3. Forests and semi-natural areas

3.1. Forests

3.2. Shrub and/or herbaceous vegetation associations

3.3. Open spaces with little or no vegetation

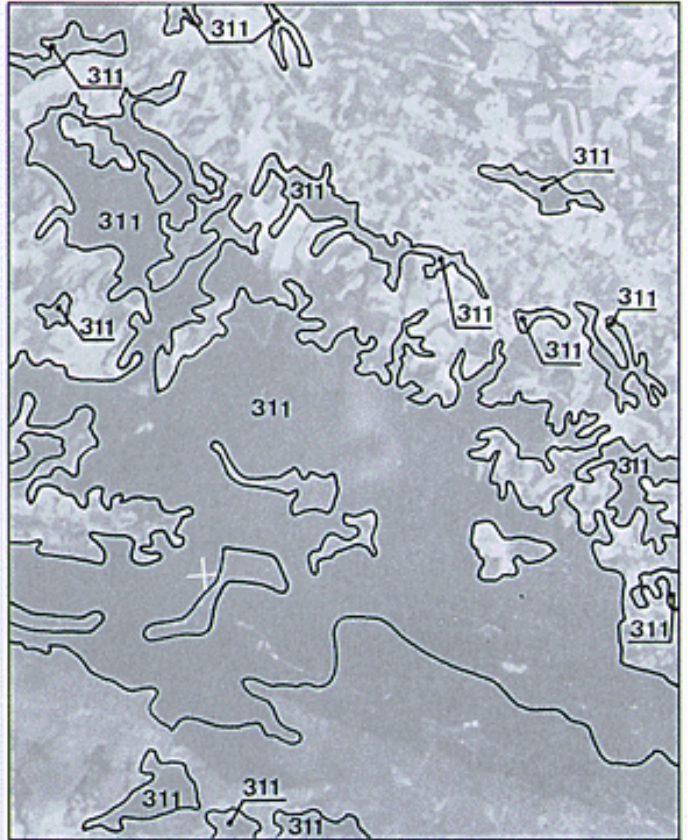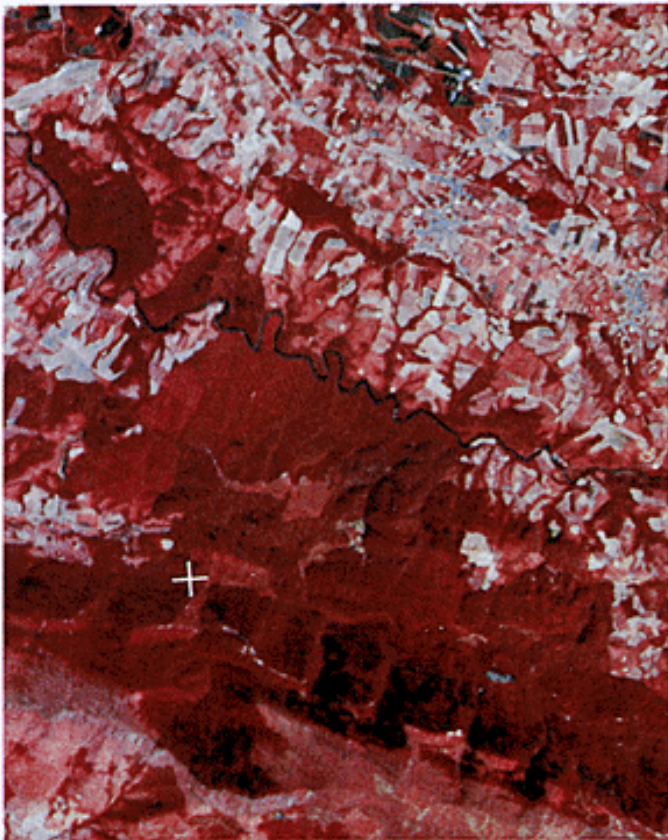## 3.1. Forests

3.1.1. Broad-leaved forest

3.1.2. Coniferous forest

3.1.3. Mixed forest

3.1. Forests

3.1.1. Broad-leaved forest

Vegetation formation composed principally of trees, including shrub and bush understoreys, where broad-leaved species predominate.

3.1.1. France/Area: Pau
SPOT 3.2.1. 1:100 000, July 1988

Interpretation

The only difficulty in identifying broad-leaved forest is caused by the effect of shadow in wooded valleys. Confusion with conifers of category 3.1.2 is then possible.

Supervised classification of satellite images may be employed to identify all the areas to be classified under 3. 1. 1. Similarly, principal component analysis may be applied to reduce the effects of cast shadow.

Rows of poplars can be recognized by their regular geometric shape near water courses or wetlands and by the vegetation index level, and should be classified under this heading.

