Managing Persistent Slabs

blase reardon

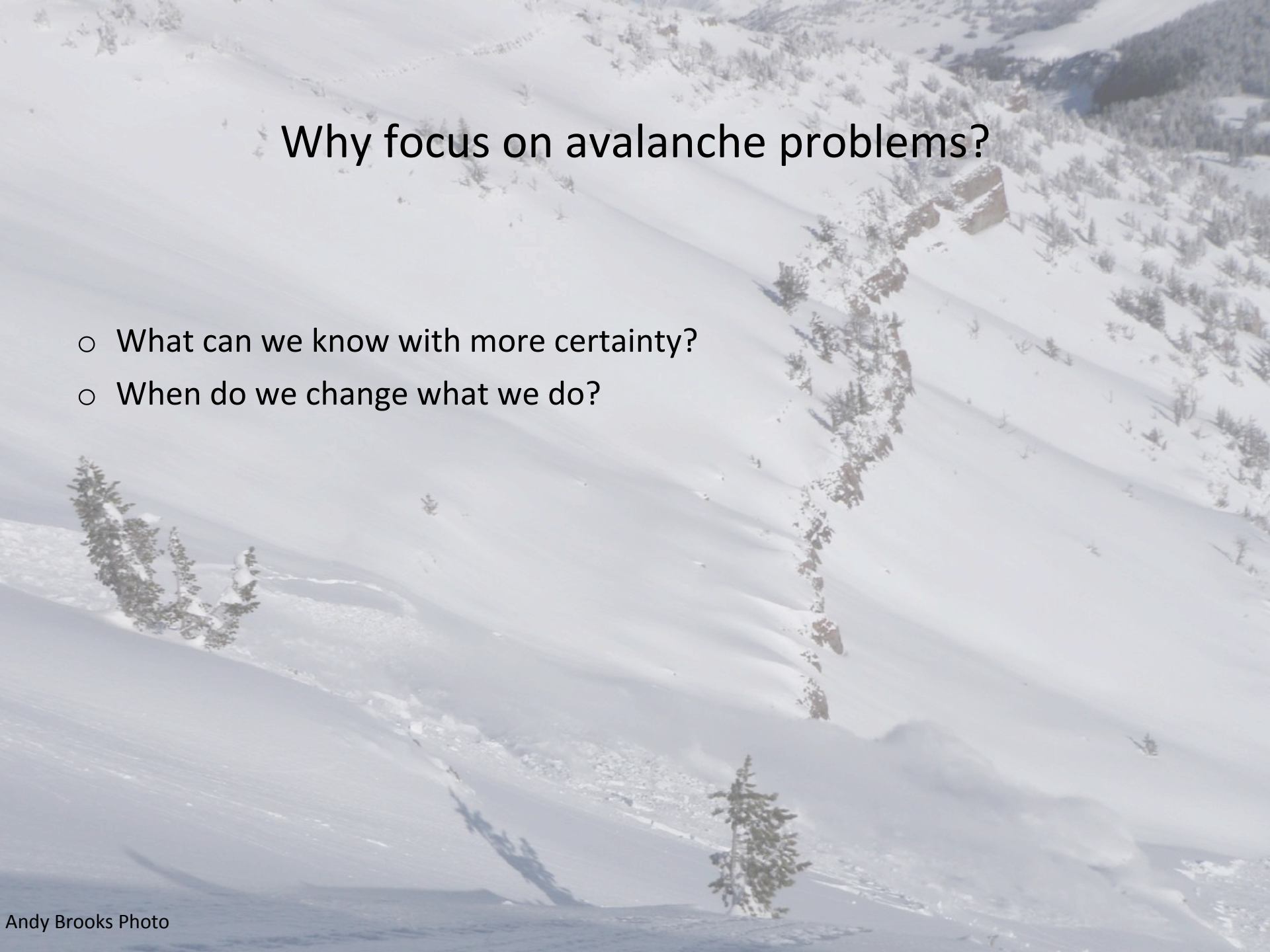
Colorado Avalanche Information Center

SAWTOOTH NATIONAL FOREST AVALANCHE CENTER

Andy Brooks Photo

Why focus on avalanche problems?

- What can we know with more certainty?
- When do we change what we do?



Andy Brooks Photo

Why focus on avalanche problems?

- Less uncertainty about avalanche character than probability of triggering
- Different avalanche problems require different risk management strategies

R. Atkins. An Avalanche Characterization Checklist for Backcountry Travel Decisions. ISSW 2004.

Andy Brooks Photo

Why focus on avalanche problems?

- What can we know with more certainty?
- What info is more reliable*?
  - Interpreting stability test results?
  - Identifying the snowpack Structure?

*Reliable = more accurate, more certain, more often

Andy Brooks Photo

Why focus on avalanche problems?

- What can we know with more certainty?
- What info is more reliable*?
  - Determining the likelihood of triggering a slope?
  - Estimating the rough size of a potential slide?

