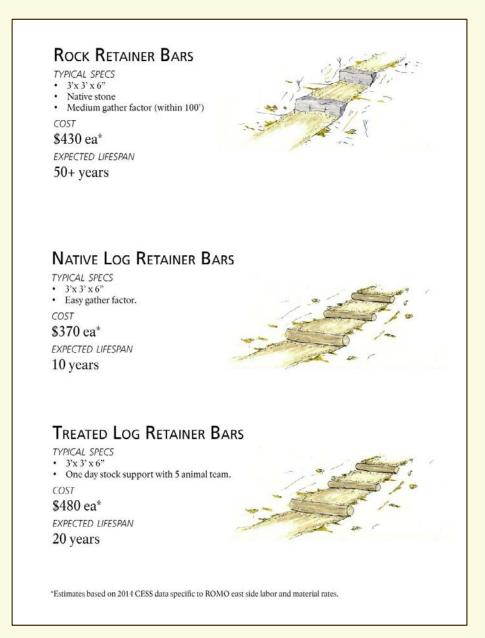
The Quarter Guideline





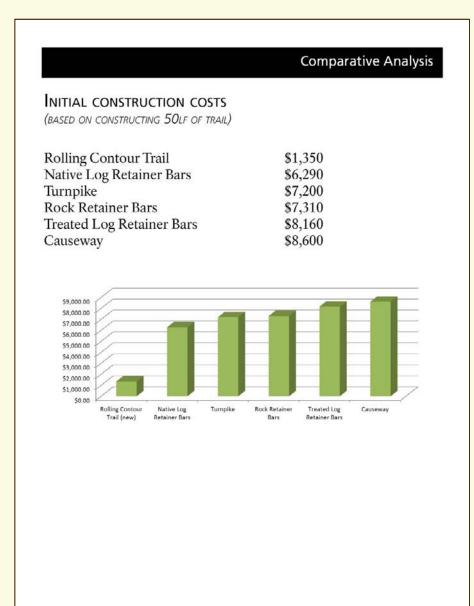
RMNP Recovery Plan – Choosing by Advantages 1 of 2

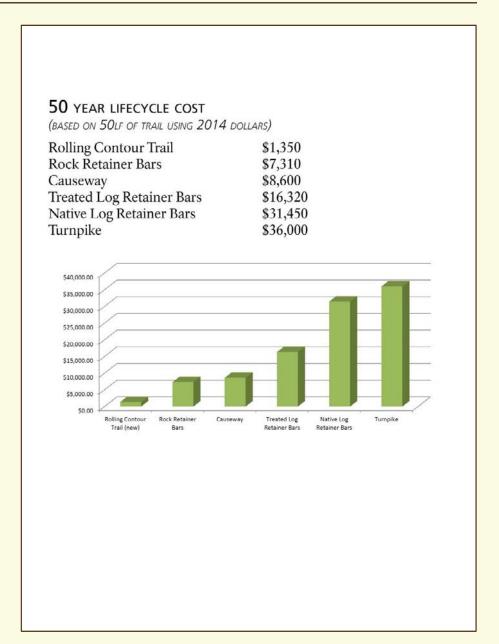






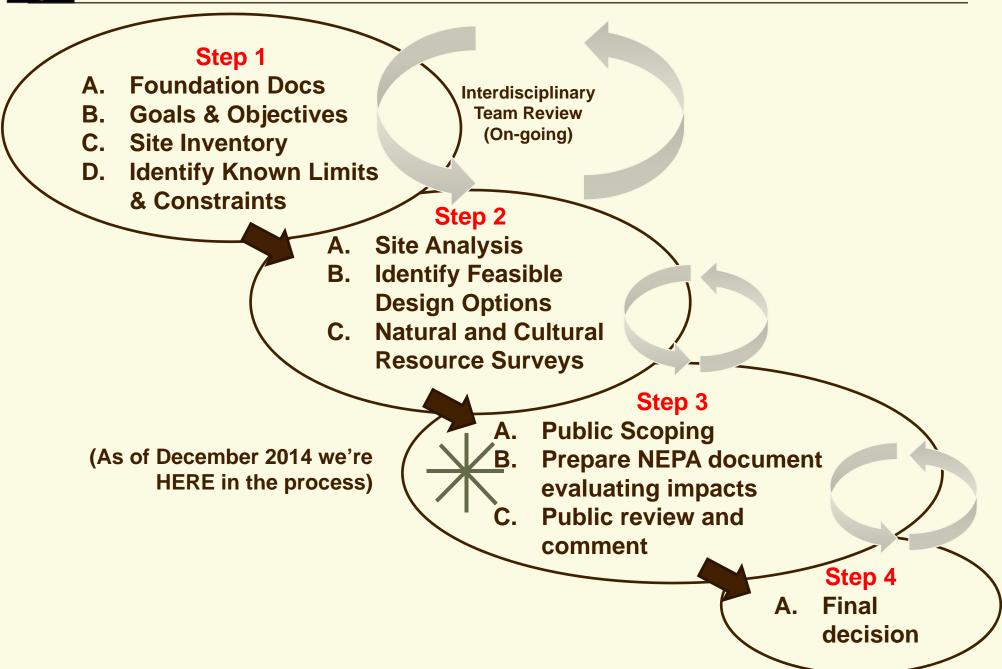
RMNP Recovery Plan – Choosing by Advantages 2 of 2







NEPA Compliance Process





Cultural Resources discovered during the design process...

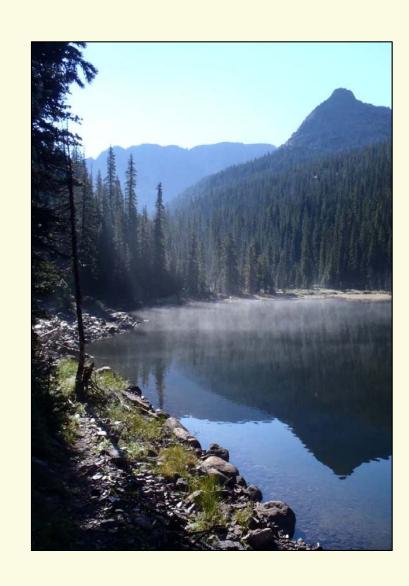




In some cases a poorly routed trail is necessary to protect these sensitive sites



- ◆ The initial trail layout for a NEPA compliance process should be general. In cases where multiple options may exist, it's best to identify control points and ideal "zones" for reroutes. Construction level detail comes later in the process.
- ◆ Be careful not to indicate or presume a "right" answer before the NEPA process commences. A Trail designer's role should be to answer "what can done," not "what should be done." Careful analysis and an interdisciplinary approach will flesh out the final answer.
- ◆ Communicate early and often that a sustainability ethic incorporates more than just Optimum Profile Grade and ideal topographic and environmental conditions.
- ♠ In some cases, the most ethical decision is to leave a less-than-ideal trail where it is. Cultural and natural resource protection takes precedence over ease-of-maintenance and visitor experience.







- ◆ Look for potential synergies with other park divisions when doing trail layout
 - i.e.: Moving a trail away from sensitive cultural resources, or high-value habitats and ecosystems.
- Form interdisciplinary design team as soon as possible and have them help you develop clear goals at the outset
- Have small interdisciplinary teams (three people is ideal) to perform preliminary trail layout in the field. Having a natural and cultural resources specialist on the field team is beneficial because...
 - Potential issues can be dealt with in real time during the beginning stages of feasibility scoping
 - Creates the opportunity for in-the-field interdisciplinary learning
 - Often time will lead to the identification of previously unknown resources
 - Creates an atmosphere of trust and open dialogue among various park divisions. Communication is KEY!



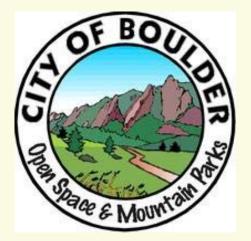


Before the Flood of 2013

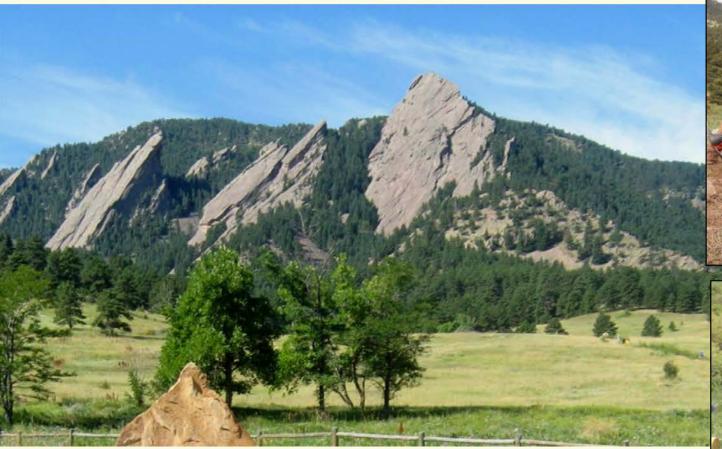


After the Flood of 2013 Hey – This Might Actually Be Better!

With a natural disaster, you never know what to expect!

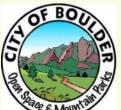


City of Boulder, Colorado Open Space and Mountain Parks

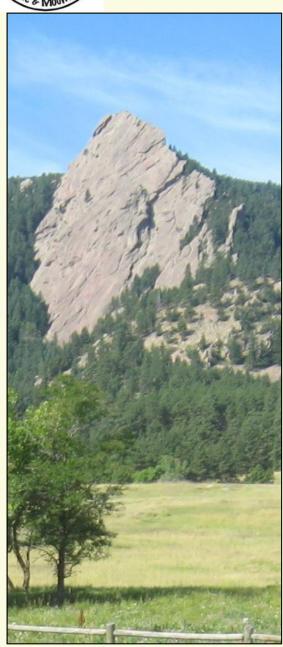




2013 Flood and Trail Sustainability



Background – Boulder Open Space & Mountain Parks



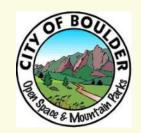
City of Boulder, Colorado – Open Space and Mountain Parks (OSMP)

45,000 acres – grasslands, foothills, and mountain terrain

145 miles of multi-use, non-motorized trails Trail users: a HIGH-use system of:

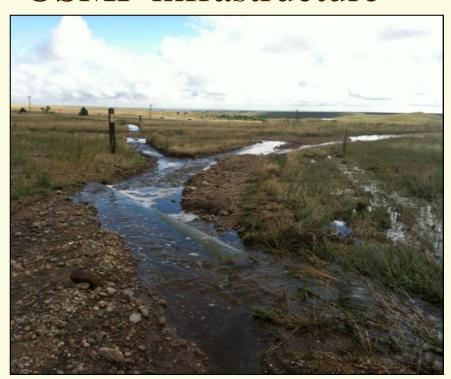
- Hikers
- Long-distance trail runners
- Mountain Bikers
- Equestrians
- Rock Climbers
- Wildlife enthusiasts
 - ...all seeking a combination of seeing nature, exercising, challenging themselves, spending time with others, seeking solitude, learning, and a host of other motivations.