Broad-leaved trees must represent more than three-quarters of the surface unit in this category, failing which the category is that of mixed forest. Young coppices and young plantations belong in 3.1.1.
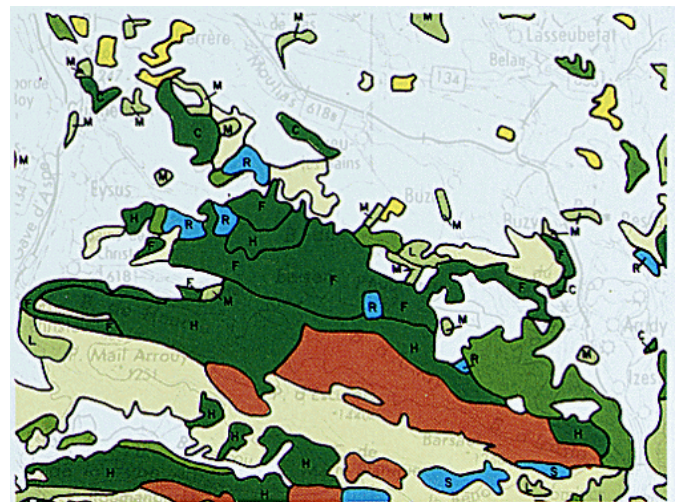
National forest inventory: map of population types (scale 1:200 000)

3.1.2. Coniferous forest

Vegetation formation composed principally of trees, including shrub and bush understoreys, where coniferous species predominate.


3.1.2. Netherlands/Area: Hardewijk
Landsat TM 4.5.3. 1:100 000, May 1989

Interpretation

Coniferous forests are recognisable on false-colour composites by their dark colour, which stands out from the brighttonesofbroad-leavedforests.1 Only young plantations could be confused with category 3. 1. 1.
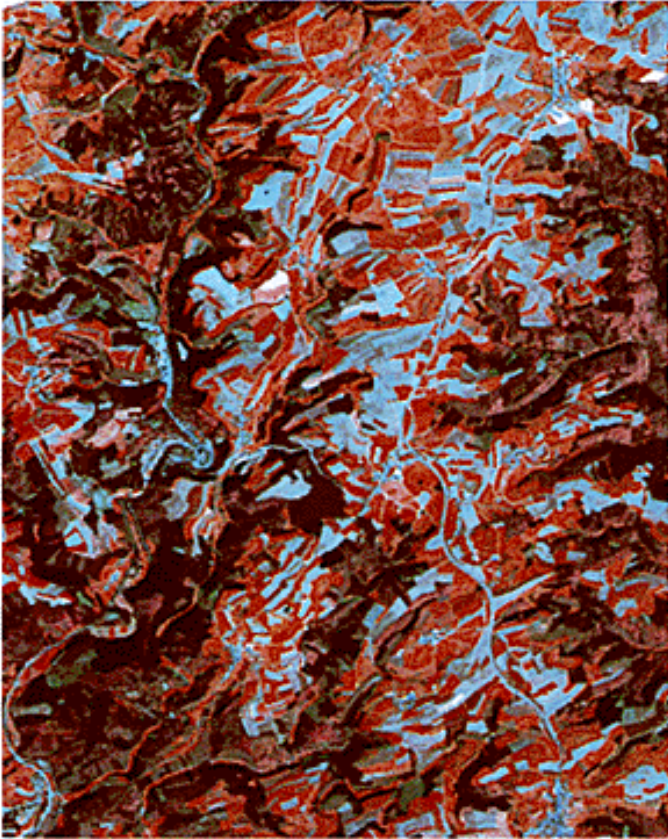
1 Surface planted with conifers must represent at least 75% of the total surface of the unit; otherwise, the unit is one of mixed forest.
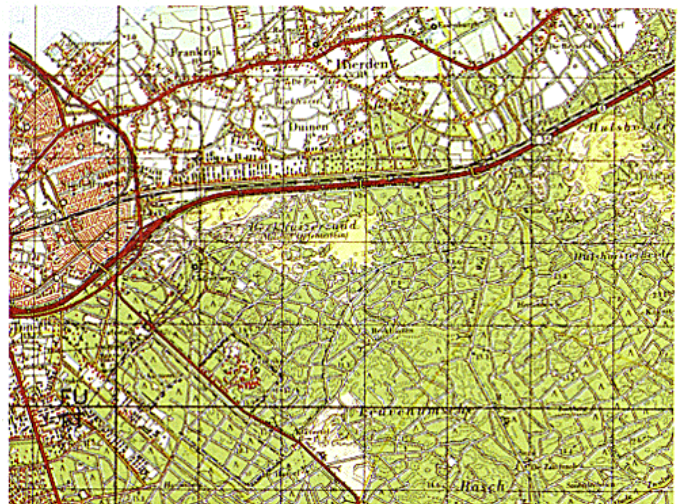
Topographic map (scale 1:100 000)

3.1.3. Mixed forest

Vegegation formation composed principally of trees, including shrub and bush understoreys, where neither broad-leaved nor coniferous species predominate.

3.1.3. Luxembourg/Area: Clervaux
Landsat TM 4.3.2. 1:100 000, August 1989

Interpretation

This category includes not only mixed forest in the strict silvicultural sense (single tree or clump mixtures), but also complex forest parcels comprising an intricate mosaic of broad-leaved and softwood species where no homogeneous stand of more than 25 ha can be distinguished. The illustrated example shows different parcels of broadleaved and softwood species classified as a whole under 3.1.3

Colour infrared aerial photograph

.3.