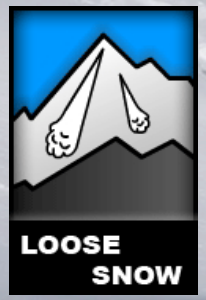
*Reliable = more accurate, more certain, more often

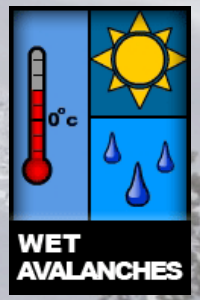
Andy Brooks Photo

What are the avalanche problems?

- Described/ Classified with observable, physical characteristics
  - Distribution
  - Persistence/ Trend
  - Direct Action vs. Delayed Action
  - Depth/ Size

- Accepted definitions for 8 avalanche problems





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What are the avalanche problems?

AVALANCHE TYPE

CHARACTER	Weak Layer / Interface	Slab Properties	Persistence	Weak Layer Location	Propagation Potential	Relative Size Potential (1-5)
Loose Dry Snow Loose Wet Snow	Various (no cohesion)	-NA-	Hours/days	Near the surface	None	R1-2
Wind Slabs	Various grains	4F-K Wind transported	Hours/days	Upper pack	Terrain feature	R1-3
Storm Snow	Various grains	Soft - stiff (F-P)	Hours/days	In or just below storm snow	Path	R1-4
Wet Slabs	Various grains	Wet loose and/or wet slab	Hours/days	Any level	Terrain feature to multi-path	R1-5 (climax)
Persistent Slabs	SH, FC, CR, FC/CR combo	Stiff - hard (4F-P)	Weeks/months	Upper to mid-pack	Path to adjacent paths	R2-4
Persistent Deep Slabs	DH, FC, CR FC/CR combo	Hard (P-K)	Weeks/months	Deep or basal	Path to adjacent paths	R3-5 (climax)
Cornices	-NA-	-NA-	Months with short-term peaks	-NA-	-NA-	-NA-
Comments		Can be wet or dry snow	Typical duration of instability	Relative to HS	Typical expectation	Typical range of size relative to path

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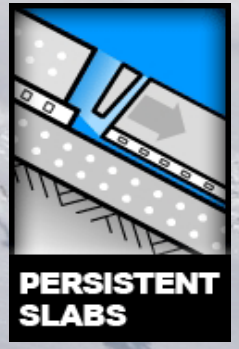
Avalanche Problem → Terrain Choice

- Predictability: Where likely triggered? Break above? Remotely?
- Consequences: Size? Terrain Traps? What chance survivable?

6-10” fresh wind slab, no PWL



No new snow, 2-3’ deep slab on PWL

Avalanche Problem → Terrain Choice

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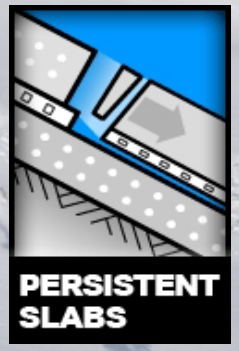
- No: > 35* leeward slopes near ridgelines
- Yes: Mid-elevation & sheltered slopes
- Test: 30-35* shallow wind slab & good runout



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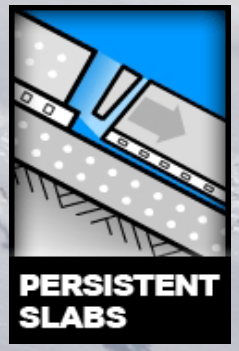

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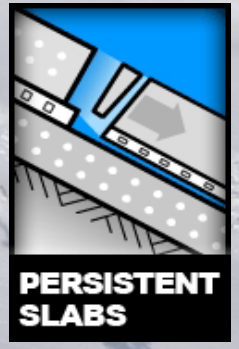
Avalanche Problem → Risk Management

6-10” fresh wind slab, no PWL
MODERATE Danger



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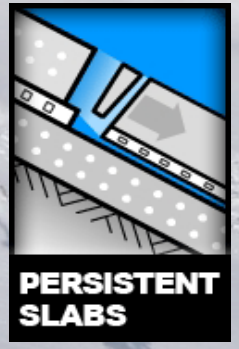

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Risk Management

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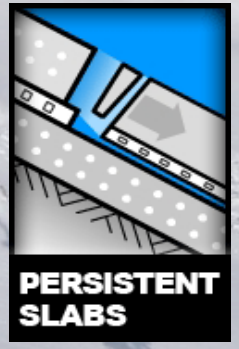

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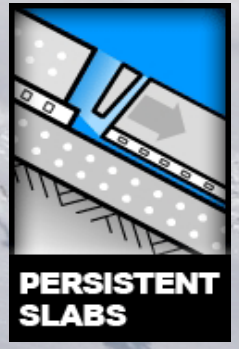

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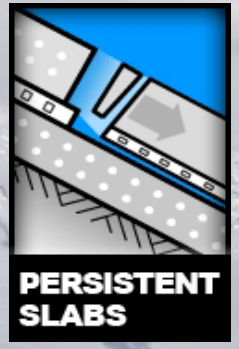

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What is a Persistent Slab avalanche?