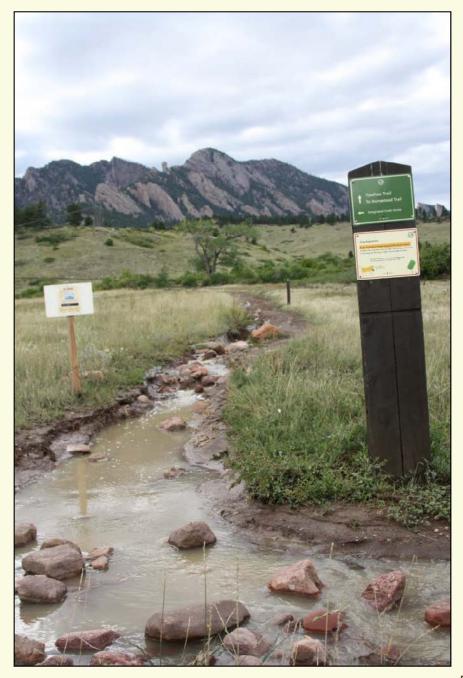




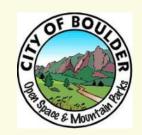
2013 Flood – Summary of Event 1 of 5

- 17 inches of rain
 September 9-15, 2013
- Intensive damage to trail system and other OSMP infrastructure





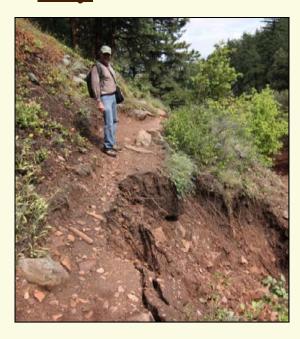
Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...



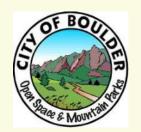
2013 Flood – Opportunity for Assessment 2 of 5

The flood was a rare and extreme event which gave us the opportunity to study:

- What trails survived the flood with little to no damage, and why?
- What trails were extensively damaged, and why?







2013 Flood - Post Flood Trail Assessment 3 of 5

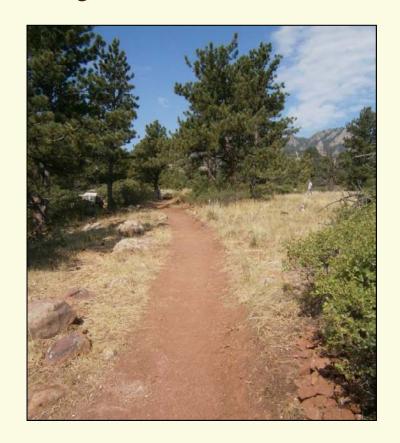
Unsustainable Trails:

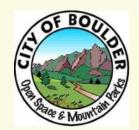
- Major soil loss
- Erosion gullies varying from a few inches to 10 feet deep
- Large depositional areas covering vegetation



Sustainably Designed Trails:

- No perceptible soil loss from trail surface
- Only damage was at sites where these trails crossed a drainage or ran close to an area with high flood water



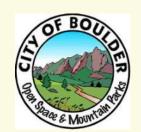


2013 Flood - Post Flood Trail Assessment 4 of 5



Why did some trails survive the flood?

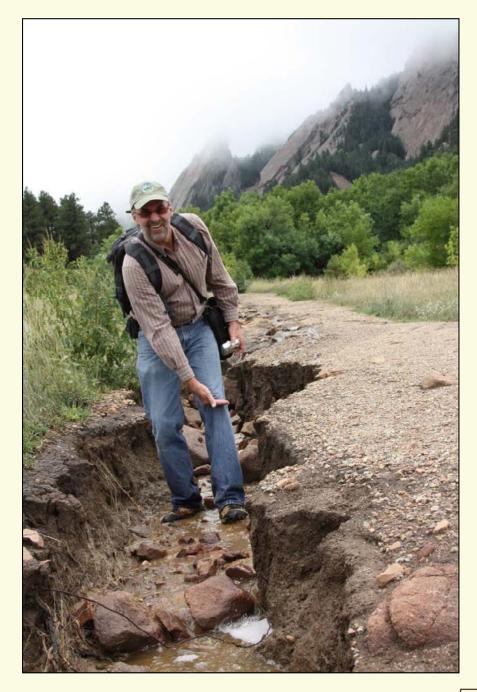
- Trails that meet sustainability criteria survived the flood very well:
 - Gentle trail profile grades relative to cross-slope
 - Profile grades ~ 8-10%
 - Incorporation of grade reversals
 - Out-sloped tread

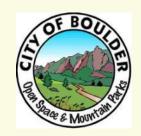


2013 Flood - Post Flood Trail Assessment 5 of 5

Why did other trails fail during the flood?

- Trails that did not meet sustainability criteria experienced extensive erosion:
 - Steep trail profile grades relative to cross-slope
 - Profile Grades > 8-10%
 - Had numerous prior "fixes" to try and keep them functional: waterbars and check steps
 - Pre-existing erosion issues

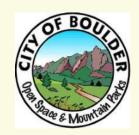




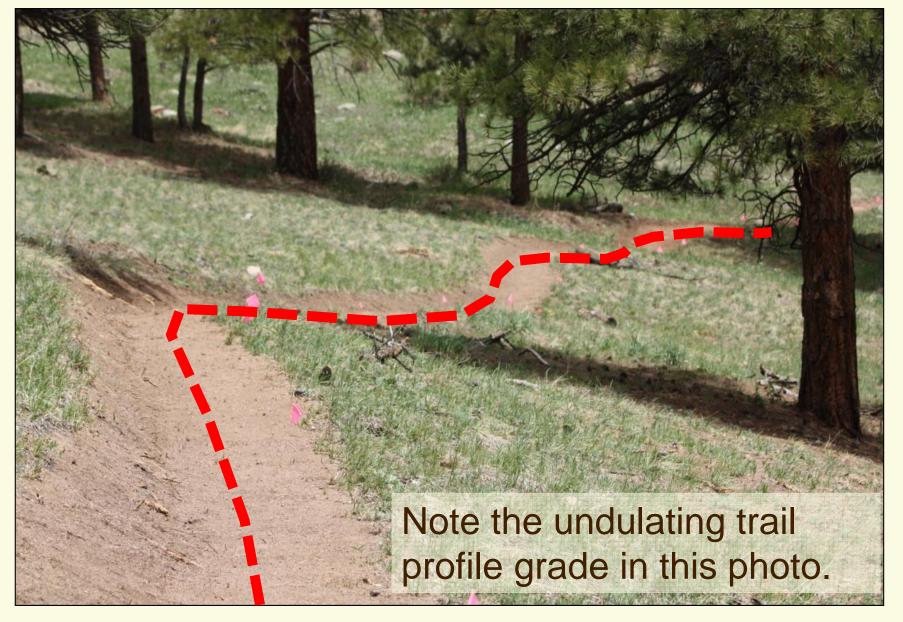
OSMP - Sustainability Tech: Grade Reversals 1 of 8



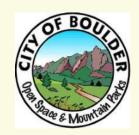
Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...



OSMP – Sustainability Tech: Grade Reversals 2 of 8



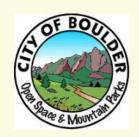
Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...



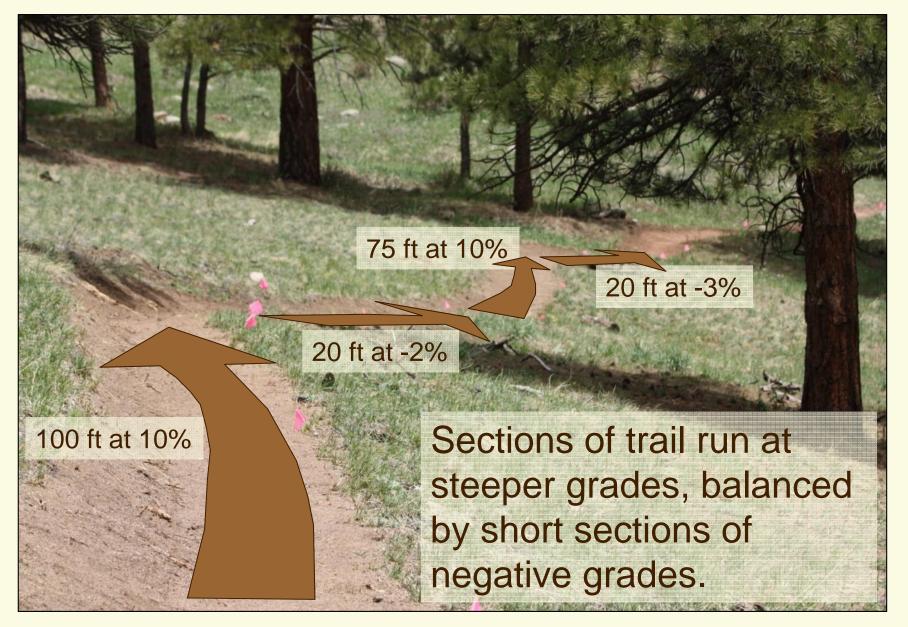
OSMP – Sustainability Tech: Grade Reversals 3 of 8

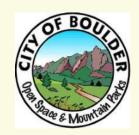


Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...

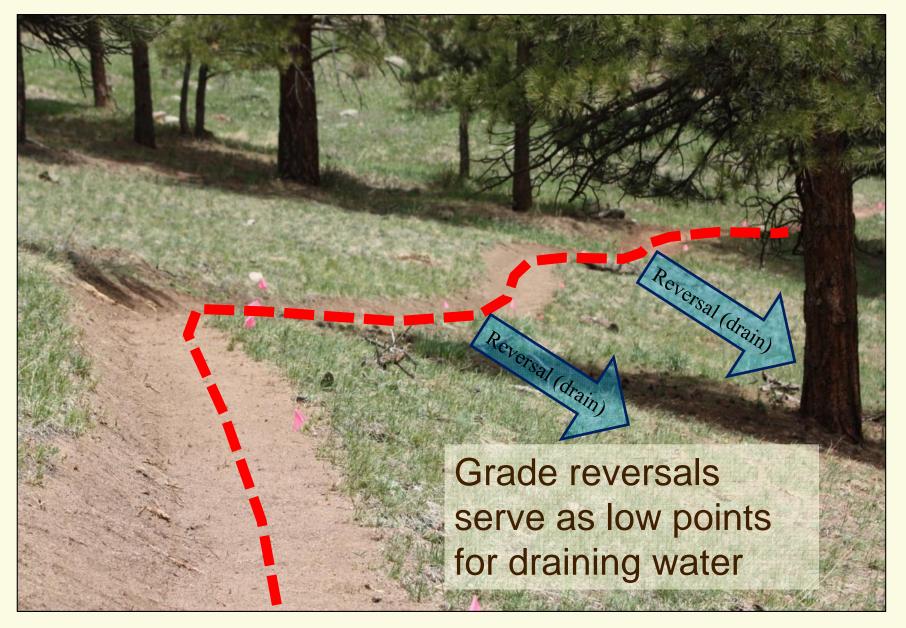


OSMP – Sustainability Tech: Grade Reversals 4 of 8

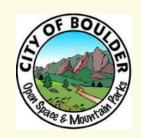




OSMP - Sustainability Tech: Grade Reversals 5 of 8

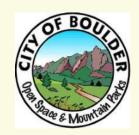


Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...