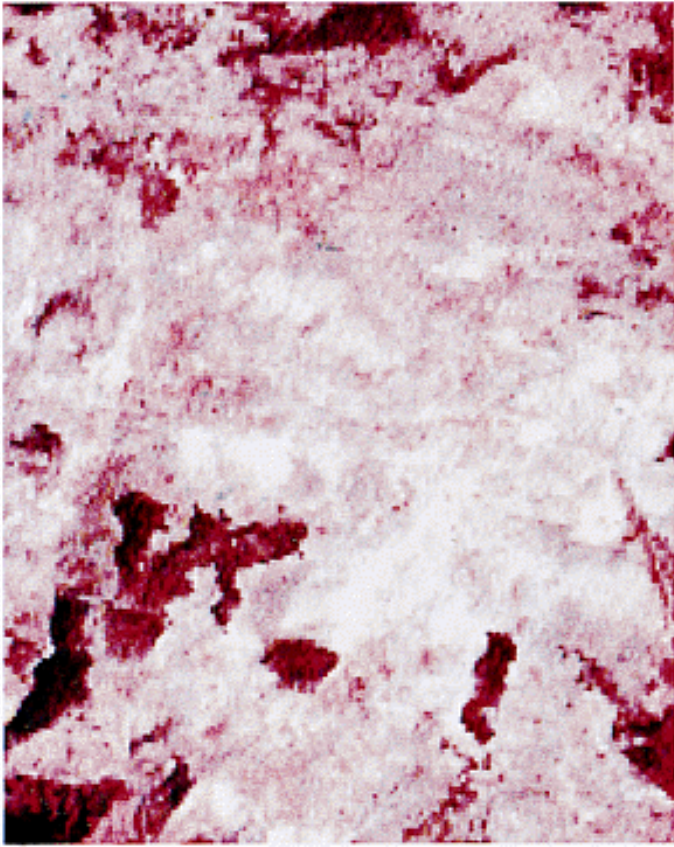## 3.2. Shrub and/or herbaceous vegetation associations

3.2.1. Natural grassland

3.2.2. Moors and heathland

3.2.3. Sclerophyllous vegetation

3.2.4. Transitional woodland/shrub

3.2.1. Natural grassland

Low productivity grassland. Often situated in areas of rough, uneven ground. Frequently includes rocky areas, briars and heathland.

3.2.1. France/Area: causse de Sauveterre
Landsat TM 4.2.1. 1:100 000, August 1989

Interpretation

This category of land cover is most often found in areas where there is extensive agricultural activity. Aerial photographs or the spectral bands of the Landsat Thematic Mapper must be analysed to separate category 3.2.1 from categories 3.3.2 (bare rock) and 3.2.2 (moors and heathland). There will normally be a range of hues reflecting the increasing abundance of ligneous vegetation.

Areas of natural grassland do not normally display parcel boundaries (hedges, walls, enclosures).

Areas which are being grazed or overgrazed when the image is recorded, especially near cowsheds or mountain sheepfolds, should be classified under 3.2.1 and not under 3.2.2 (moors) or 3.3.3 (sparsely vegetated areas).

The criteria to be taken into account are distance from permament habitation and the length of time during which animals can graze (less than 120 days: from June to September).
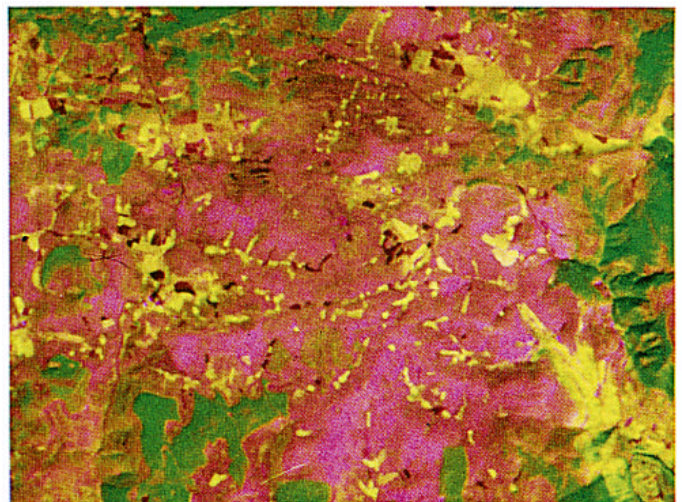
SPOT ACP1/ACP2/XS2

3.2.2. Moors and heathland

Vegetation with low and closed cover, dominated by bushes, shrubs and herbaceous plants (heather, briars, broom, gorse, laburnum, etc.).

3.2.2. Netherlands/Area: Veluwe
Landsat TM 4.5.3. 1:100 000, May 1989

Interpretation

It is possible to distinguish:

Atlantic moors, secondary formation resulting from forest degradation, appearing in two forms:

> * moors composed of European gorse, bracken, etc. (tall growth);

> * moors composed mainly of ericaceae (heathers) (low growth);

subalpine moors, formation based on rhododendrons, bilberries and calluna, generally succeeding subalpine forest and grazing land.