- Slab hardness can be soft to hard
- Fails on underlying persistent weak layer
- Fails in middle to upper snowpack

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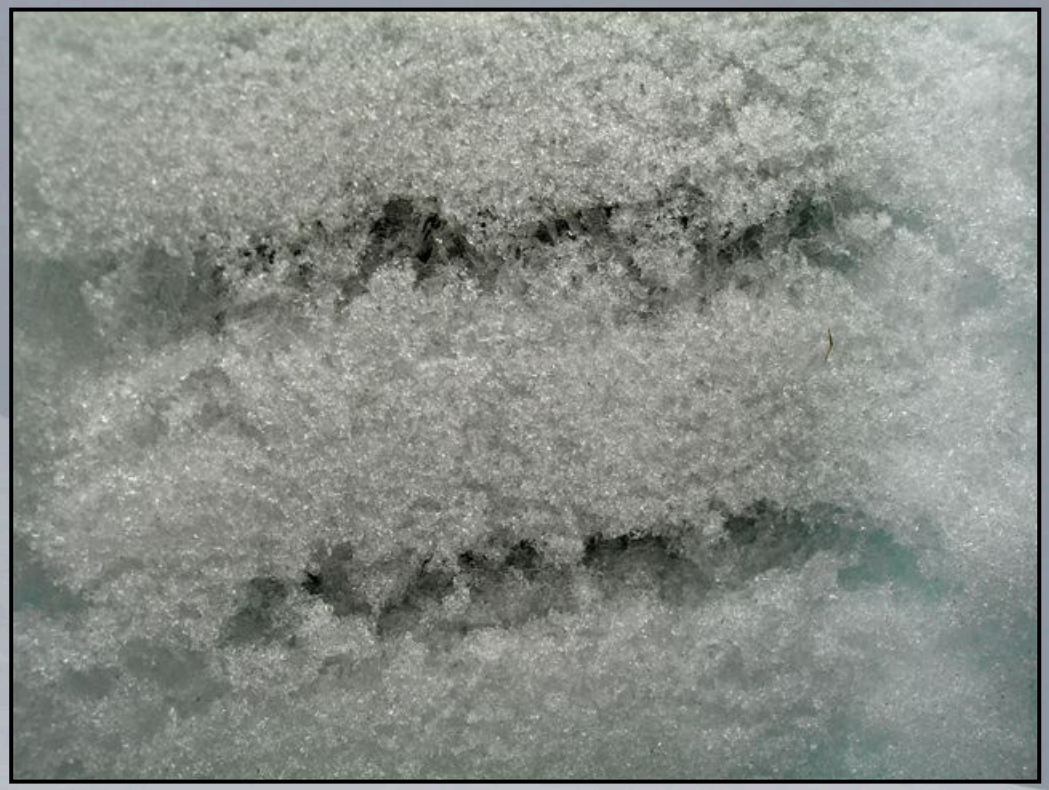

What is a Persistent Weak Layer?

PWLs typically composed of faceted grains
Can form within the snowpack

- Depth hoar, small facets, facets around crusts

What is a Persistent Weak Layer?

PWLs typically composed of faceted grains

Can form in the snowpack

Can form near the surface

- Surface hoar, NSF, facets around crusts

What is a Persistent Weak Layer?

PWLs often formed by large-scale weather

- Days to weeks
- Slope to Mountain Range

What is a Persistent Weak Layer?

PWL properties slow to change

- Weeks to months
- Change slower than properties of slab above

What is a Persistent Weak Layer?

