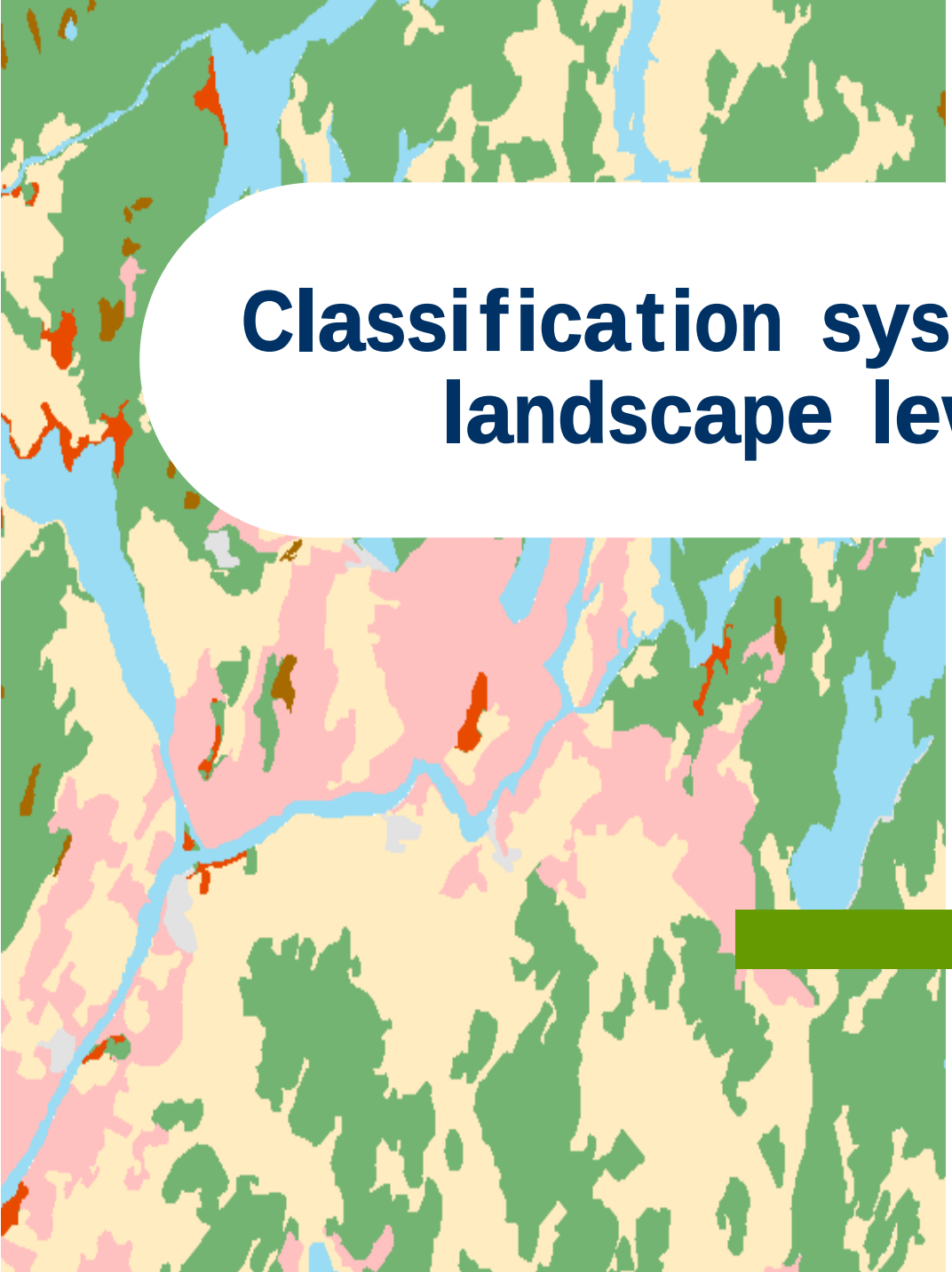


Classification systems in Norwegian landscape level monitoring

Workshop, Tune, Denmark – 11th & 12th October 2001

A classification system for landscape monitoring: Nordic & International perspectives