Analysis of the biogeographical context and knowledge of the terrain generally make for good identification of moors and heathland on satellite images. However, it is recommended that the interpretation be compared against aerial photographs. There is a risk of confusion with coniferous forests (3.1.2) and bogs on sloping ground (4.1.2).
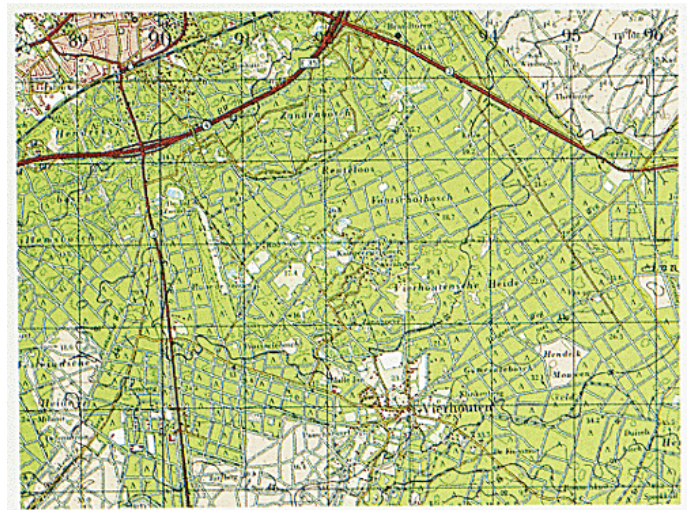
Topographic map (scale 1:100 000)

3.2.3. Sclerophyllous vegetation

Bushy sclerophyllous vegetation, including maquis and garrigue.
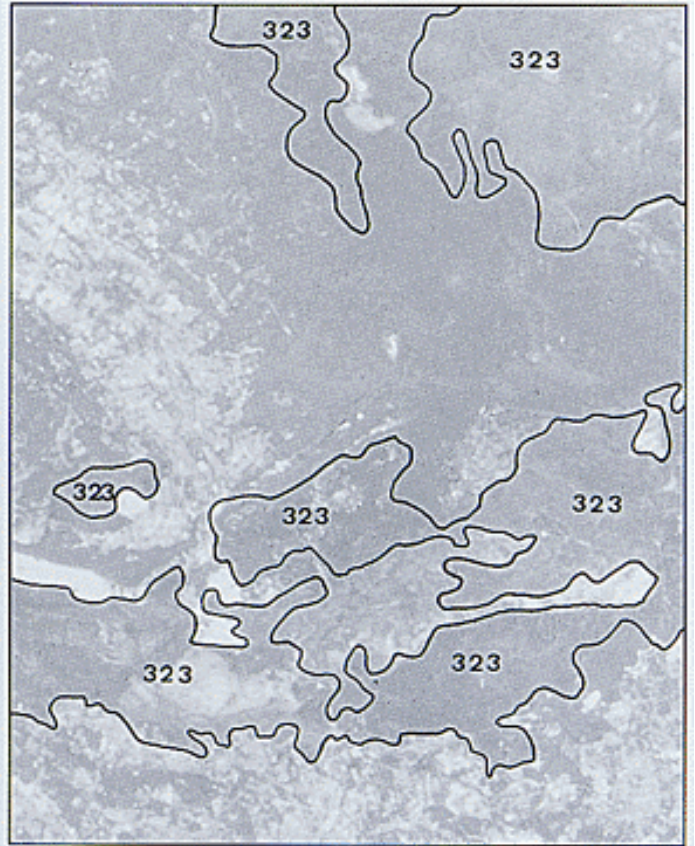
3.2.3. France/Area: Toulon
SPOT 3.2.1. 1:100 000, August 1989

Interpretation

Maquis is dense vegetation associations composed of numerous shrubs covering acid siliceous soils in Mediterranean areas. This formation generally consists of small oaks, oleasters, arbutus, lentiscus, junipers, briar wood and an understorey of cistus and low heathers.

Garrigue is discontinuous bushy associations of the Mediterranean calcareous plateaus. It is often composed of kermes oak, lavender, thyme and white cistus. There may be a few isolated trees. Garrigue is found on a dry, filtering substrate (usually calcareous).

Bushy sclerophyllous vegetation is a subforest formation often difficult to distinguish from Mediterranean forest (possibility of confusion between high maquis and sclerophyllous forest). Use of ancillary data (aerial photographs, forest inventory maps, vegetation index) is highly recommended.
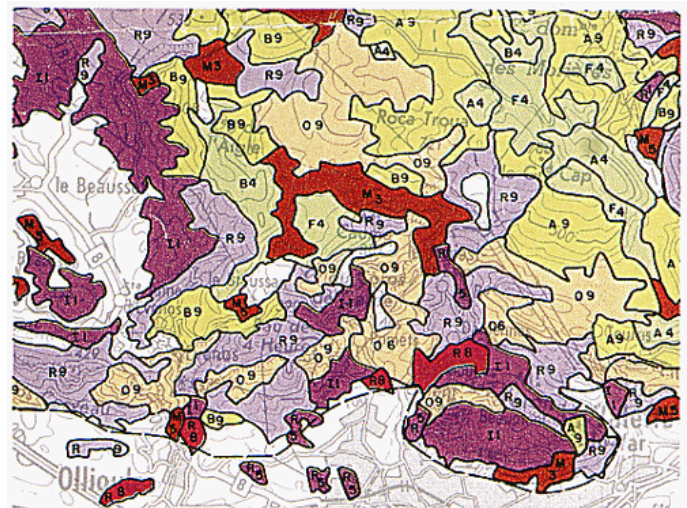
National forest invetory (scale 1:200 000)

3.2.4. Transitional woodland/shrub

Bushy or herbaceous vegetation with scattered trees. Can represent either woodland degradation or forest regeneration/colonisation.