PWL form relatively uniform weak layers

- More uniform than slab above
- Can produce large avalanches

So Persistent Slabs are different…

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- Propagate across terrain features
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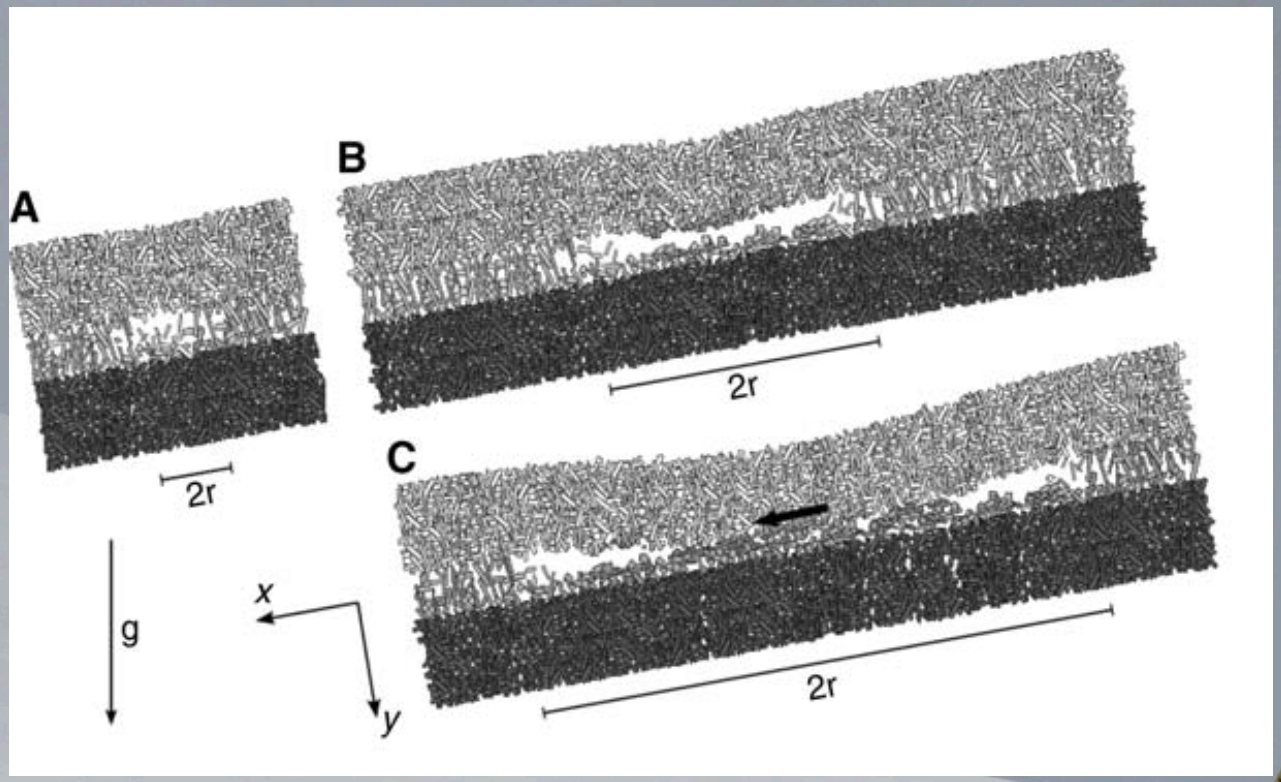
•Can be triggered remotely or sympathetically

So Persistent Slabs are different…

- Propagate across terrain features
- Can fail with multiple tracks on slope

Why are Persistent Slabs unpredictable …



- Persistent slabs triggered when weak layer collapses

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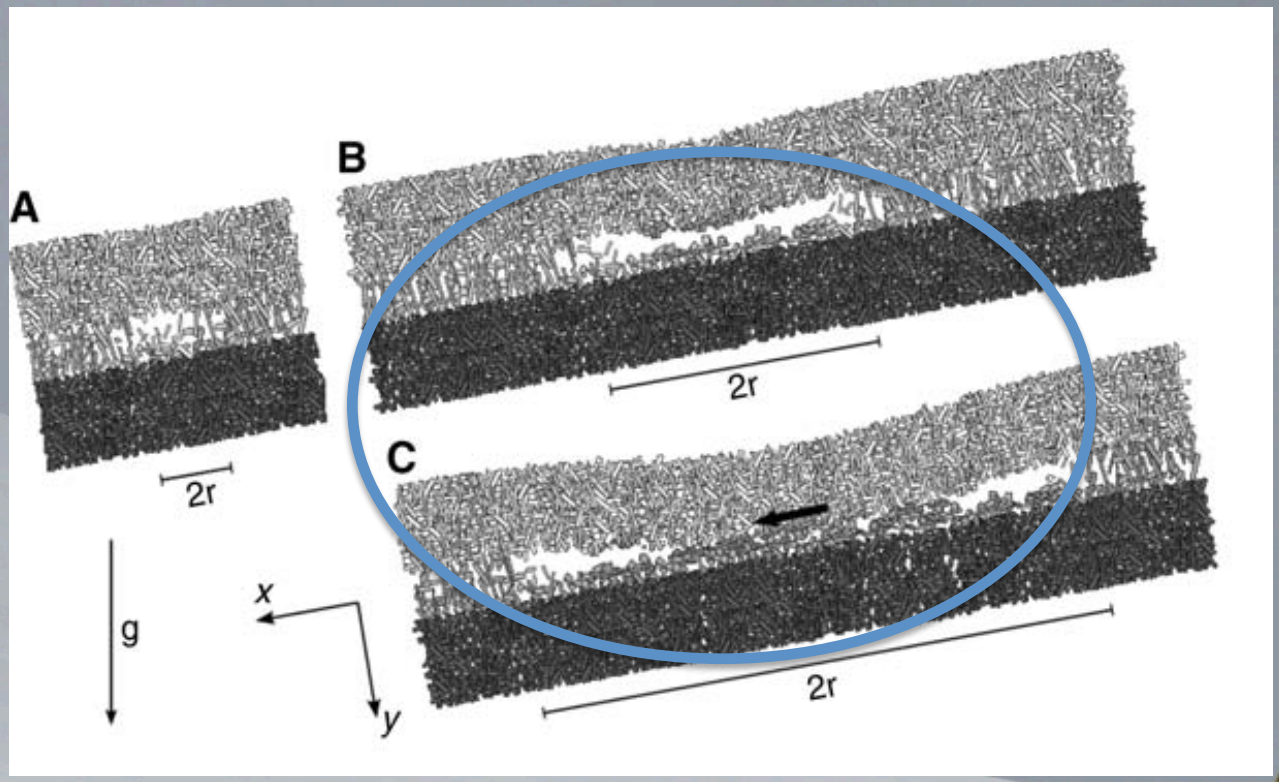