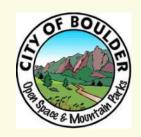
OSMP - Sustainability Tech: Grade Reversals 6 of 8



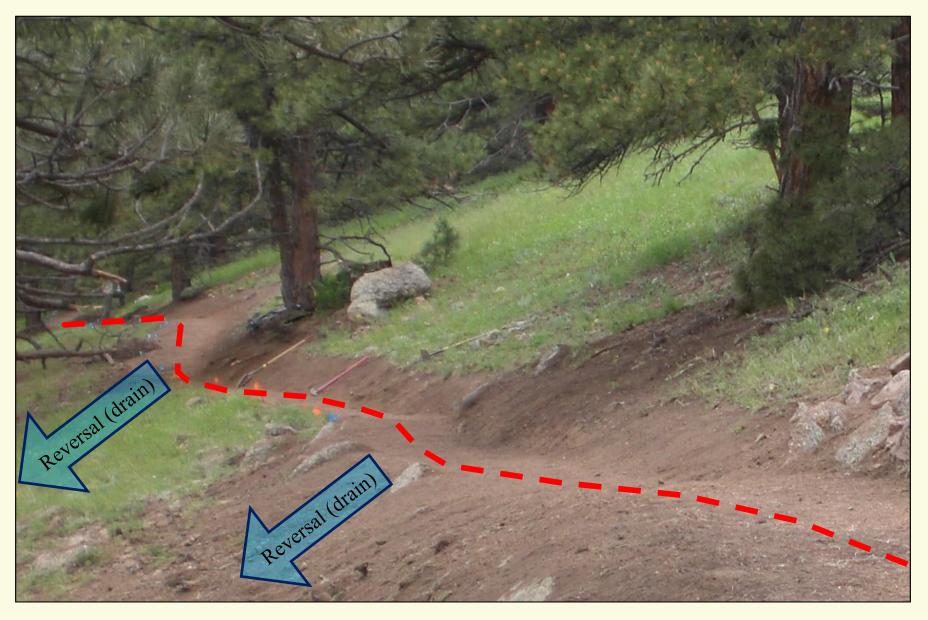


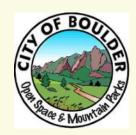
OSMP - Sustainability Tech: Grade Reversals 7 of 8





OSMP - Sustainability Tech: Grade Reversals 8 of 8

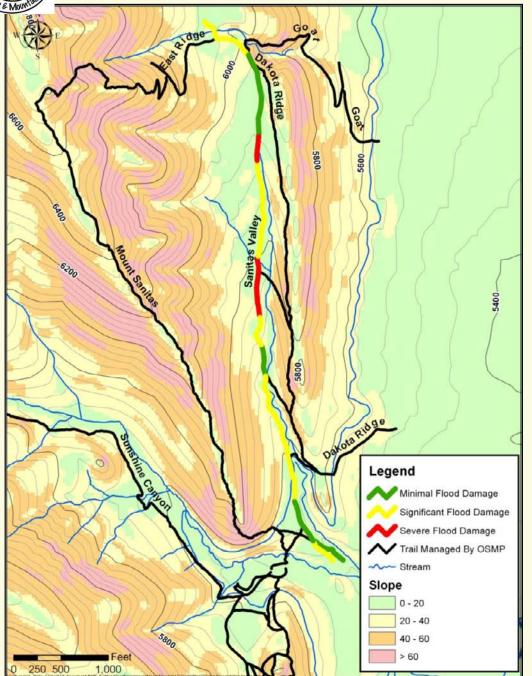




OSMP-Grade Reversals, Outslope (Cant) & Waterbars

	Grade Reversals	Outslope	Waterbars
Type of water flow:	Trickle flow	Sheet flow	Channelized flow (more potential for erosion)
Construction Labor:	Easy, with good layout/design	Moderate: takes a keen eye	Intensive: wood/rock work
Maintenance Requirements:	None	Moderate: requires regular re-shaping	Intensive: >annual clearing, replacement of rock/wood
Durability / Sustainability:	Excellent	Moderate: outslope will wear down over time	Moderate, BUT requires constant maintenance to be effective
Off-Trail Impacts:	Minimal	Minimal	Sediment deposits
Effectiveness:	Excellent	Moderate	Requires constant maintenance to be effective; ineffective at steeper grades (>15%?)

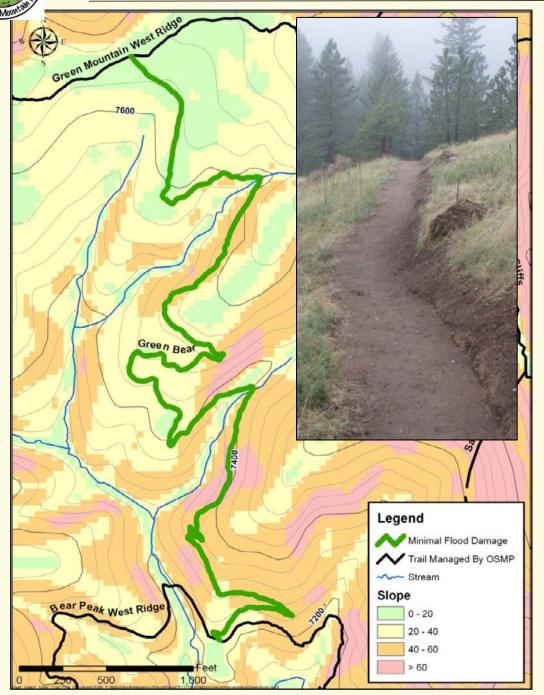
OSMP – Case Study – Sanitas Valley





	Sanitas Valley
Length:	6300 ft
Average Grade:	9%
Typical Cross- Slopes:	<20%, some 20-40%
Drainage Features:	Waterbars
Flood Damage:	Most: SIGNIFICANT- SEVERE

OSMP – Case Study – Green Bear Trail

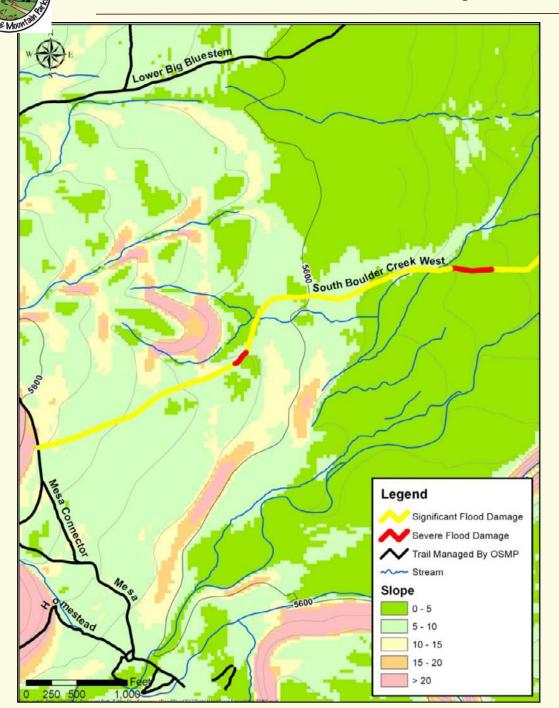


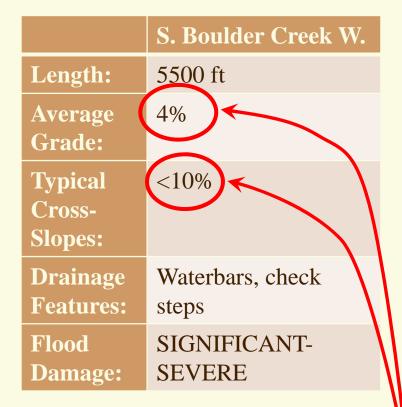


	Green Bear
Length:	7820 ft
Average Grade:	6%
Typical Cross- Slopes:	20-60%
Drainage Features:	Grade reversals, outslope
Flood Damage:	NONE

Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...

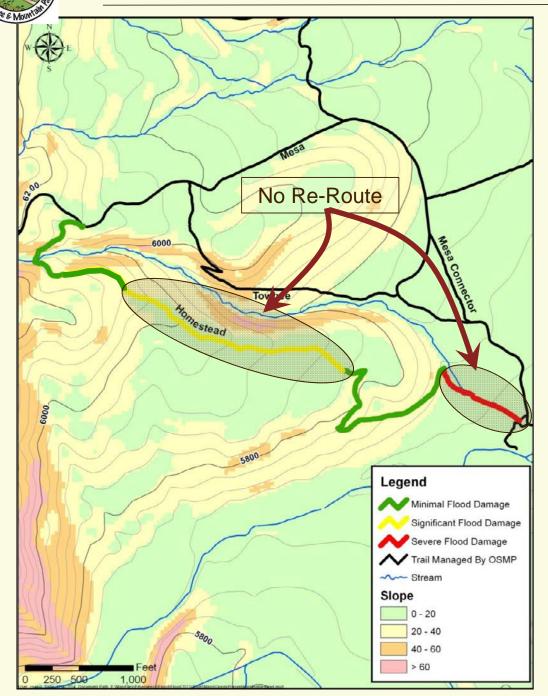
OSMP – Case Study – South Boulder Creek West





The lesson: While this trail is not very steep, it is too steep for this cross-slope. Trail grade relative to cross-slope needs to be factored in!

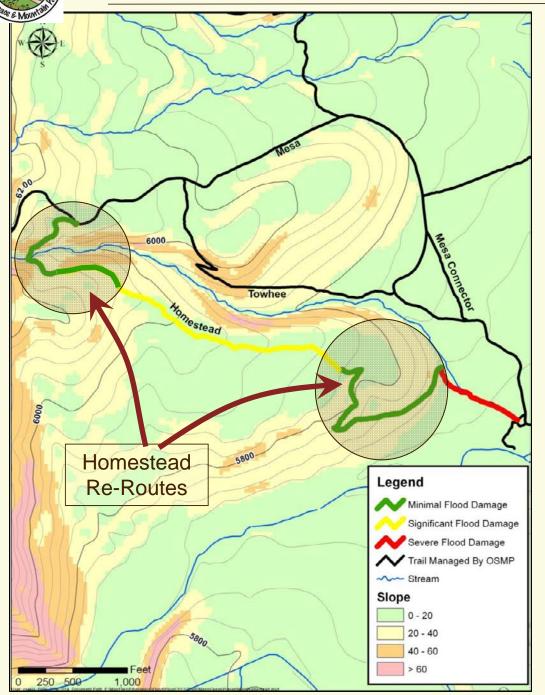
OSMP – Case Study – Homestead Trail – No Re-Routes



	Homestead, no re-route
Length:	Lower: 1000 ft Upper: 2590 ft
Avg Grade:	Lower: 6% Upper: 9%
Typical X-Slopes:	<10%
Drainage Features:	Waterbars, check steps
Flood Damage:	SIGNIFICANT-SEVERE

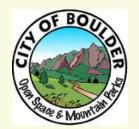


OSMP – Case Study – Homestead Trail – Re-Routes



	Homestead re-routes
Length:	Lower: 2320 ft Upper: 1850 ft
Avg Grade:	Lower: 7% Upper: 6-10%
Typical X-Slopes:	20-40%
Drainage Features:	Grade reversals, outslope
Flood Damage:	MINIMAL





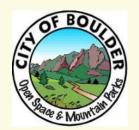
OSMP – 2013 Flood Take-Home Lessons 1 of 2

See pages 144 - 145 of the "Guide to Sustainable Mountain Trails Sketchbook"

- Sustainably-designed trails survived a 1,000-year flood event!
- Unsustainable trails did not.
- Trail sustainability is based on design principles and protocol.
- Trail design should incorporate:
 - Profile grades:
 - 1/4 < Profile Grades > 1/3 of Cross Slope
 - Max 8-10% sustained profile grades
 - Grade Reversals Common
 - Outslope (Construction Phase)