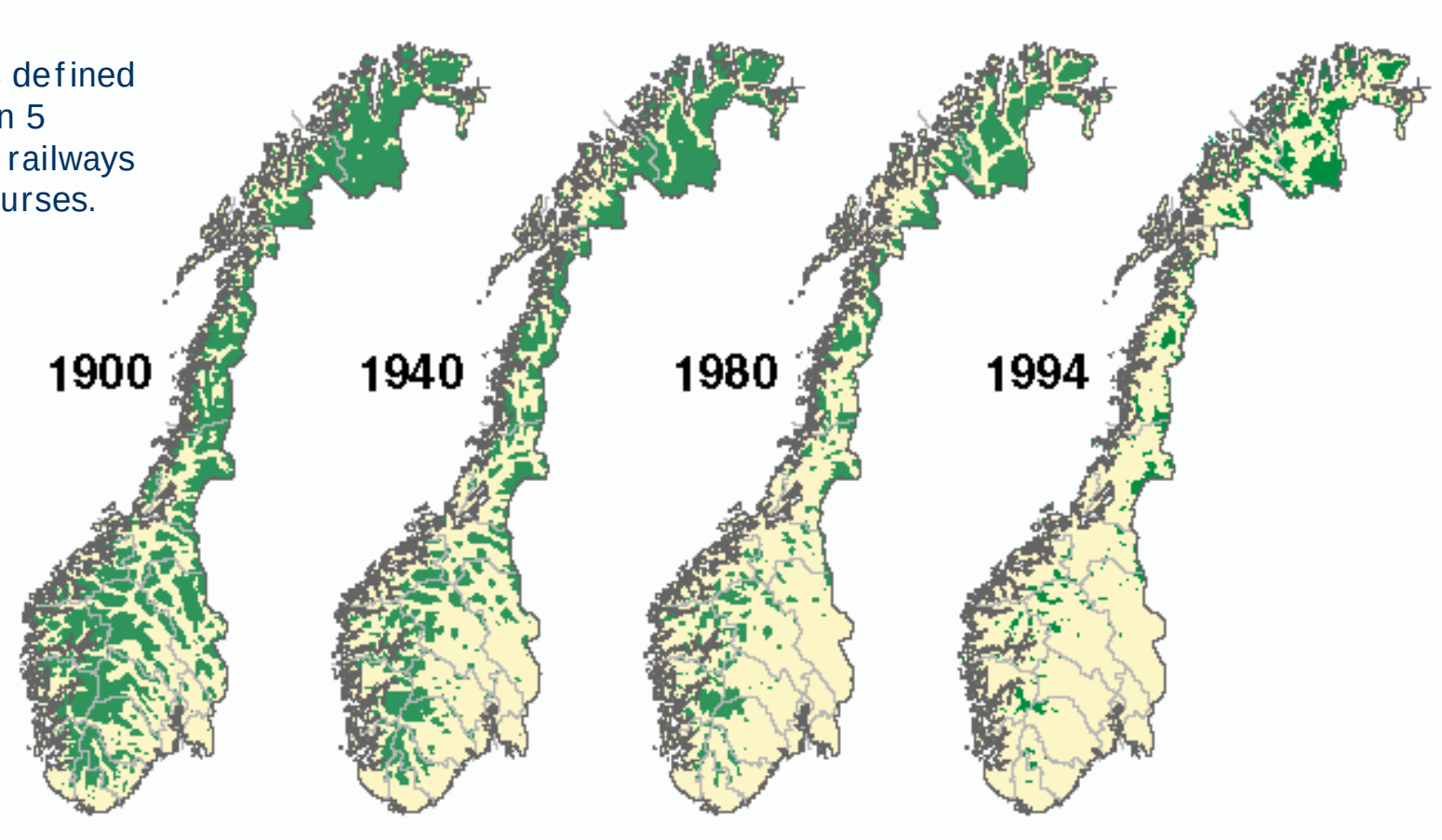
AR18x18 – landscape monitoring

- **A**rea **R**esource inventory at landscape level
- Development of a new monitoring programme that covers all area types in Norway
- Sampling design
  - Systematic sampling (no pre-stratification e.g. by nature types)
  - 18 km interval
  - Total of 1000 samples
- Sampling unit
  - 1 x 1 km sample squares

