Sustainable landuse:
Geomorphology of the Cairngorms

Dr Vanessa Kirkbride and Dr John Gordon
Scottish Natural Heritage
Sustainable landuse: Geomorphology of the Cairngorms

- Geomorphology: landforms and land forming processes
- What constraints and opportunities the relict and active parts of the Cairngorms landscape offer for sustainable landuse.

When is a landform or land forming process sensitive to change?

**Relict landforms**: sensitivity is proportional to the degree of loss and damage

**Dynamic land forming systems**: does interference bring a change in the nature or rate of processes operating? *eg* hill slopes does the slope fail more often, or in a different way?
Mapping the geomorphological heritage of the Cairngorm Mountains

1. Geological Conservation Review sites
2. Extent of the GIS
Landforms and processes

• Preglacial legacy
  – Remnants of an ancient landscape and bedrock structure, and weathering

• Glacial landscape
  – A world class landscape,
  – glacial erosion,
  – depositional landforms,
  – past rapid climate change

• An arctic landscape
  – periglacial processes and landforms
  – Slope processes: Rock and snow avalanches, debris flows and rock glaciers

• A sensitive landscape
  – Plant and geomorphological process interaction. Wind stress, snow and soil moisture.
  – Dynamic rivers: wandering, meandering and braided channel forms.
  – Archives of past environmental and climatic changes
Preglacial legacy:

Bedrock structure and weathering
Remnants of an ancient landscape, “preglacial” landforms.
A world class glacial landscape,

landforms of glacial erosion
Glacial landscape:

Depositional landforms
Past rapid climate change:

Landforms from deglaciation
An arctic landscape:

periglacial processes and landforms
Slope processes:
Rock and snow avalanches, debris flows and rock glaciers
A sensitive landscape: wind stress.

Plant and geomorphological process interaction.
A sensitive landscape: snow and soil moisture.

Weathering and erosion
Dynamic rivers: wandering, meandering and braided channel forms.
Archives of past climate change
Active river corridor, (and active alluvial fan)

Periglacial deposits and landforms

Stable bedrock
Glacial deposits and landforms

Slope deposits and landforms
Sparse vegetation and wind stressed surfaces

Snow and snowmelt

Geomorphology around Ben Avon

- 1.2. Blockfield
- 1.3. Sparse vegetation
- 1.4. Partially vegetated wind stressed surface
- 1.5. Semi-permanent snow patch and melt-out deposits
- 1.6. Patterned ground
- 1.7. Tor
- 1.8. Wet flushes and snowmelt drainage
- 1.9. Stubble vegetated surface
- 1.9b. Peat
- 2.1. 2.1a. Solifluction sheets and lobes
- 2.1b. Boulder lobes
- 2.2. Rock outcrop
- 2.3. Debris slope
- 2.4. Debris cone
- 2.5. Snow avalanche modified debris slope
- 3.1. Ice-rafted bedrock
- 3.4. Dome iceblock
- 3.5. Ice-contact slope
- 3.6. Moraine
- 3.7. Moraine limit
- 3.8. Boulder and drift limit
- 3.9. Undifferentiated ice-marginal deposits
- 3.10. Dissected drift
- 3.11. Undifferentiated drift
- 4.2a. Ice-marginal kame
- 4.5. Melter water channel (bedrock)
- 4.7b. Former lake shoreline
- 4.9. Unconsolidated glaciofluvial deposits
- 4.10a. Postglacial relic alluvial fan surface
- 4.11a. Postglacial river terraces and alluvium
- 4.11b. Active river corridor
Recommendations

• **An asset for Tourism**: The Cairngorm Mountains are outstanding for their geomorphological history, and landforms. This is the foundation for internationally important habitats and species, and the outstanding landscape character of the area.

• **A key factor in sustainable land management**: Consideration of geomorphological sensitivity is a vital part of working in sympathy with natural processes, in assessing natural hazards and implementing sustainable management of ecosystems, particularly under future climate change scenarios.

• **Adaptation to climate change** will be partly constrained by geomorphological systems and processes. Dynamic geomorphology needs to be integrated in current monitoring programmes in the Cairngorm Mountains.

• **Further data gathering**: GIS could be extended to cover the full extent of the Cairngorms National Park. The preparation of a *Geodiversity Action Plan*, (Cairngorms National Park Plan 2007), would provide a focus and a strategic approach for addressing many of these issues.