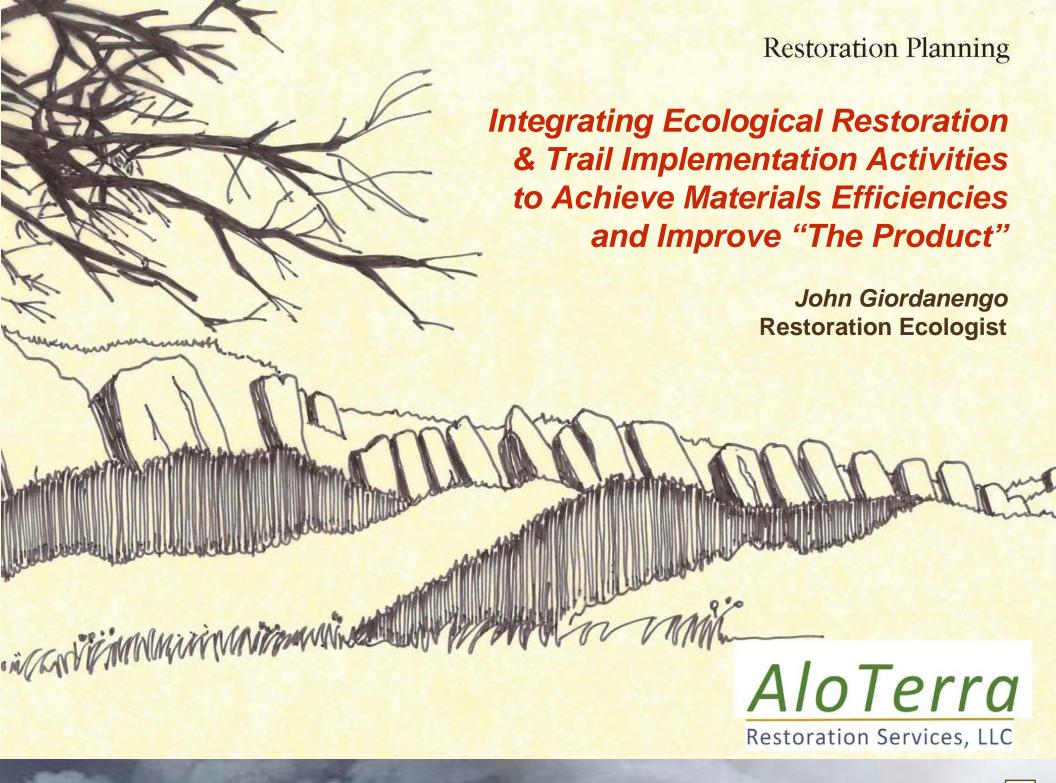
OSMP – 2013 Flood Take-Home Lessons 2 of 2

See pages 144 - 145 of the "Guide to Sustainable Mountain Trails Sketchbook"

- Trail design should <u>not</u> incorporate:
 - Profile grades >1/3 of prevailing crossslope
 - Profile grades > ~ 8-10%
 - If you have to design trails steeper than this, plan on armoring, e.g.
 - Steps
 - Staircases
 - Imported / alternate surfacing materials
 - Etc.
 - Waterbars











- What is Ecological Restoration?
- What is the Point?
- Standard Treatments
- Integrating Ecological Restoration with Trail Implementation
- Monitoring / Adaptive Management
- Questions & (Maybe) Answers

Inputs

- ◆ Typical Inputs
- Outputs from Other Process Areas
- ◆ Lessons Learned Summary

Accomplishing restoration activities parallel to new trail design activities communicates a sense of responsibility towards resource stewardship.



Tools & Techniques

- ◆ Typical Tools & Techniques
- Web Search / Literature Review / Science Review
- Establish Restoration Goals
- ◆ Site-Specific Site Analysis
- Microclimate Analysis
- ◆ Estimating Techniques
- 4-Step Restoration Design Strategies
 - Closure Strategy
 - 2. Stabilization Strategy
 - 3. Revegetation Strategy
 - 4. Monitoring & Evaluation Strategies
- ◆ Compliance Review
- ◆ Funding Strategy
- Management Team Review
- ♦ Compliance Review

Outputs

- DRAFT Restoration Planning Package for Review
 - ♦ Written Summary
 - Plan Drawings
 - ◆ Typical Sections
 - ♦ Typical Details
 - Custom Details
 - ◆ Cost Estimates
 - Materials List
 - ◆ Labor Estimates
 - ◆ Specifications
 - Trail Management Techniques
 - ♦ Actions Sequences
 - ♦ Checklists
 - ◆ Lessons Learned Summary
- ◆ FINAL Restoration Planning Package
- FINAL New Trail Design Package

See **Sketchbook** pages 83 – 94.







Ecological restoration is the process of assisting in the recovery of an ecosystem that has been degraded, damaged, or destroyed.

The key word is "PROCESS."





- User Management
- Aesthetics
- Protect Rare Species, Water Quality, Etc.
- Free Materials for Trail Implementation
- Free Disposal of Trail Building Materials

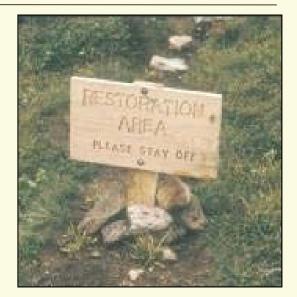
Aquilegia saximontana



4 Steps to Ecological Restoration for Trails



- 2. Slope Stabilization
- 3. Revegetation
- 4. Monitoring / Adaptive Mgt.







Sample Ecological Restoration Closure & Signage













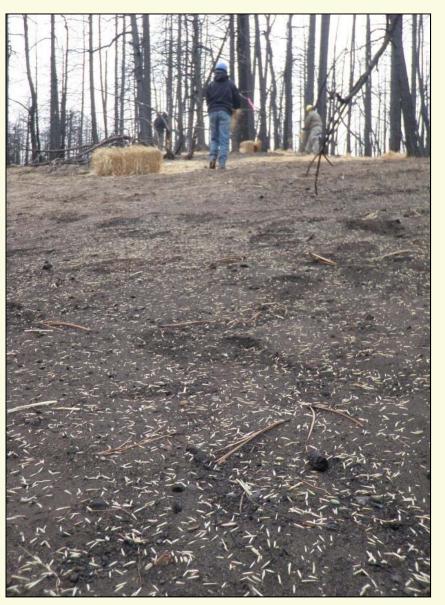
- Grasses
- 8" Depth
- 8" Width

"Replace Your Divots!"



Sowing of Native Seed Example





Bromus marginatus (Bromar, MT)

Elymus trachycaulus (Prior, CAN)

Pascopyrum smithii (Rosana, MT)

Poa secunda (Mountain Home, MT)

Triticale



Unconventional Use of Rakes









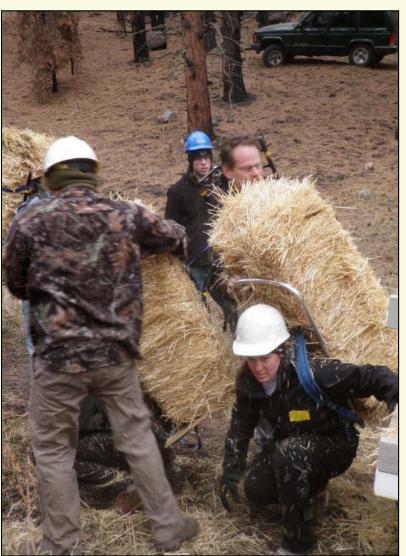






Hand Mulching



















Mulch is....

If soil is the mattress...

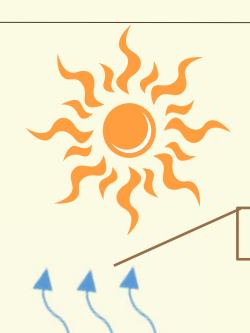
- Compost
- Fertilizer
- Humate
- Topsoil



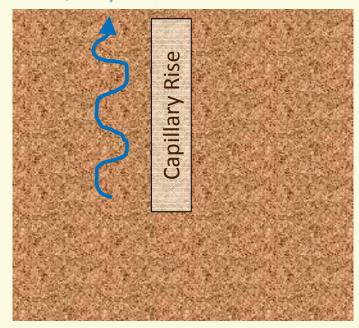






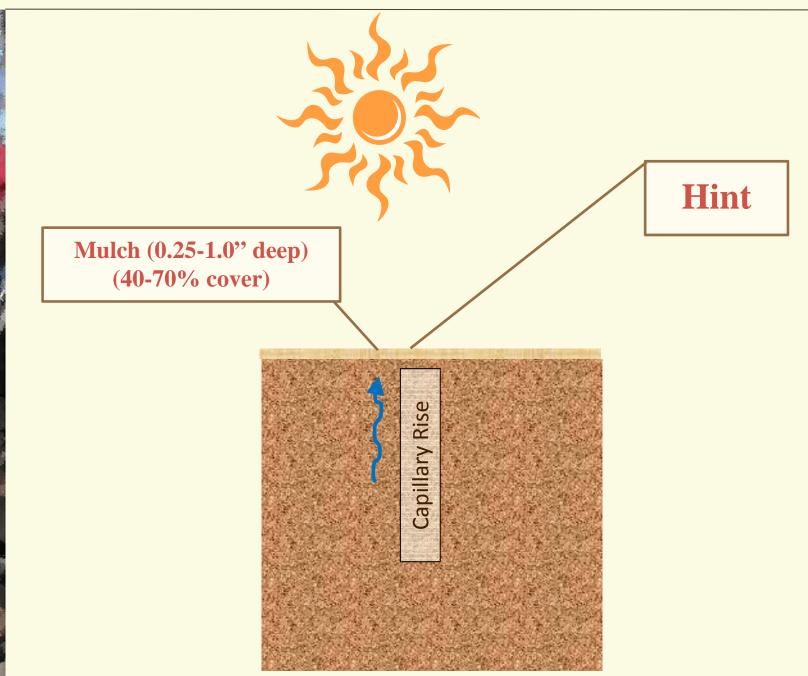


Evaporation (41" annually)





What is the Difference in This Picture?