3.2.4. Spain/Area: Tremp
Landsat TM 4.5.3. 1:100 000, September 1987

Interpretation

To interpret the illustrated example, it is necessary to consult the geological map, which shows the calcareous regions where category 3.2.4 contrasts clearly with the sclerophyllous vegetation. To eliminate the considerable differences in reflection between the south-east and northwest slopes, we suggest that the data be processed at an interactive station (normalisation of the visible red/near infrared bands).

This category includes areas subject to erosion or where plant health is giving cause for concern, and areas which are being afforested, which, if the aforestation is natural, usually means that land units classified under 3.2.2 or 3.2.3 will be present, bordering on forest units classified under heading 3. 1. Category 3.2.4 encompasses two distinct types of evolution. Units in this category are often difficult to identify and delineate on satellite images, which merely indicate their presence.

The context (areas of erosion, steep slopes, set-aside) must be taken into account, but the information taken from the satellite image or obtained through processing at an interactive station (normalisation of the visible red and near infrared bands) must be checked on aerial photographs.
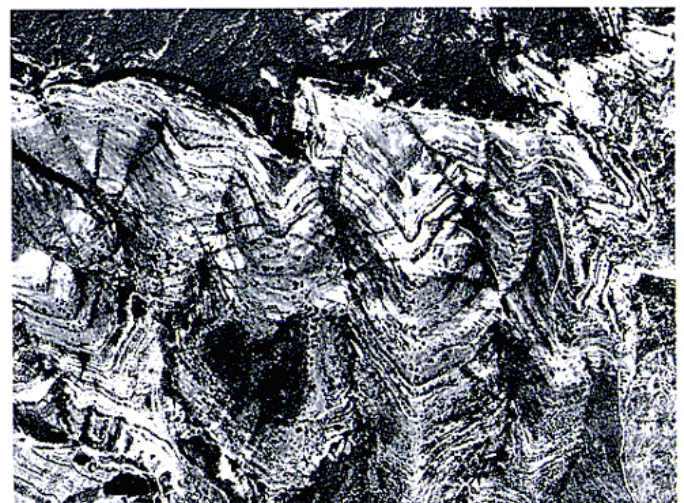
Panchromatic aerial photograph

Areas which are being reafforested or are regenerating after tree-felling or forest fires should be classified elsewhere, under the 3.1 headings.

3.3. Open spaces with little or no vegetation

3.3.1. Beaches, dunes, sands
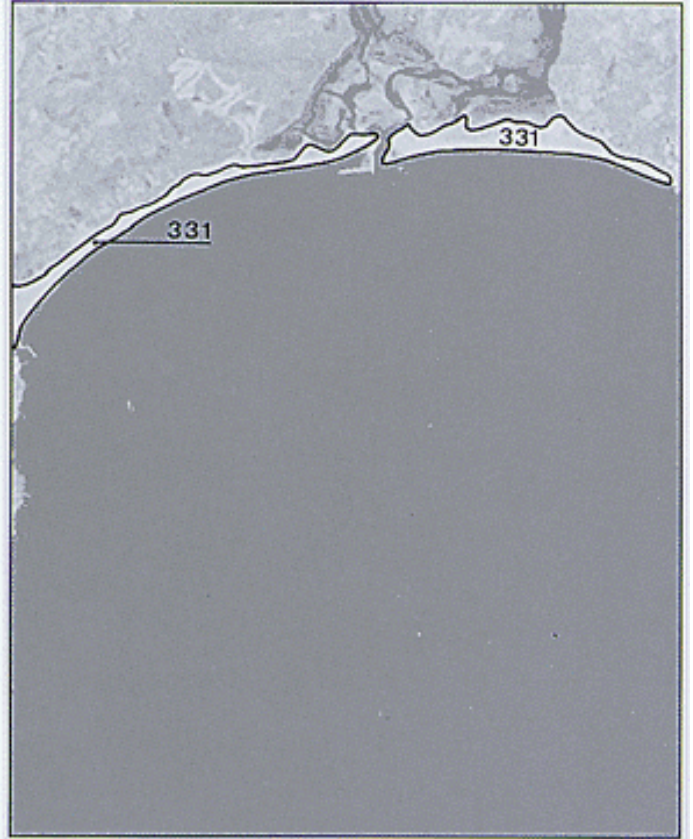
3.3.2. Bare rock

3.3.3. Sparsely vegetated areas

3.3.4. Burnt areas

3.3.5. Glaciers and perpetual snow

3.3.1. Beaches, dunes, sands

Beaches, dunes and expanses of sand or pebbles in coastal or continental locations, including beds of stream channels with torrential regime.