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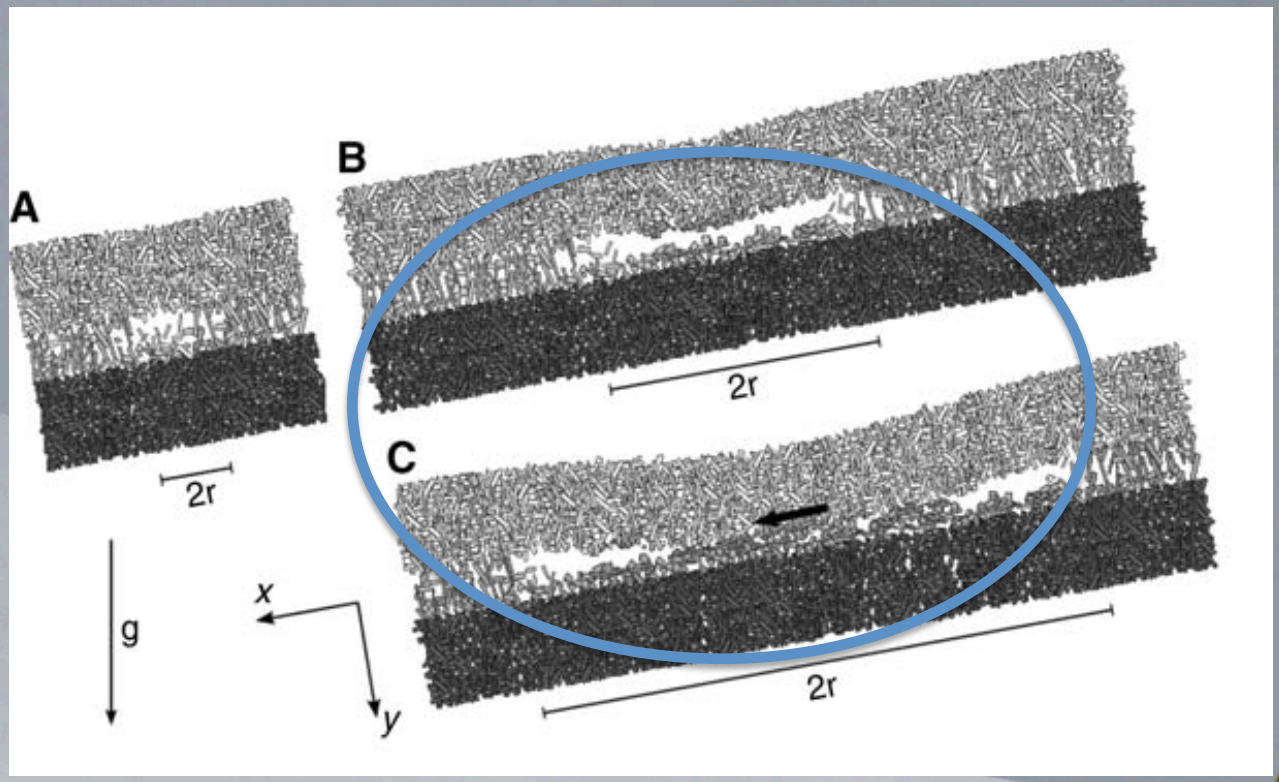