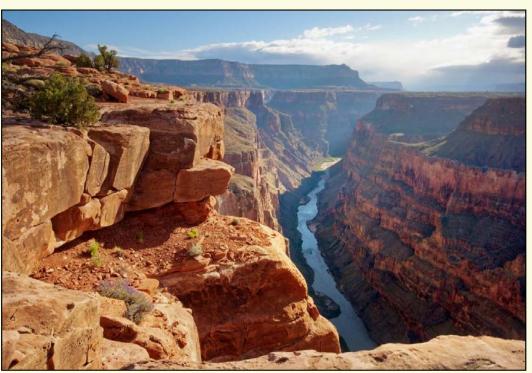


69



Gulley-ing Examples





Extreme

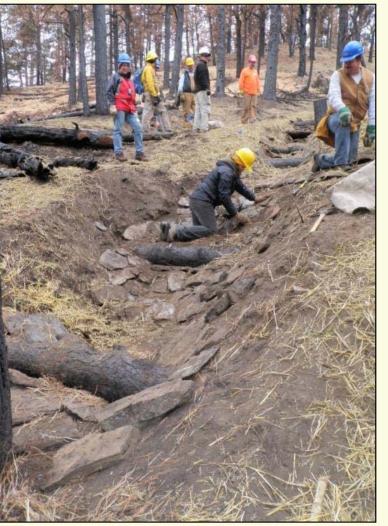










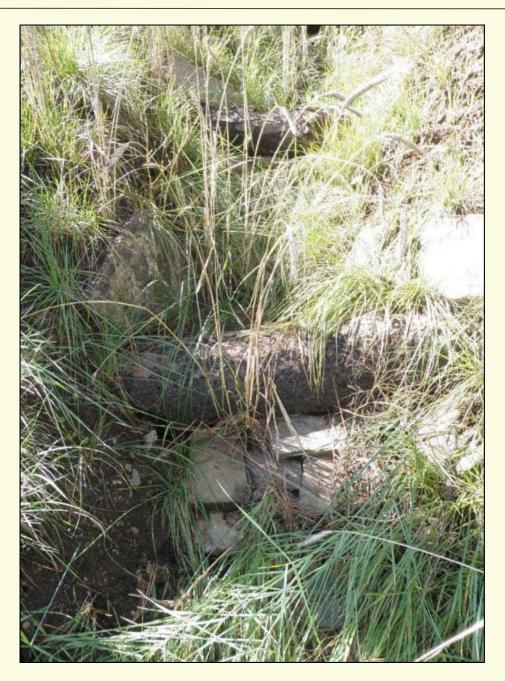


















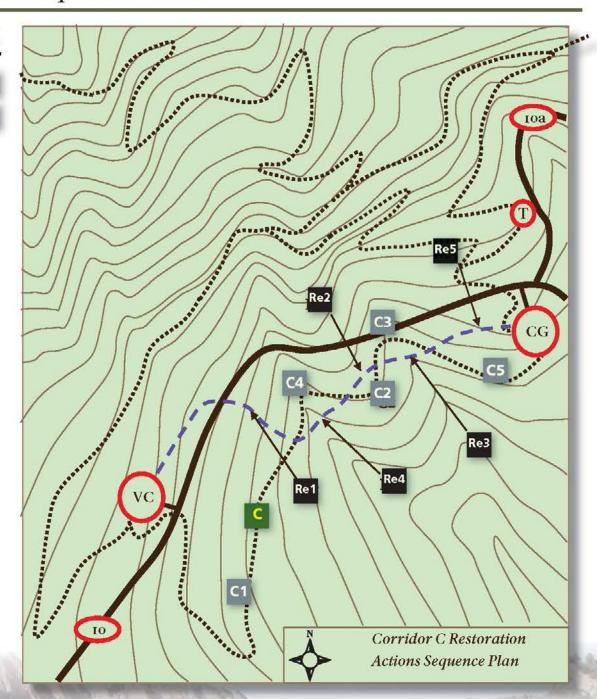


Corridor Restoration Actions Sequence - Plan

Legend

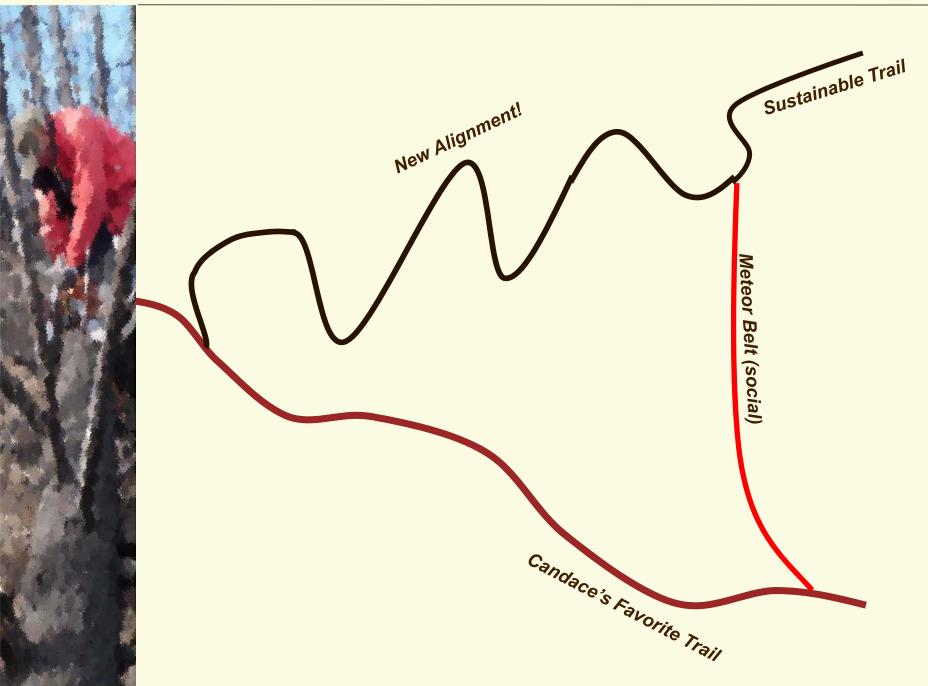
Restoration Actions Re4

Construction Actions C5



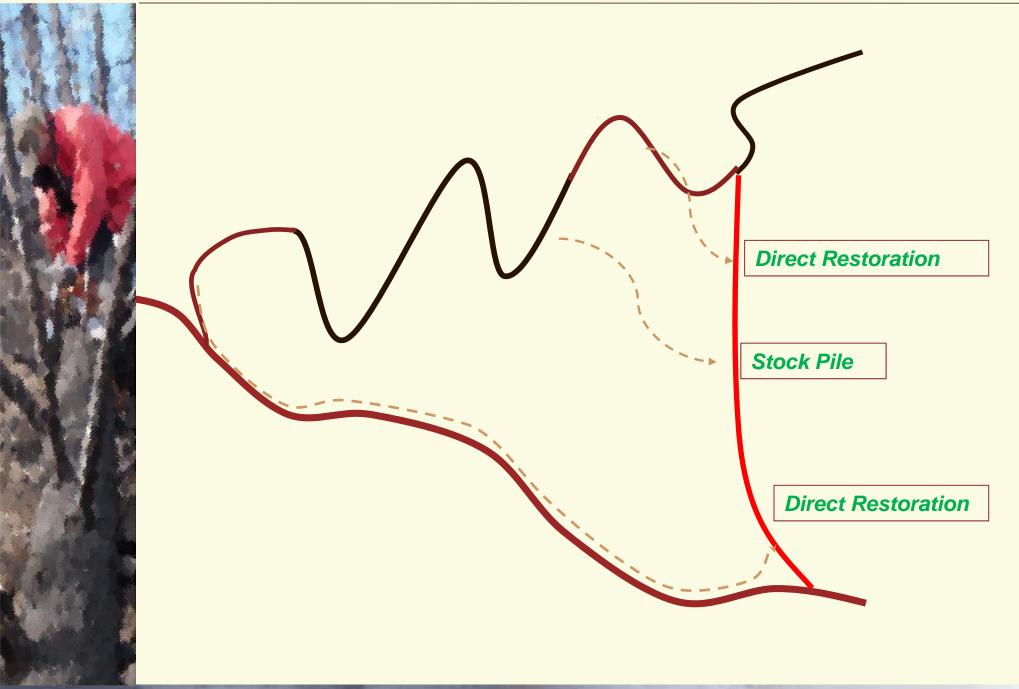


Restoration and Trail Closure Planning Sequence



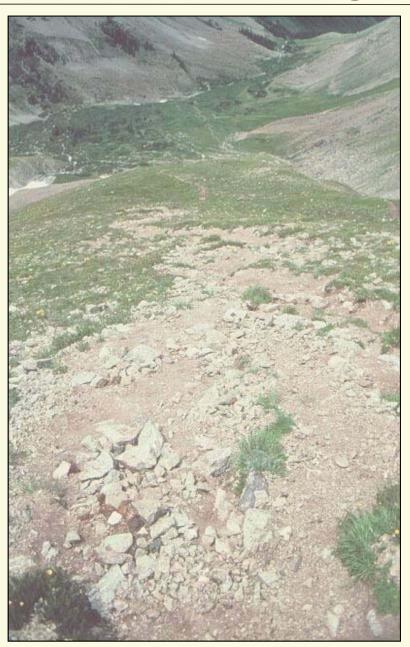


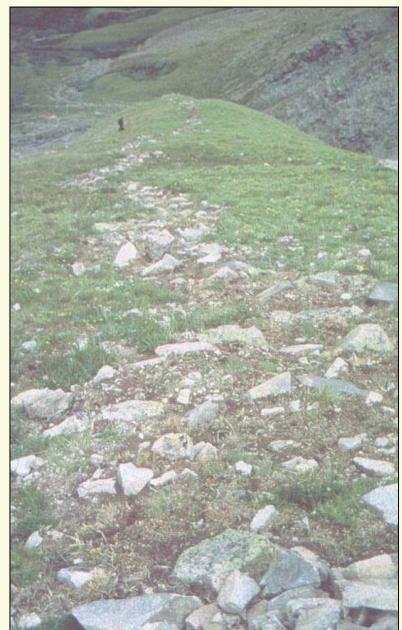
Restoration and Trail Closure Planning Sequence



AloTerra
Restoration Services, LLC

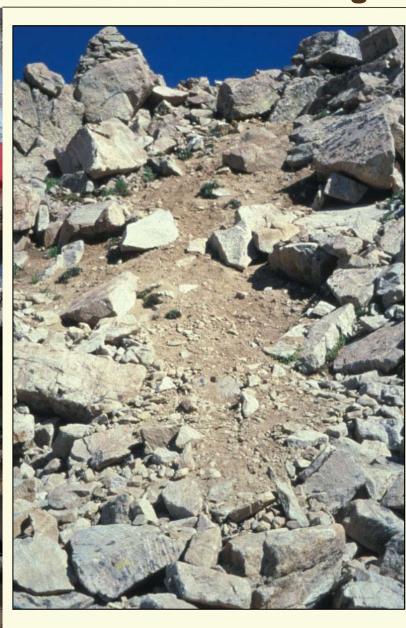
Before & After Ecological Restoration Photos 1 of 2

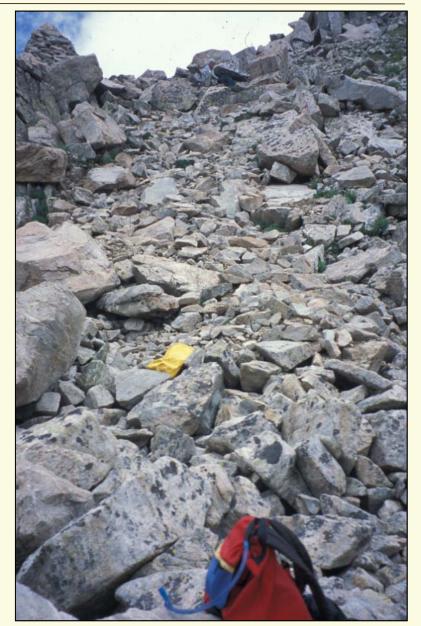




AloTerra
Restoration Services, LLC

Before & After Ecological Restoration Photos 2 of 2













Field-Based Sketchbook / Workbook Training Process



Sketchbook / Workbook Training - Preparation

- 1. Sketchbook / Workbook Preparation ~ 40 hours
 - 1. Utilize InDesign or PPT format
 - 2. Incorporate GIS exports / SketchUp / other graphics
 - 3. Cut / paste Sketchbook / other information
 - 4. Include lots of space for notes / sketches
- 2. Can establish Beginner, Intermediate, Advanced levels
- 3. Send out links to enrolled students 2 weeks in advance
- 4. Host Team to identify a real life issue a "Student Project"
- 5. Host Team to provide GIS / other outputs
- 6. Host Team to provide logistics support
- 7. Host Team to provide Workbook materials, markers, pin flags, flagging, etc.
- 8. Host Team to also have local opportunities to talk about global issues if not available on the project site.
- 9. Non-Profit Partner (VOC, CFI, etc.) Sponsorship a +
- 10. Need fall-back position, i.e.: Classroom or similar, and a copy machine is helpful

Sketchbook / Workbook Training – Format

- 1. 100% Field work is best, the best classroom there is ...
- 2. 2-Day Trainings are usually sufficient ...
 - A. Can also be done during the week per you staff's schedule or on a weekend
- 3. 1.75 days Training
- 4. .25 days Presentations
 - A. 12-15 minutes each team with Feedback
 - i. Management Review a +
 - B. Each team focuses on a particular issue or constraint
- 5. Can be customized per Agency or Non-Profit interest
 - A. Hiking only
 - B. Historic trail rehabilitation in kind
 - C. Multiple use / hiking / horse / mountain bike
 - D. Climbing access
 - E. Mountain bike only
- 6. Agency Certificate / Non-Profit Partner Certificate