3.3.1 Portugal/Area: Lagos
Landsat TM 4.5.3.. 1:100 000, August 1985

Interpretation

Beaches must be at least 100 m wide to be included. Beaches in front of urban coastal areas should be distinguished from artificial surfaces. Sandy riverbanks can be included only if they occupy 25 ha or more. Since the tide level will vary from one satellite image to another, the coastline should be determined by reference to the more recent 1: l 00 000 maps, though changes brought about by erosion, sedimentation or the construction of port areas or defensive sea walls should be taken into consideration.
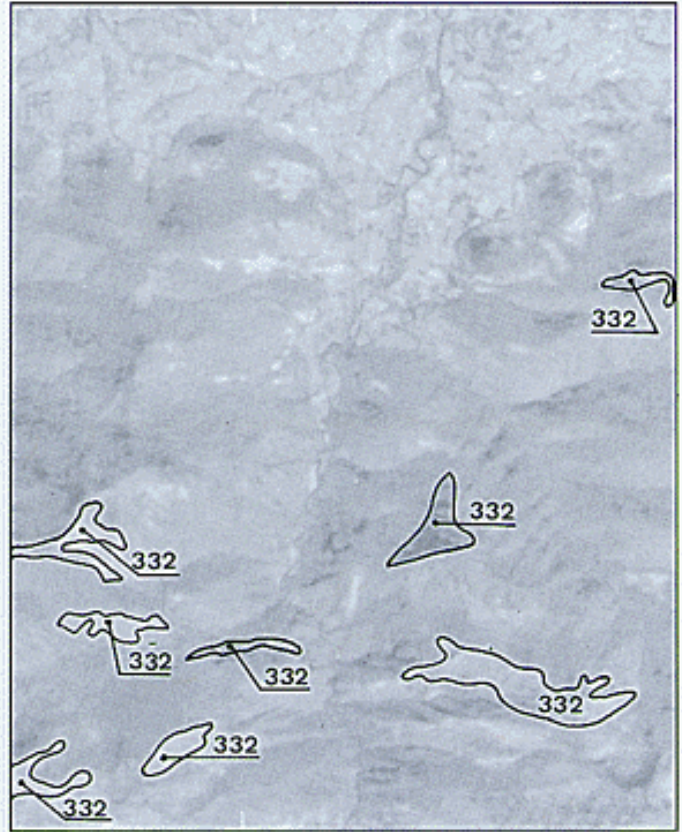
'Grey' dunes fixed by specific vegetation (marram grass, sedge, couch grass, mosses and lichens, etc.) belong in this category. Wooded 'black' dunes should be classified under 3. 1.

Topographic map (scale 1:100 000)

3.3.2. Bare rock

Scree, cliffs, rocks outcrops, including active erosion, rocks and reef flats situated above the high-water mark.

3.3.2. Fance/Area: Pau
SPOT 3.2.1. 1:100 000, July 1988

Interpretation

In interpreting this item it is useful to consult topographic maps, where areas of bare rock and scree are coloured black or blackish-brown. Another function of the topographic map is to help plot rocky areas concealed by the effects of shadows in deep, narrow valleys. Processing at an interactive station (mineralization index, principal component analysis) may be used.

A topographic map indicating contours must be consulted in order to make an accurate judgement of shadows cast in very rough, uneven valleys. Account must be taken of the presence of categories 3.3.2 and 3.2.2 in these narrow valleys.

Topographic map (scale 1:50 000)

3.3.3. Sparsely vegetated areas

Includes steppes, tundra and badlands. Scattered high-altitude vegetation.
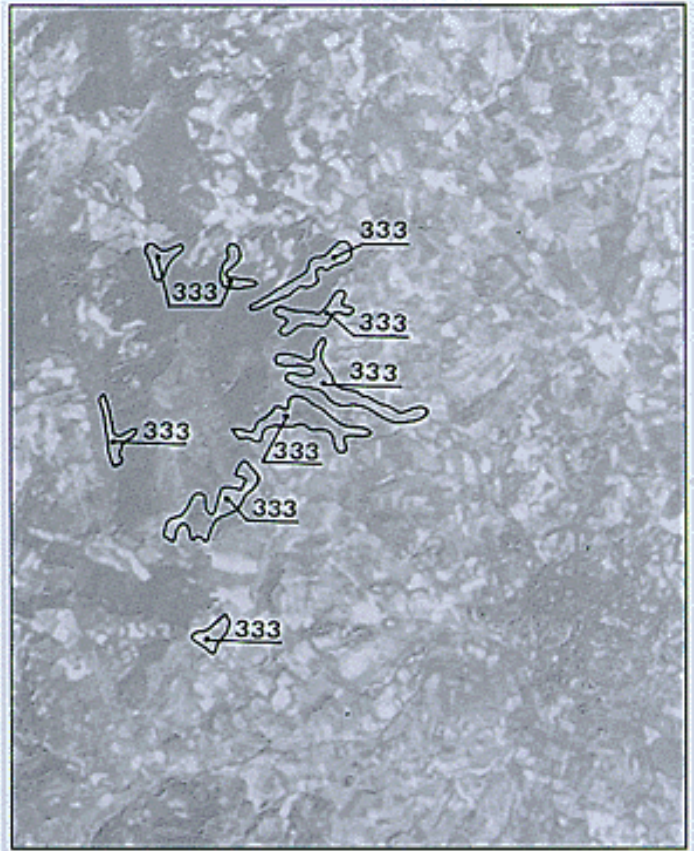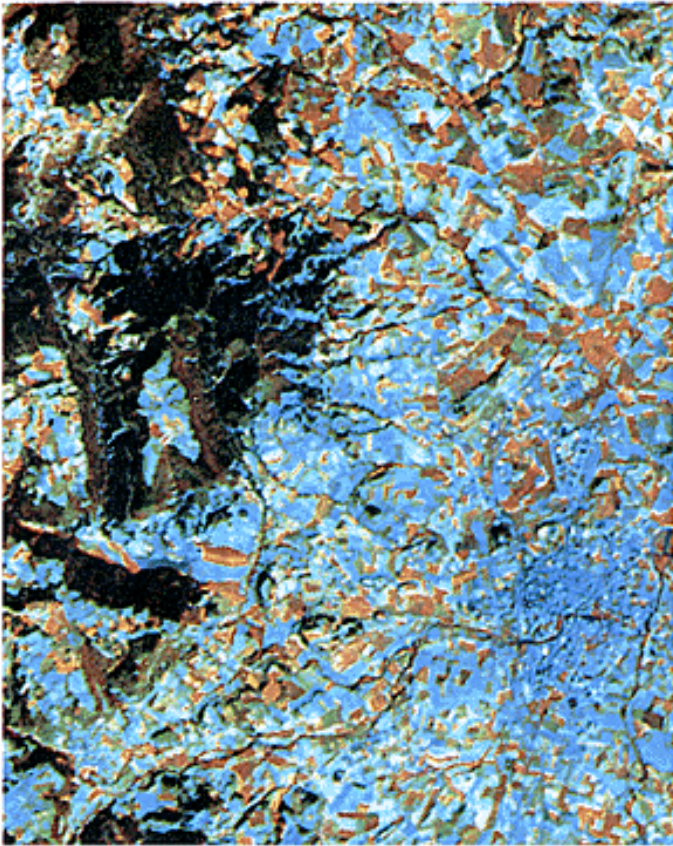
3.3.3. Spain/Area: Vic
Landsat TM 4.5.3. 1:100 000, September 1987