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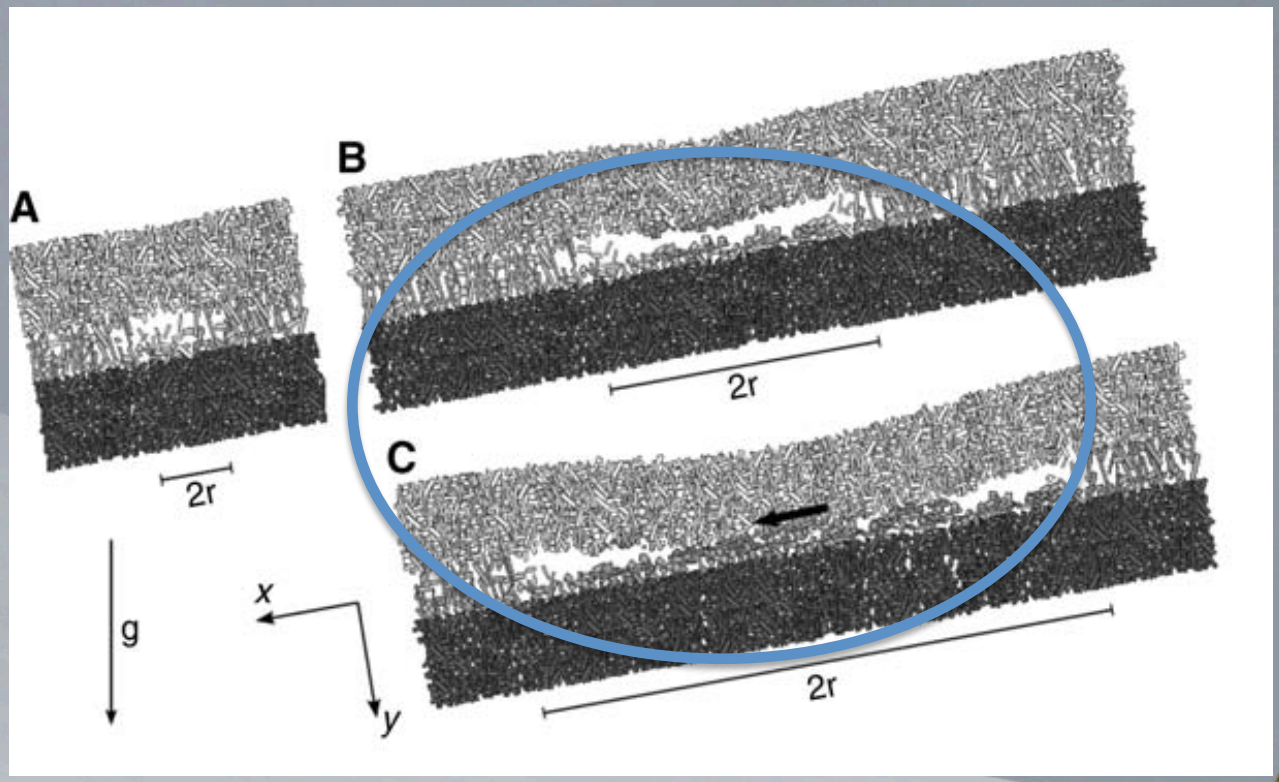

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- Propagation driven by slab
- Larger slides when PWL and slab more homogenous

Why are Persistent Slabs unpredictable …

More Video!

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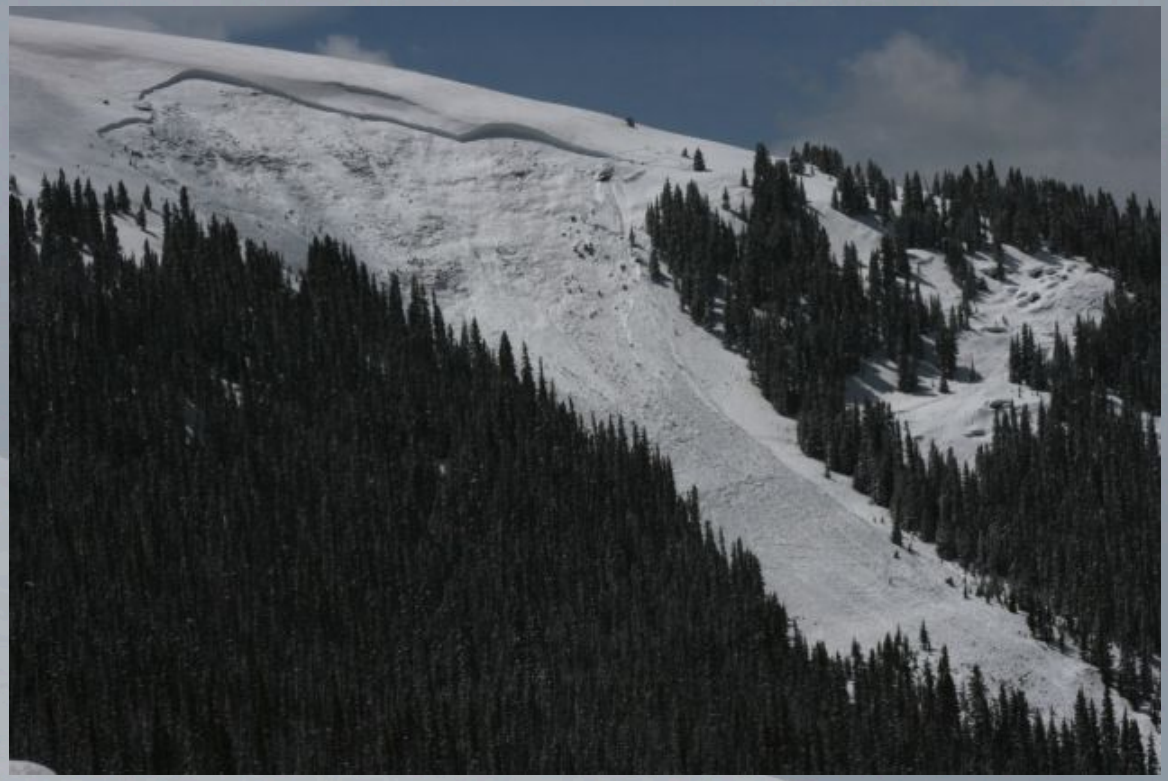
- Propagation driven by slab
- Larger slides when PWL and slab more homogenous