Landscape in change

Wilderness in Norway 1900-1994

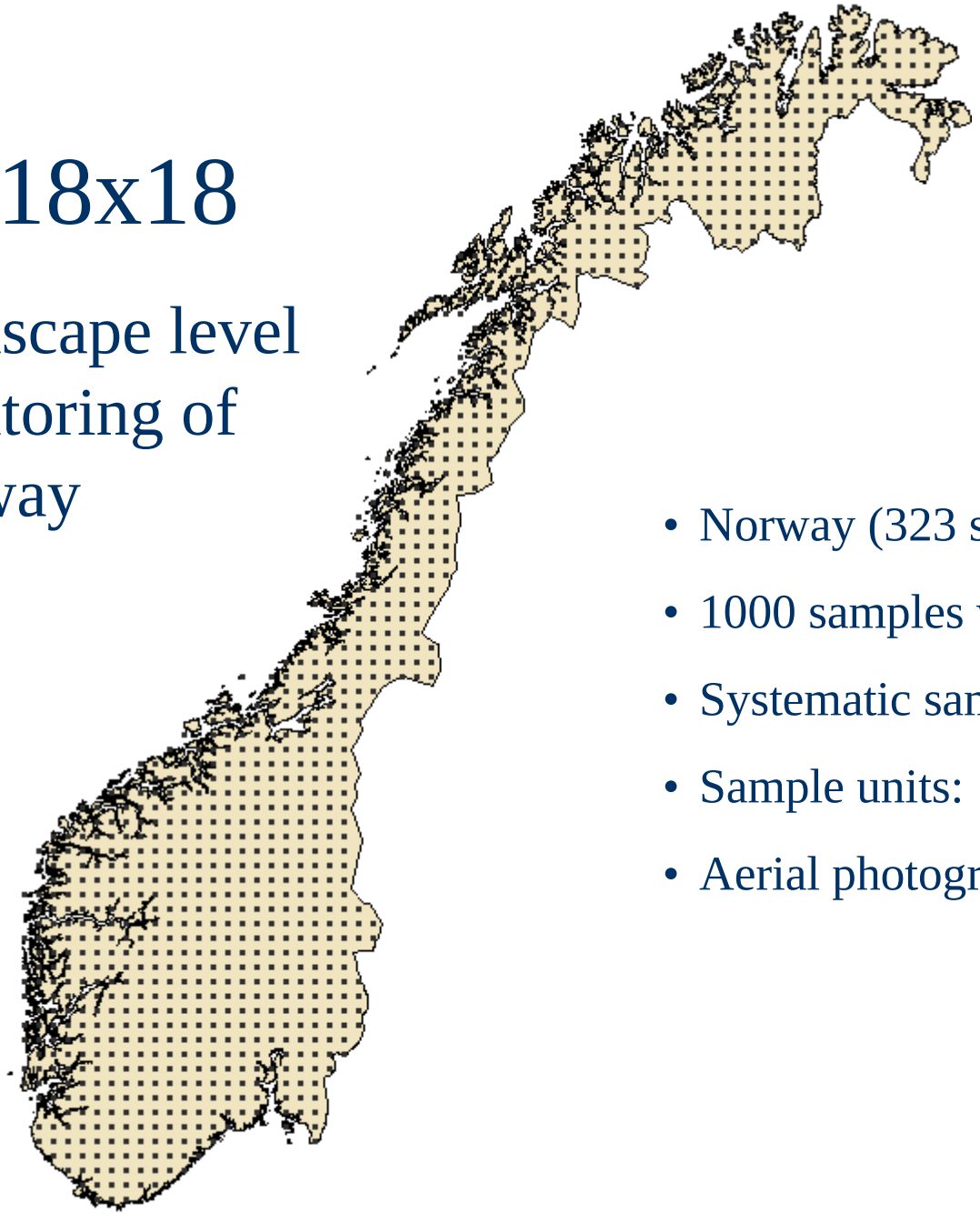
Wilderness territory is defined as areas lying more than 5 kilometres from roads, railways and regulated water-courses.