Sketchbook / Workbook / Organization

Training Curriculum

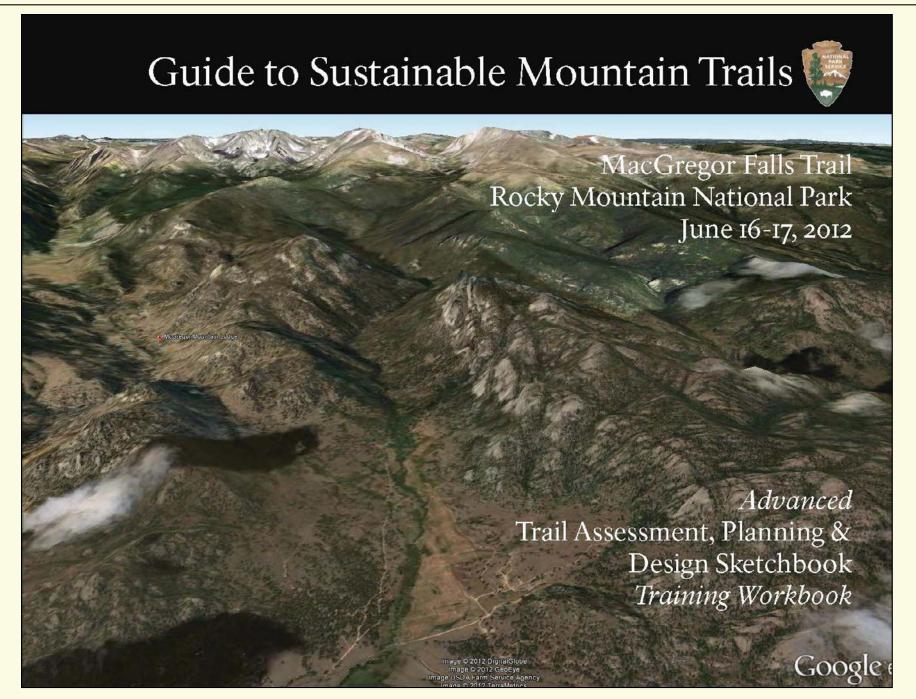
- 1. Staff / Instructor Assignments 3 4 Recommended
- 2. Interdisciplinary Teams of 4 5 Recommended
- 3. Staff / Instructor Roles & Responsibilities

Tools & Techniques

- 1. Classroom / Lecture & Discussion
- 2. Walk & Talk
- 3. Field Work / Observation / Note Taking / Journaling / Photography
- 4. Group Discussion
- 5. Individual Activities
- 6. Research
- 7. Reading Assignments

Round Robin / Rotate throughout the training! Have loads of fun!

Sketchbook / Workbook Training Process 1 of 8



Sketchbook / Workbook Training Process 2 of 8

Organic Act	Recreation Accessibility
National Park Service Management Policies	Sustainability
Natural Resources Management Guidelines	Value Analysis / Choosing by Advantages
National Park Service Green Parks Plan	RobinWinksArticle
Wilderness	Preservation / Conservation Literature
CCC - Era	Other

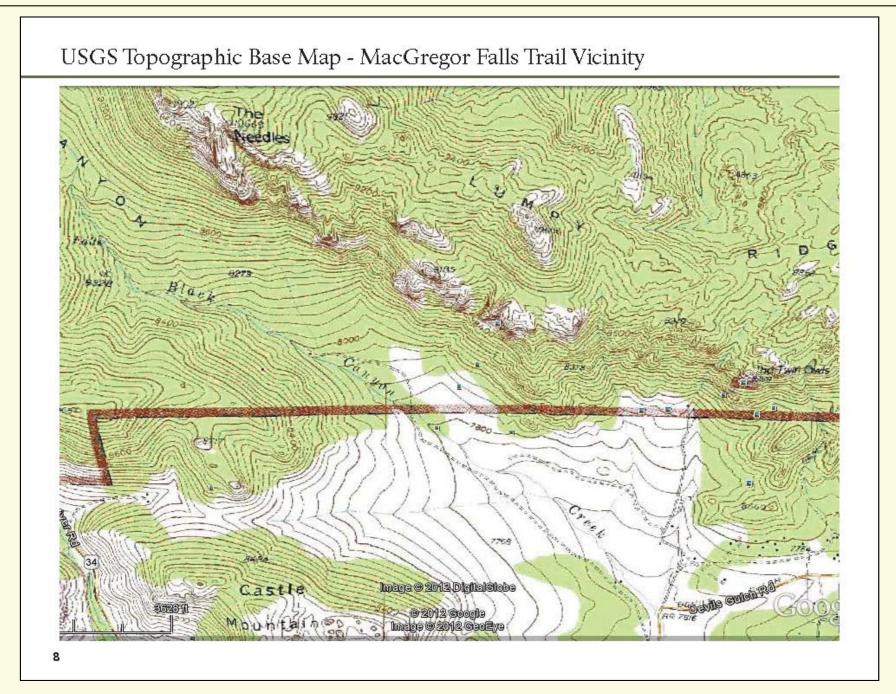
Sketchbook / Workbook Training Process 3 of 8

MacGregor Falls Trail Project - Stakeholder Analysis

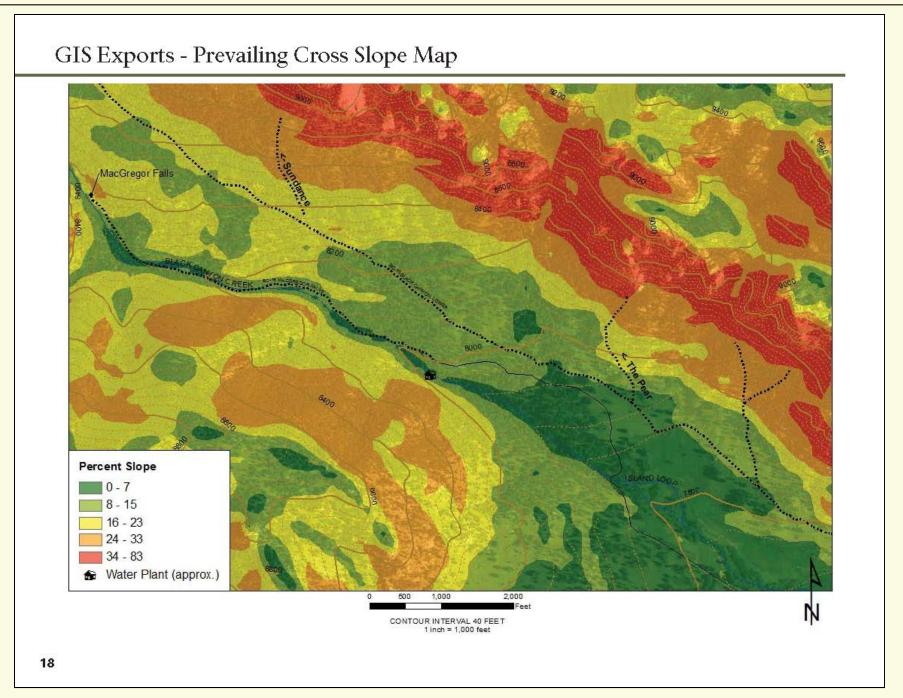
1 2 3 3 4 4 5 6 7 8 9 9 10 9 11 11 12 12 13 14 15 15	2		Stakeholder	Interest	Influence	Information
3	3	I			3	
4 6 5 6 7 8 9 9 10 9 11 12 13 14	4 6 5 6 7 8 9 9 10 9 11 12 13 14 14 15	2				
5 6 6 6 7 7 8 9 10 11 11 12 13 14	5 6 6 6 7 8 9 9 10 9 11 12 12 13 14 14 15 15	3				
6	6	4				
7	7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	5				
8 9 10 10 11 12 13 14	8 9 10 11 12 13 14	6				
9	9	7				
II II 12 I3 I4	10 II 11 II 12 II 13 II 14 II 15 II	8				
II 12 I3 14	II I2 I3 I4 I5	9				
12 13 14	12	ю				
13 14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	I3 I4 I5 III	II				
14	14 15	12				
	15	13				
15		14				
	lotes	15				

6

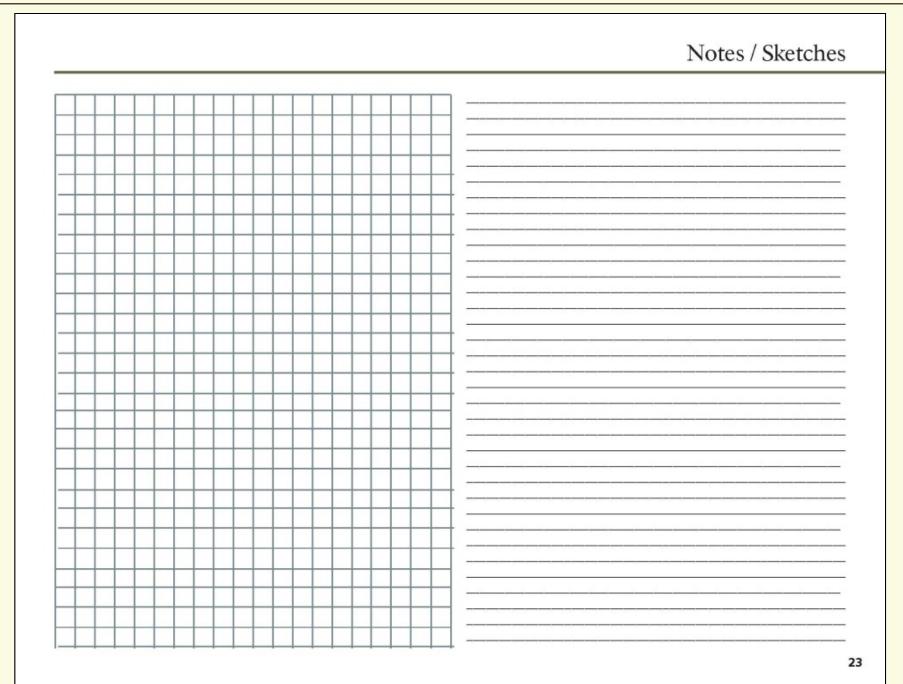
Sketchbook / Workbook Training Process 4 of 8



Sketchbook / Workbook Training Process 5 of 8



Sketchbook / Workbook Training Process 6 of 8



Sketchbook / Workbook Training Process 7 of 8

Estimates_						
					<u> </u>	
Station	Cross Slope	Cross Slope	Profile	Azimuth	Soils	New Trail Design Notes / Mgt. Options
Station	Cross Slope Left (%)	Right (%)	Grade (%)	Azimium	30118	New Itali Design Notes / Mgt. Options

Sketchbook / Workbook Training Process 8 of 8





Sketchbook / Workbook Curriculum Overview 1 of 2

	1727				Falls Trail ~ 6.	D= Danny
Suggested Dur	atior		Sketchbook P	age #		= Hugh Kevin Matt (RMN
"Why's & How's"	Suggested Duration	Sketchbook Page #	wo-Day Sketchbook Seminar Outli		Advanced Class	Rocky Mountain N Park TWG = Trails Wol Group)
Sketchbook / Training Overview	0.25	156	Purpose of Training / Goals / Studer Expectations (3 or 4 Each Please)	11		н
		1		,	1	
/				'	Made a Anna ann ann ann an ann an an ann an ann an a	5 / Milen exprosite
/ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \					Adranced Package - Draft fo Use; Highest Graphic Qu	
				•	Photographs and Most De	
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \				L&D = Lecture & Discussion	on Analysis; Some Independ	ent &
					Creative Work (Fill in Boo	
1				= Individual Activity RI Role Play FE:	P = // heckoff ~ 90% + Items, Perf = / Problem Quality - Students J	50.0 (E-1); T-1 (E-1);
					Recommendations), Exceller	
				Sketch & Charette	& Excellent Graphic Commu	
Project Overview			MacGregor Falls Trail / MacGregor F		1	K
Training Purpose						D
Partnership / Nonprofit Role				Tooching Took	nigua	M
How to Get an "A" in This Training	0.00	100 101	1077a-2-24-02221-a11	Teaching Tech	iiiique	H
Sketchbook at a Glance	0,25	160 - 161 3	"Find it All Here" Table of Contents	L&D		H
		156	Towards a Sustainability Ethic	GA/IA	X	Instructor
1		4	History of the Sketchbook	L&D	Î	IIISII UCIOI
•		5	Purose & Target Audiences	L&D	T X	Т Н
ketchbook Outline			Art & Science	L&D	XXX	Н
			Trail Project Cycle Tool	L&D	X	H
5		17	Trail Project Management	L&D	X	Н
6		17	Typical Tools & Techniques	L&D	XXX	Н
		17	Management Team Review	L&D	XXX	H
9		17 18	Compliance Review (NEPA & Section	on 106) L & D GA / IA	XXX	H
		144	Lessons Learned Techonique Pitfalls to Avoid	L&D	X	H
		A 3000000 Y	Lessons Learned	GA / IA	X	
2		145, 146, 147	More Tools	L&D	X	H H
3		154	New Tools & Techniques	GA / IA	Î	— 1 H
4		10.1	Synthesis	- Ottor	0	-
5 Foundations	0.50		"Stand on These"	L&D	3	H
6		8	Olmsted Report	L&D	XXX	H
7		10, 11, 12, 13	Policies of ASLA, i.e.: Protect, Resp	ect, En L&D	XXX	K
8		10	1 Environmental Ethics	L&D	XXX	K
9		10	2 Research	L&D	XXX	K
9		-10	2 (tooodion	2.00	737373	13 10 80