Interpretation

This category includes areas at high altitude which are sparsely vegetated owing to erosion or late melting of snow or ice cover (mountain steppes).
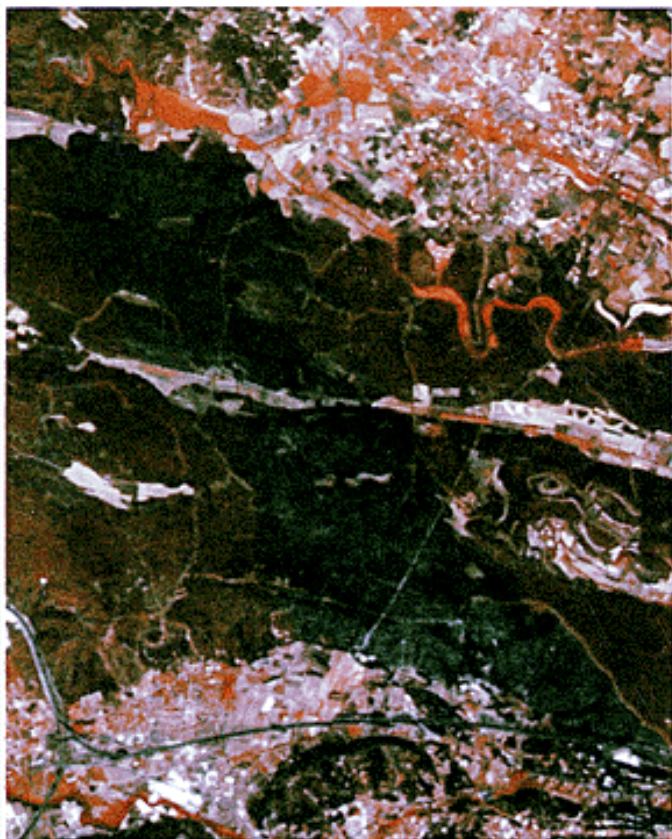
Ancillary data (aerial photographs, geological or pedological maps) are often needed to interpret this items correctly.
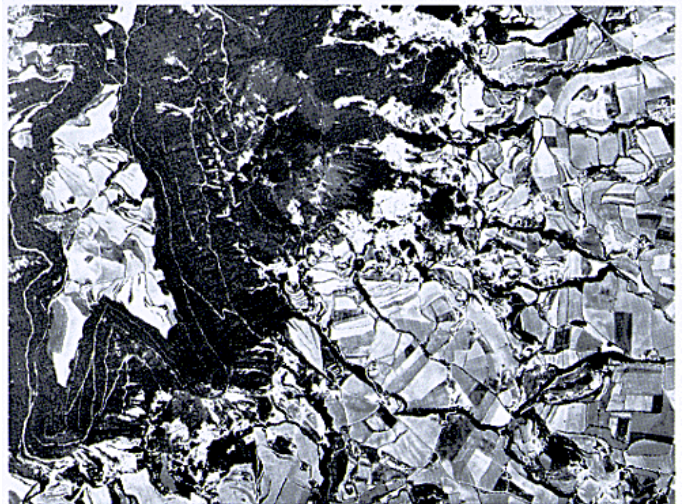
Panchromatic aerial photograph

3.3.4. Burnt areas

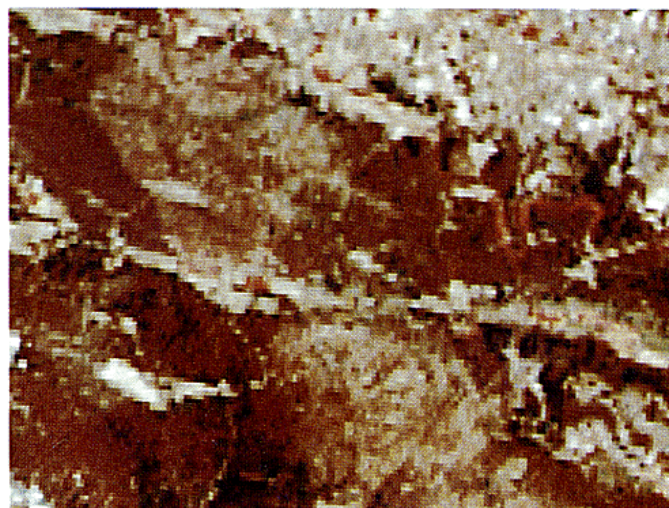Areas affected by recent fires, still mainly black.