Source : Brun M / SKMe: Norwegian Mapping Authority - Environmental Unit.

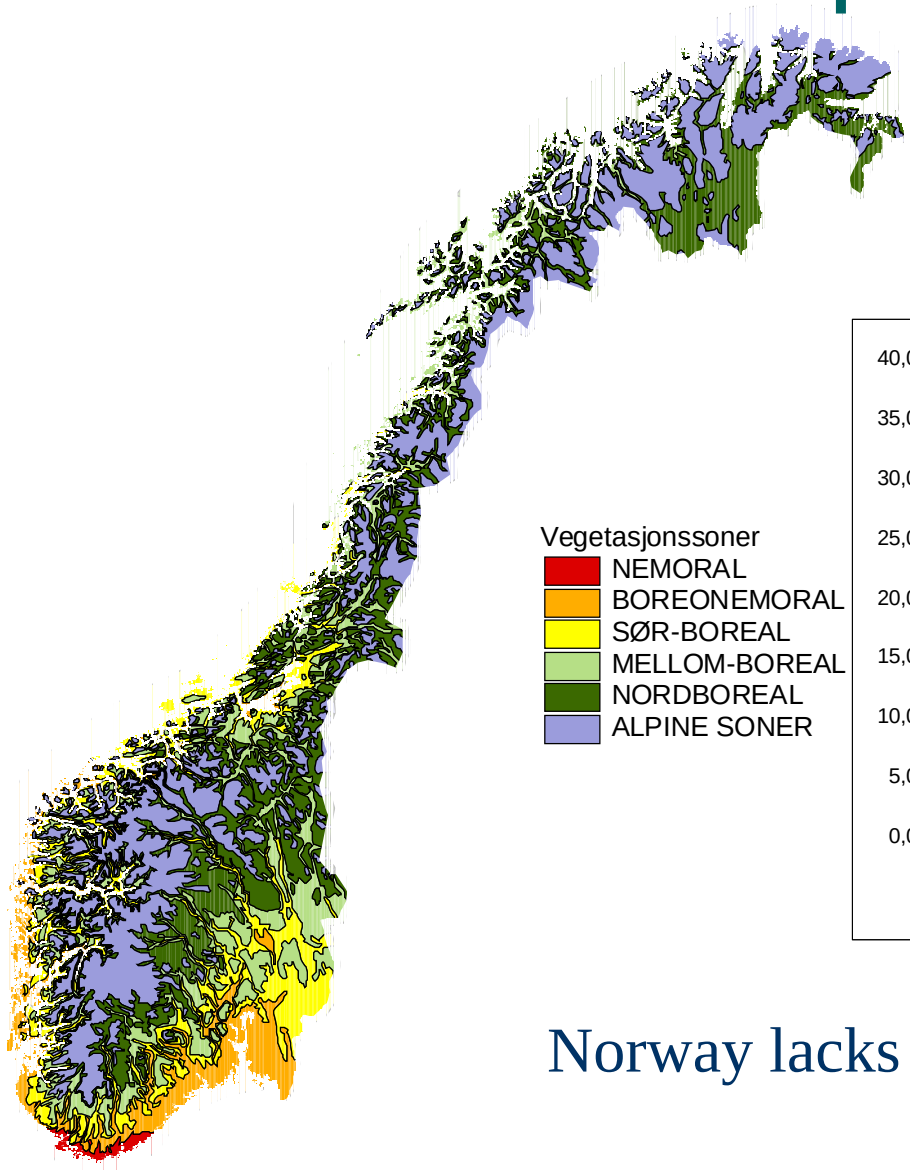
AR18x18

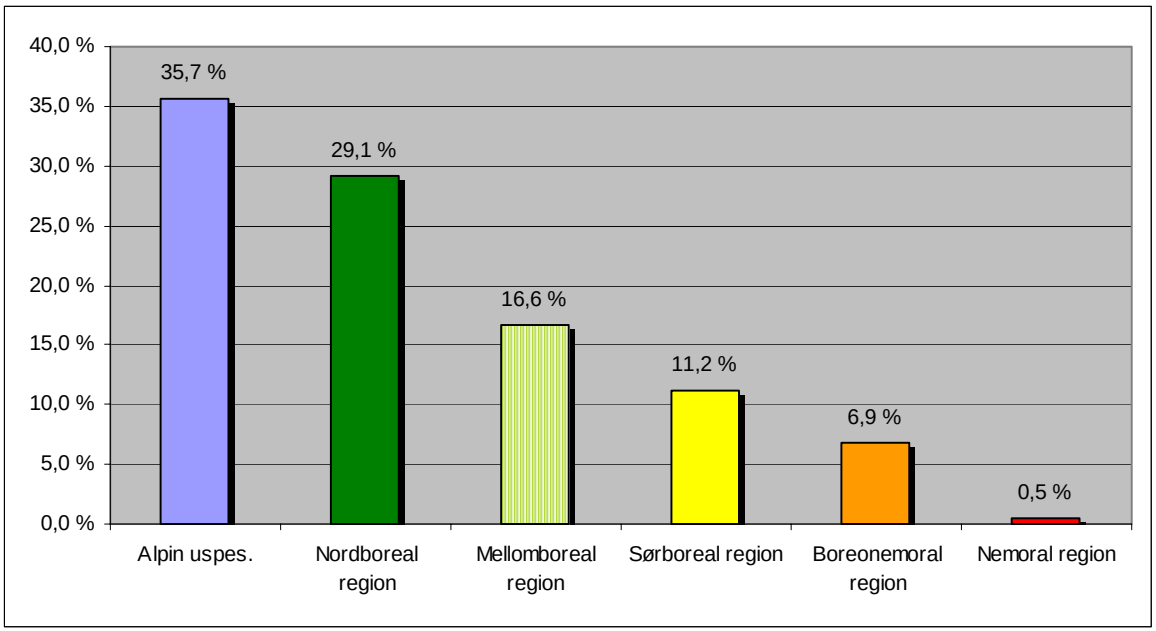
Landscape level monitoring of Norway



- Norway (323 sq. km)
- 1000 samples with 18 km interval
- Systematic sampling
- Sample units: 1 x 1 km
- Aerial photographs: 1:13.000

Number of sample units by vegetation zones





Norway lacks a mapping programme for alpine areas

Expected output from AR18x18

- Lack of a mapping programme that gives a total overview of Norwegian landscapes
  - Subalpine birch forest – where and how much does the tree line move?
  - Reindeer grazing – impact on vegetation?
  - Cabin building on shorelines – impact on public access?
  - Road construction – impact on spatial structure (fragmentation)?
  - Regrowth of earlier managed and cultivated land – where and how much (e.g. coastal dwarf shrub heaths)?
- Relation to census level mapping
  - Ground reference for satellite image interpretations of land cover mapping and monitoring

Properties of the classification system for AR18x18

- Scientifically based
- Covering our information needs
- Practical and flexible to use
- Correlation to many other systems, national and international

Land cover – a basis for AR18x18

Study of relevant classification systems:

- Land cover criteria are central in many mapping systems:
  - vegetation types, land types, habitat types, urban green structure
- Land cover: description of land in terms of its (bio)physical cover with focus on form and structure
- Classification for AR18x18 based on land cover as main component provides high degree of correlation with many other systems