Sketchbook / Workbook Curriculum Overview 2 of 2

34 New Trail Design - Part II	0.50	100.00	"Applying the Art"	CA NACIMAGE SI PLANT PARATTAN	HEREITE .	D
35		81	New Trail Design - Design Notes Example	GATIATW&T	XXX	D
136		102 - 118	Implementation Techniques & Options	GA/IA/W&T	XXX	M
137		73 - 81	Field Work - Teams Prepare Draft New Tra	GA/IA/W&T	XXX	TEAMS
138			Synthesis	L&D	Ŷ.	D
Maintenance / Rehabilitation / Armor						
139 Spectrum	0.25	21-2-18	"Ensuring Mountain Trail Sustainability - It i	L&D		D
140		134	Maintenance, Rehabilitation & Armor Desig	L&D	X	K
141		125	Maintenance, Rehabilitation & Armor Desig	L&D	X	K
142		125	Output: Maintenance, Rehabilitation & Armi	L&D	X	K
143		126	Maintenance / Rehabilitation / Armor Strate	L&D	X	D
144		127	Trail Maintenance Design	L&D	X	D
145		127	Maintenance Tools & Techniques	L&D	X	Ď
46		128	Trail Rehabilitation Design	GA/IA/W&T	- X	D
147		129	Rehabilitation Tools & Techniques	GA/IA/W&T	- X	D
148		The second secon	Armor Design	GA/IA/W&T	XXX	D
149		72, 130, 132 déjàvu	Trail Management Options	VACIACITIST	X	-
150		uejavu -	Maintenance / Rehabilitation / Armor Desig	L&D/S&C	Ŷ	K
51		_	Synthesis	2007000	^	K
	0.25		"A Bridge May be the Largest Single Investme	ont Along a Trail		D
52 Mountain Trail Bridges	0.23	400		translation to the second seco	307	.D
153 154		100 97	Mountain Trail Bridges Checklist	L&D	XX	15700
		1000000	Mountain Trail Bridges Flowchart	L&D	XX	D
55		97	Output: Mountain Trail Bridges Summary P	L&D	XX	D
156		déjàvu	Web Search / Literature Review / More Tod			120
157		98	Mountain Trail Bridge Design Overview	GA/IA/W&T	XX	D
158		99	Mountain Trail Bridge Options	GA/IA/W&T	XX	D
159		54	Choosing by Advantages or Value Analysis	GA/IA/W&T	XX	0 1 07
160			Synthesis			D
161 Restoration Planning	1.00		"The Intrinsic Values of our Impacted Lands V			K
162		94	Restoration Planning Checklist	L&D	XXX	K
163		85	Restoration Plannint Flowchart	L&D	XXX	K
164		85	Output: Restoration Planning Summary Pag	L&D	XXX	K
165		déjàvu	Web Search / Literature Review / More Tod	84		3080
166		87	Restoration Goals	L&D		
167		87	Why Restoration?	L&D	"Let Them	Make
168		90	4-Step Restoration Planning Strategies	GA/IA/W&T	200 1110111	mano
169		90	Closure Strategy	GA/IA/W&T	Their Cas	20"
170		90	Stabilization Strategy	GA/IA/W&T	Tilleli Ca	5 C
171		90	Revegetation Strategy	GA/IA/W&T		
172		90	Monitoring & Evaluation Strategies	GA/IA/W&T	XXX	DK
173		92 - 93	Restoration Actions Coquences	GA/IA/W&T	XXX	DK
74		_			XXX	M
175 Individual Time / Team Time	3.00		Team Design / Creativity / Charette Tim		Proposition A	TEAMS
176 New Trail Design Review	1.00		"Let Them Make Their Case"	<u> </u>		TEAMS
177 New Hair Design New ew	1.00		Each of 4 teams makes a 15-minute preser	RP	XXX	TEAMS
178 The Trail Ahead		72	Technology Will Strengthen a Trails Program		50000	JEANO:
179 Seminar Synthesis	0.25		Synthesis - z-Day Deminar	GA GA		DKMH
180 Semina Synthesis	0.25	154	The Trail Ahead	L&D	XXX	DKWIH
ME EUR		154			1,000,000	
181	0.25		Take Aways (Compare to Expectations)	GA / IA / RP	XXX	STUDENTS
182	0.25		Evaluations	GA/IA/RP	XXX	STUDENTS

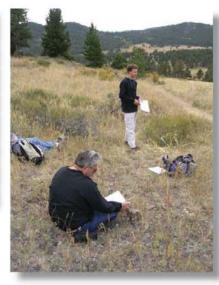
Cal Wood Nature Center / Mt. Yale with CFI / U. of Denver



Stewardship Partnerships & Training. Providing agency staff and volunteer training opportunities streamlines the delivery of sustainable trail projects while increasing achievement of land management agency stewardship goals.











Wife Dawn



Is it a Process or a Product that you are after?

- 1. The Sketchbook and the Sketchbook / Workbook Trainings emphasize a continuously improving Process.
- 2. The *Sketchbook* and the *Sketchbook* / Workbook Trainings emphasize a continuously improved Product.

However, we don't feel that improving the Product, in its current state, is sufficient.

That is where improving the Process comes in.

Improving the Process, will ultimately lead to less Product to have to correct!

Towards a Sustainable Mountain Trail Ethic ... Synthesis 2 of 3

- 1. Achievement of Sustainable Mountain Trails ... requires hard work.
- 2. "Art," the creativity part of the "Art & Science" is ...
- 3. The "Science" part ... is coming into clarity as being as important as the "Art" part.
- 4. Communication, and new methods of communication are critical to how your team will achieve success.
- 5. Consider Sustainability as Tri-Partate
 - A. Environmental
 - **B.** Organizational
 - C. Economic
- 6. ^ We have truly only talked about Environmental Sustainability, but my premise is that Environmental Sustainability will give your Organizational and Economic Sustainability better hope for success.

Towards a Sustainable Mountain Trail Ethic ... Synthesis 3 of 3

The nation's backlog of unmaintainable trails ...

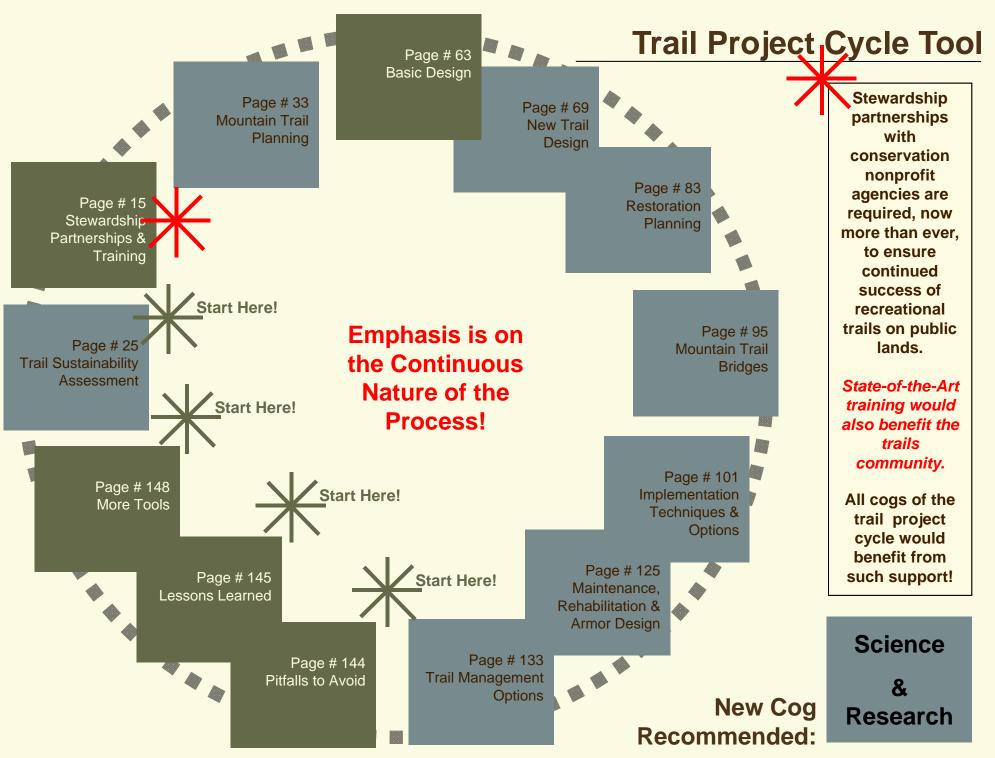
... coupled with the dwindling recreation budgets of land management agencies ...

... indicates the overwhelming need to ...

... teach and train more trail leaders ...

... reach out to the scientific community to facilitate the best avenues to pursue research on factors which influence environmental sustainability and ecosystem recovery ...

... and at the same time, new partnerships are required to strengthen the trails community and extend its reach ...



Sustainable Mountain Trails Webinar #3 Towards a Mountain Trail Sustainability Ethic ...

- 1. Study historic / inspiring conservation literature?
- 2. Get refreshed with Sustainable Mountain Trails literature?
- 3. Have a fresh look at your trail projects regarding sustainability?
- 4. Take AT Webinars? Take archived AT Webinars?
- 5. Initiate a new partnership?
- 6. Conduct training for your agency / partners?
- 7. Go to the National Trail Symposium in Portland in 2015?
- 8. Obtain a mentor from the Trails Community?
- 9. Conduct Damage Assessments after storms?
- 10. Conduct Trail Sustainability
 Assessments in advance of your trail plans?
- 11. Initiate a Scientific Study in advance of starting a mountain trail plan?



<u>Popular Literature Research – Internet</u>

Jump to ...