3.3.4. France/Area: Aix-en-Provence
SPOT 3.2.1., June 1989

Interpretation

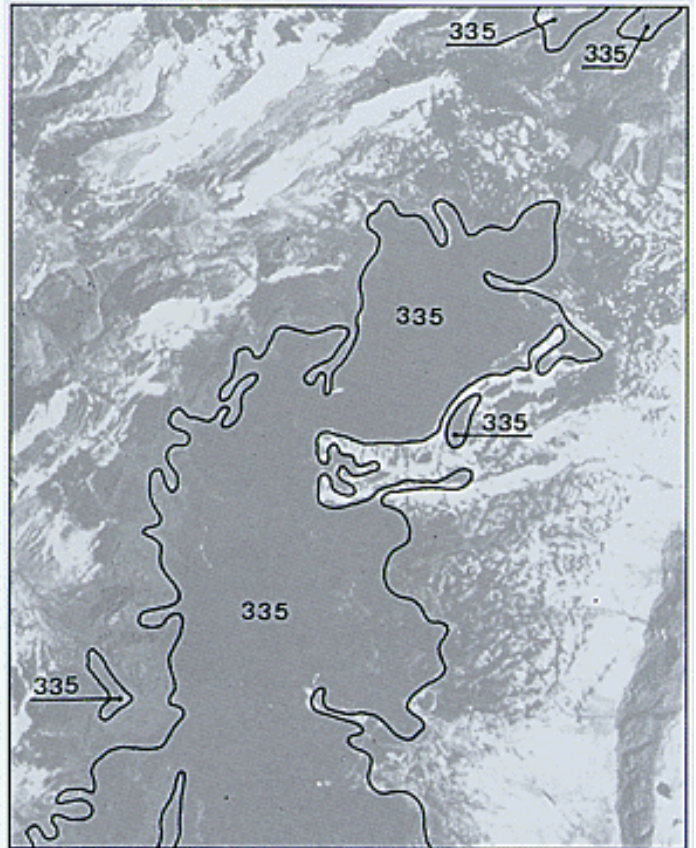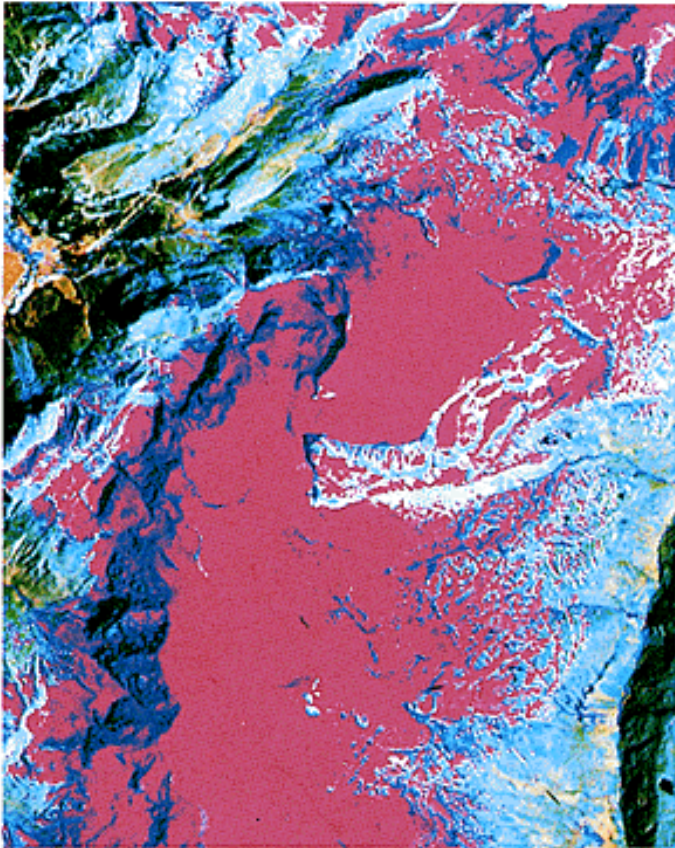These areas include fires in forests and semi-natural areas (heading 3).

Identification of this category is made easier by the use of multitemporal images at an interactive station.

Landsat MSS 4.2.1., July 1988

3.3.5. Glaciers and perpetual snow

Land covered by glaciers or permanent snowfields.

3.3.5. France/Area: Vanoise
Landsat TM 4.5.3. 1:100 000, June 1991

Interpretation

This category includes areas covered by solid or melting ice and snow. Surfaces located on shaded slopes must also be taken into consideration.

Auxiliary data should be used, such as topographic maps, where these areas are indicated by blue contours, and satellite data obtained between 15 July and 15 September, when there is least snow.

Topographic map (scale 1:50 000) reduced to 1:70 000