3Q – monitoring of the agricultural landscape

- Sample units 1 x 1 km
- 1475 samples (centre point on agricultural land)
- Aerial photographs 1:12.500
- 5 year interval
- Results reported for
  - Landscape spatial structure
  - Biodiversity
  - Cultural heritage
  - Accessibility

3Q legend (level 2) – used for photo interpretation

A Agricultural land

- **A1** Fields of annual agricultural plants, and cultivated meadows
- **A2** Horticultural land
- **A3** Pasture

B Natural bare ground

- **B1** Bare rock, boulders and scree
- **B2** Gravel, sand, earth and peat

F Permanent unforested dry-land vegetation

- **F1** Semi-natural grassland
- **F2** Heaths and ridges
- **F3** Maritime vegetation
- **F4** Cleared forest

M Natural, unforested wetland vegetation

- **M1** Mire and other freshwater wetlands
- **M2** Salt and brackish wetlands

S Forest and tree-covered land

- **S1** Deciduous forest
- **S2** Mixed forest
- **S3** Coniferous forest

U Urban areas

- **U1** Transport
- **U2** Buildings
- **U3** Other built-up areas
- **U4** Storage areas, dumps and rubbish tips
- **U5** Mineral extraction
- **U6** Urban greenways, sport and recreation areas

V Water, snow and ice

- **V1** Freshwater
- **V2** Snow and ice
- **V3** Saltwater and brackish water

3Q legend – correlation with land cover

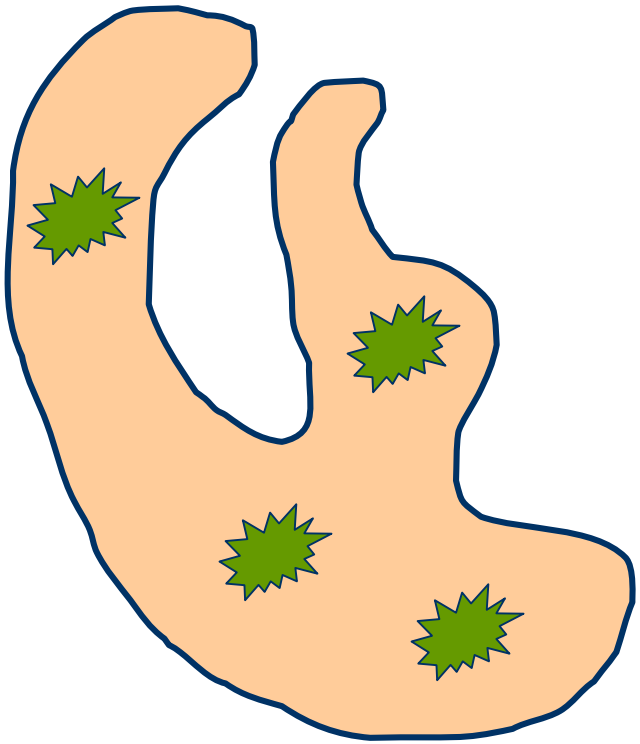
- Using FAO's LCCS to study correlation with land cover
  - Why? Class criteria are clearly stated
- Overall results
  - 3Q legend correlates well with LCCS
  - Some disagreement in use of cover, partitions in percent levels
    - Number of levels used and breakpoints (tree and shrub cover)
    - Bare areas: 3Q < 25% vs. LCCS < 4% !!!
  - 3Q adds a criterion of grazing status – if an area is clearly being grazed by livestock (i.e. pasture)

Different breakpoints for criterion Vegetated

Alternative 1 (3Q)

Vegetated if > 25% of area is covered with vegetation

Object belongs to:
B Natural bare ground



Alternative 2 (LCCS)

Vegetated if > 4% of area is covered with vegetation

Object belongs to:
F Permanent unforested dry-land vegetation

Three designs of classification systems

- Criteria are given
  - implicit by class definitions
  - explicit as interpretation keys
  - explicit as independent classifiers that are individually observed and recorded
- Which design best satisfies our need for a classification system for AR18x18?