The Bottom Line:



We can trigger large, deep, deadly avalanches

- From a distance or from below

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- Weeks or even months after the layer formed

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- On slopes with tracks

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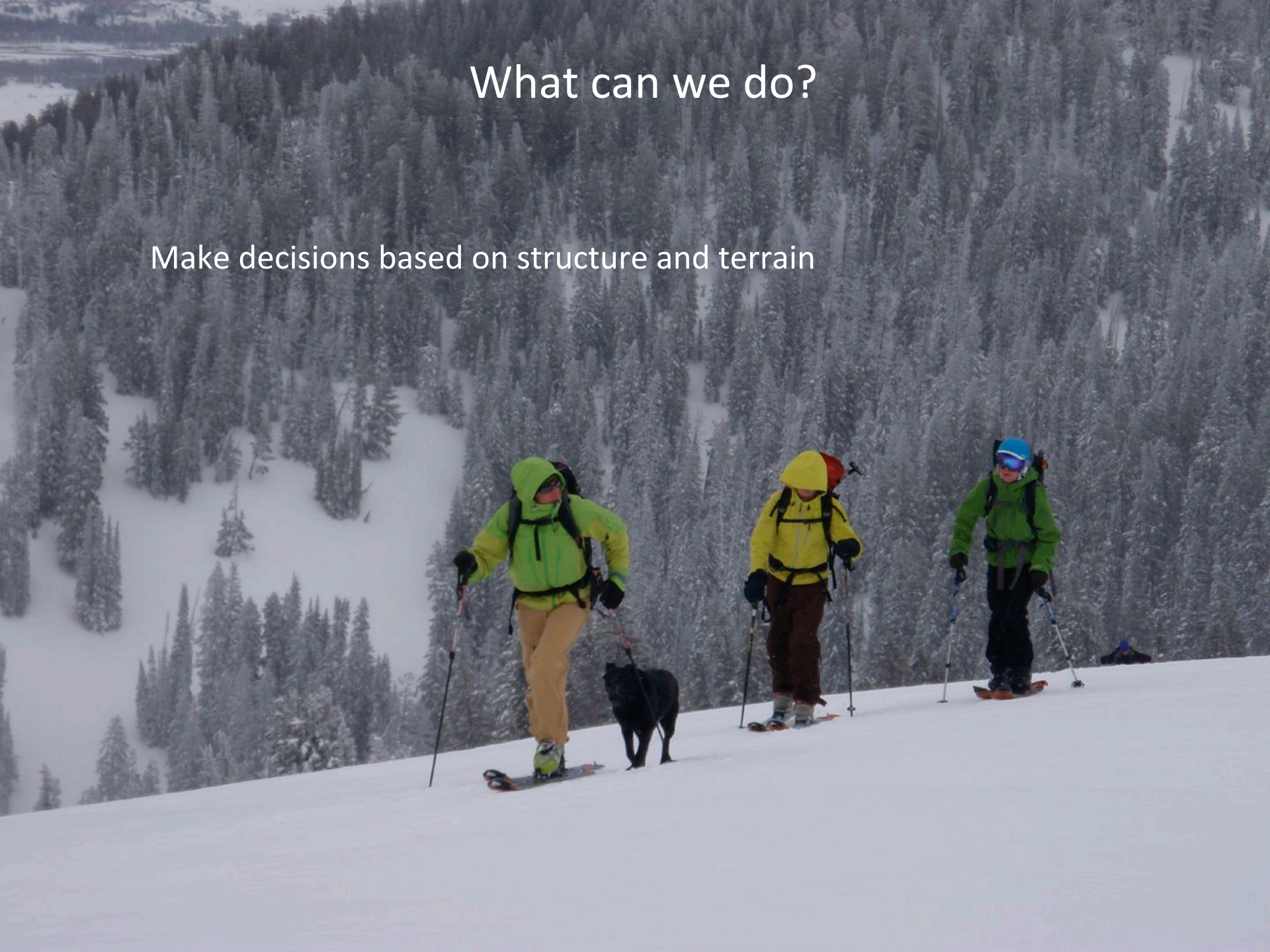
We can trigger large, deep, deadly avalanches