NPS Sustainable Trails website

http://www.nps.gov/dsc/trails.htm

National Park Service Key Trail Literature (New Resources)

http://www.nps.gov/dsc/trails-literature.htm

American Trails / Resources website

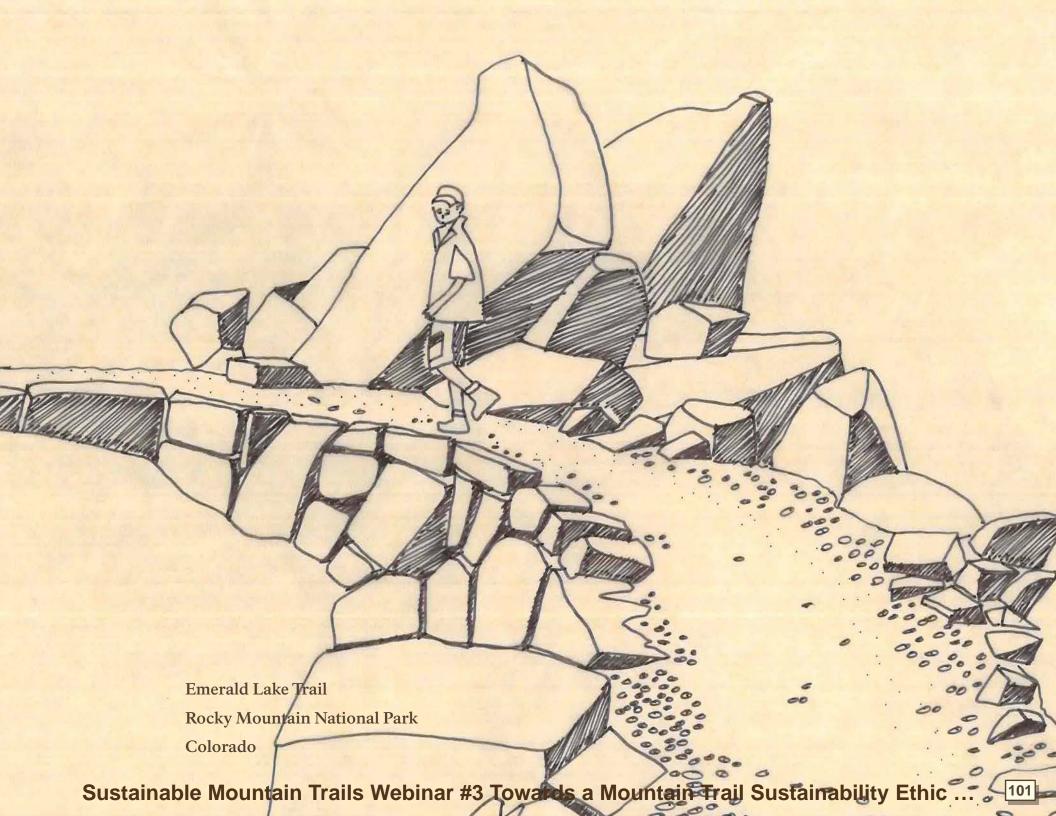
http://www.americantrails.org/resources/index.html

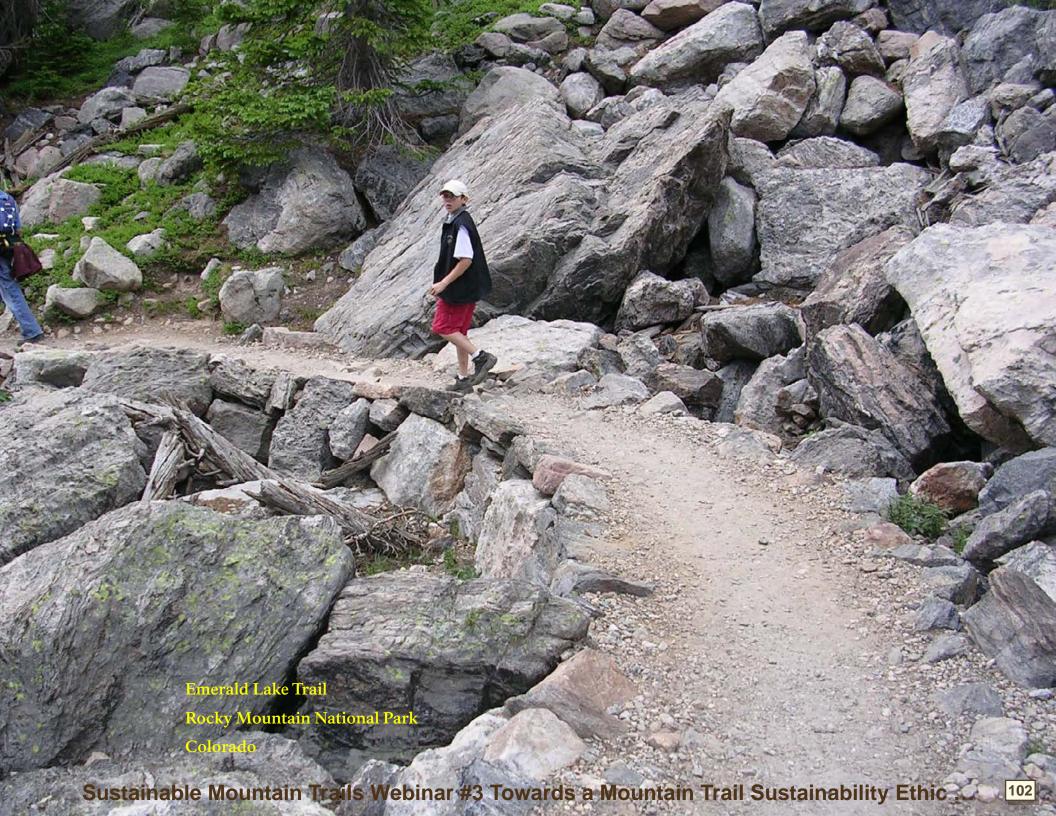
University of Minnesota Forestry Libraries

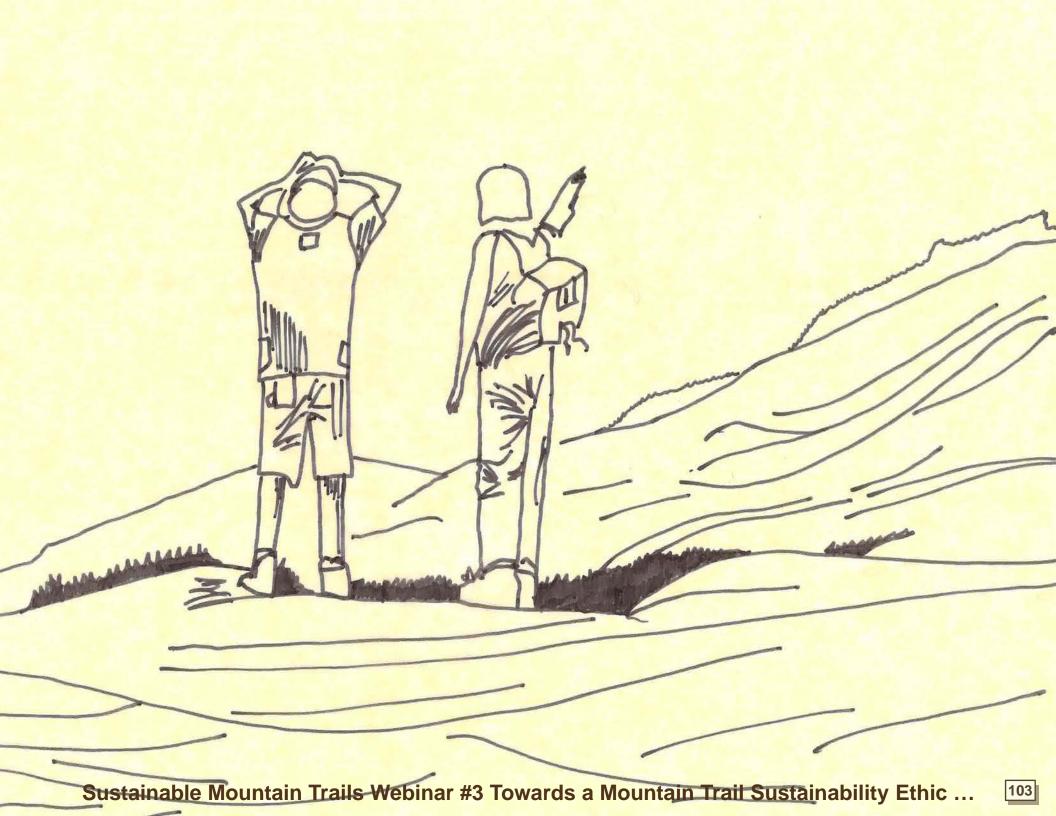
http://www.lib.umn.edu/cgi-bin/forestry/index.cgi

Google.com

Posting of Key U.S. Forest Service & BLM Trail Literature ... is in process ... Stay tuned!











Danny Basch – Background … Sustainable Mountain Trails

- Danny is an active trail user and enthusiastic advocate for outdoor-based recreation.
- ◆ His love for the woods was fostered as a youngster in what is now Cuyahoga Valley National Park and cemented when his family moved to Estes Park, Colorado, in 1983.
- ◆ Since then, he has gained over 20 years of experience maintaining and managing the trails in and around Rocky Mountain National Park and currently oversees the operations branch of facility management.
- Danny is a Master Instructor in the Outdoor Stewardship Initiative (OSI).
- ◆ AT Sketchbook Webinar Series Presenter:
 # 2 Fundamentals of Mountain Trail Sustainability
 # 3 Towards a Mountain Trails Sustainability Ethic ...

lan Brighton – Background ... Sustainable Mountain Trails

- ◆ Ian began his trails career as a teenager working for the City of Boulder Open Space "Junior Ranger" program. He returned for 9 seasons and eventually became a Trails Foreman.
- ◆ 2014 AT Sketchbook Webinar Series Presenter:
 # 2 Fundamentals of Mountain Trail Sustainability
 # 3 Towards a Mountain Trails Sustainability
 Ethic...
- ◆ 2010 2013 University of Colorado, Denver
 Masters of Landscape Architecture
 Wilderness Design Emphasis
- ◆ 2011 Present Rocky Mountain National Park Facilities Management System Specialist Flood of 2013 Recovery Project Leader

Greg Seabloom – Background ... Sustainable Mountain Trails

Greg has provided interdisciplinary leadership to sustainable mountain trail projects for almost 20 years.

- **Expertise:**
 - Sustainable mountain trail design
 - Interdisciplinary leadership to trail project formulation
 - Organizing projects for implementation via Youth Corps, non-profit partners, day-labor, and volunteers
- 2012 Present Trails Supervisor, Boulder, CO OSMP
- ◆ 2005 2012 Field Programs Manager, Colorado Fourteeners Initiative (CFI)
- ◆ 1997 2005 Various: Lory State Park, Pacific Northwest Trail Association, Youth Corps of South Arizona, etc.
- **◆** 2001 Trail Design for Sustainable Trails, Inc.
- Sketchbook, 2006 & 2007 editions, contributing author
- Greg has conducted 2-day field-based Sketchbook-style "Design Assistants" training for the CFI.

John Giordanengo – Ecological Restoration Expert

John has provided leadership to the Ecological Restoration Community for over 17 years in Colorado & Wyoming.

- **Expertise:**
 - ◆ Leadership to the Ecological Restoration Profession Planning & Design Processes – through enhanced collaborative communication
- Staff: Wildlands Restoration Volunteers
- **♦** Staff: Colorado Fourteeners Initiative

Colorado Riparian Association

- ◆ Chair, Big Thompson River Restoration Coalition
- Co-Founder: Coalition for the Poudre River Watershed
- ◆ Many local restoration / natural resource planning boards
- ◆ Sketchbook, 2006 & 2007 editions, contributing author
- ◆ John is a Master Instructor for Outdoor Stewardship Inst. and author of their Ecological Restoration curriculum Awards: 2010 Excellence in Riparian Management Award,

Contact John at john@aloterraservices.com or at 970-420-7346

Hugh Duffy – Background ... Sustainable Mountain Trails

- 1960's & 1970's Exposed to the Appalachian Trail
 @ Bear Mountain State Park, New York
- ◆ 1970 (first) Earth Day Carman's Creek
- 1980 Bachelor's of Landscape Architecture Syracuse University
- ◆ 1980 1983 USFS
 - Recreation Planning
- ◆ 1983 1985 Buffalo National River, Arkansas
 - Park Landscape Architect
- 1986 Appalachian Mountain Stewardship Training, Boston, MA
- ◆ 1985 2014 Various NPS Projects
- ◆ 1997 2012 Various Professional Trail Consultations
- ◆ 2007 Present Sketchbook & Following Documents