- From a distance
- Weeks or even months after the layer formed
- On slopes with tracks
- When no obvious signs of instability are present

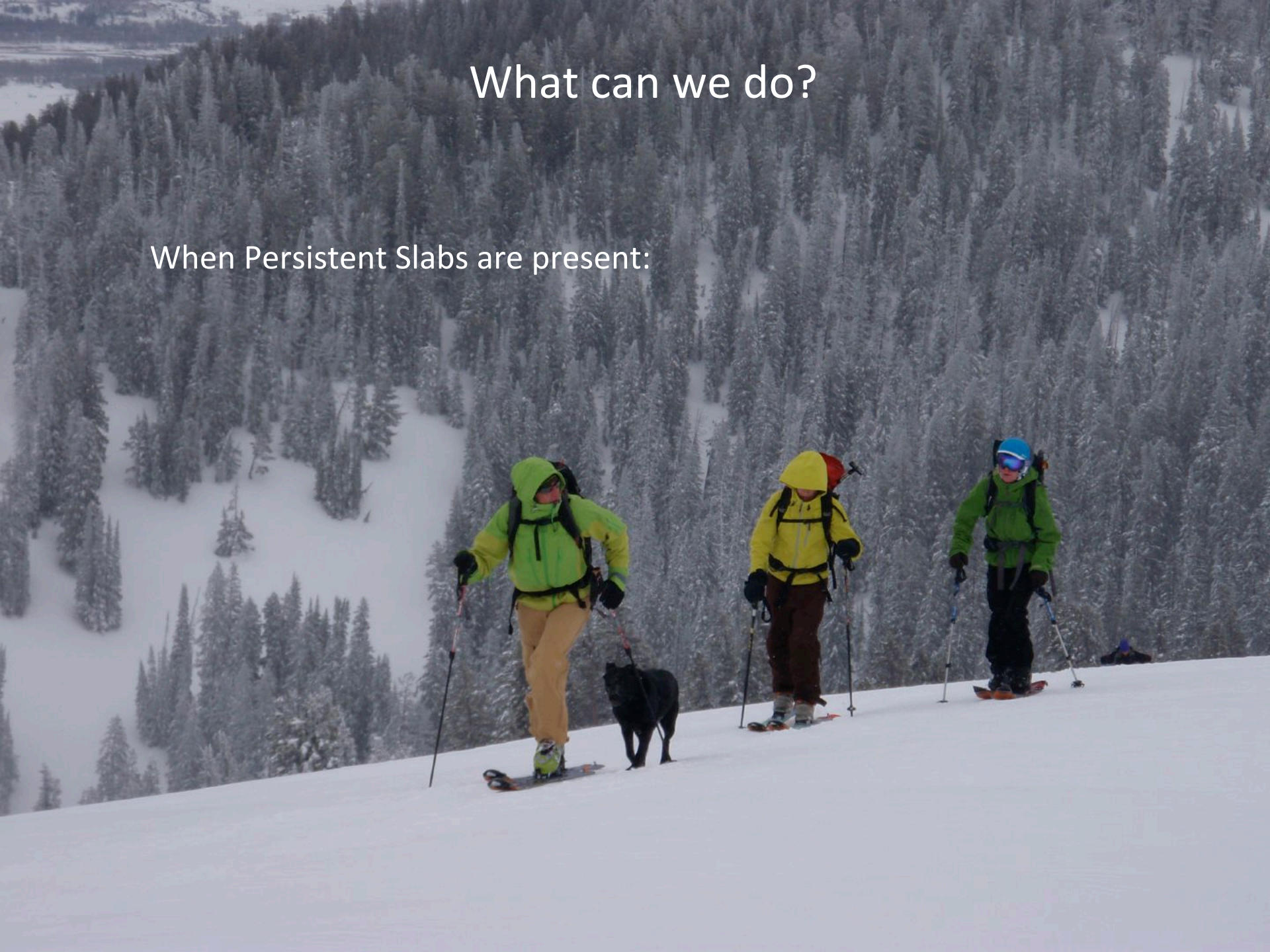
What can we do?

Make decisions based on structure and terrain



What can we do?

When Persistent Slabs are present:



What can we do?

When Persistent Slabs are present:

- Slope angle, slope angle, slope angle!!

What can we do?

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- Avoid likely trigger points

What can we do?

When Persistent Slabs are present:

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- Where slab is thinner
- Convexities
- Rocky slopes with variable snow depths

What can we do?

When Persistent Slabs are present:

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- Avoid being in or above terrain traps

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- Gullies
- Cliffs
- Rocks and trees

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What can we do?

When Persistent Slabs are present:

- Slope angle, slope angle, slope angle!!
- Avoid likely trigger points
- Avoid being in or above terrain traps
- Don't assume stability

- Tracks on a slope
- Slab &/ or surface snow that feels "bomber"