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Updated CLC illustrated nomenclature guidelines

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Introduction

The current version of the „ CLC nomenclature guidelines" is a significantly updated and enhanced document based on:

Bossard, M., J. Feranec, J. Otahel (2000): CORINE land cover technical guide – Addendum 2000. EEA Technical report No 40

and

Deliverable "Proposal for enhancement of CLC nomenclature guidelines" ETC SIA EEA subvention 2013 WA1 Task 261_1_1: Applying EAGLE concept to CLC guidelines enhancement,

created in a three-step procedure.

Step 1: version 3 July 2014

The aim of enhancement was to assist CLC2012 mapping activities in implementing countries, where either traditional visual photointerpretation or semi-automated production methods are applied. Changes to the document were based on

- experiences of implementing countries during former and current CLC inventories,
- problematic issues revealed by the CLC Technical Team
- considerations connected to the concept of EAGLE (Eionet Action Group on Land Monitoring in Europe).

Step 2: version 30 September 2017

The aim of enhancement was to provide a concise supporting document for the CLC2018 mapping activities. The modifications were based on

- feedback collected from NRC LCs in the October 2016 CLC2018 survey
- thematic improvement by experts of specific biogeogorahical regions addressed by authors
- image stock updated by authors, NRC LCs and addressed experts.

Structure of class descriptions

The following structural items are applied as sub-headings of class description:

Name: class names are kept unchanged in most cases

Subtitle: brief definition of the class, listing the key points to help deciding when to assign the class (land cover components making up the class, thresholds, some basic land use information, where applicable), intention is to avoid complicated description and redundancy with other sections of the text.

Clarification: further explanation and definition of the used terms and advice on interpretation of the class. Advice on how to separate from other similar classes. Provision of further criteria. Information on land use, complementary to definition, which mostly focuses on LC.

This class is applicable for: describes the particular spatial setting in real landscape or real-life instance when given class should be used; does not focus on the single elements making up the class; contains information mostly on location, pattern, function, use. Not necessarily an exhaustive list, but concentrating on most typical examples, including also regional specialities (until now mostly listed under "particularities").

This class includes: landscape elements potentially making up the spatial units (polygons) of the class. Mostly referring to land cover (e.g. associated grass surfaces), but also to specific landscape element features (e.g. protecting dikes). When listing land cover items, the Land Cover Components (LCC) block of the EAGLE matrix is followed in naming and in examining exhaustiveness of the LC items list. Two types of items appear under „includes" list:

- elements that make up the polygon regardless of their size

- elements that can make up a CLC polygon of a different class by themselves, but if <25 ha they are to be generalised into the given class.

At this stage of enhancement both mandatory and optional element are listed under this item. The level of necessity is indicated in text where this is needed for proper understanding of the class. However, the manner and structure of systemic separation of mandatory vs. optional elements is not yet fully elaborated, and therefore is not applied in all class definitions at this stage. In a future step it is proposed to be carried out in line with the system of bar-coding worked out for the EAGLE matrix.

This class is not applicable for: real life instances for which the class shall not be used for, or with which interpreters are likely to mix up class with. Not intended to be an exhaustive list. Where possible, the applicable class is specified for items under this list. Class descriptions are cross-checked in order to ensure that such items are not omitted from the „applicable for" list of the relevant class.

This class excludes: landscape elements and land cover types that are excluded from class, must not occur in it by definition.

Generalisation: advice on how to generalise structures that are likely to occur in association with representatives of the described class. Illustrated with simplified figures.

Particularities: In a former version of the Illustrated Guide, these particularities were introduced with the intention to highlight features that are special to Central-Eastern European countries, which were newcomers to the CLC program at that time of re-writing the last guidelines version. In a number of cases it is proposed to leave out this part from class descriptions, because it has lost its relevance. Instead, if still helpful to mention, the particularities items are proposed to be integrated under the "applicable for" heading. New particularities were introduced to classes 133 and 231.

Textual modifications

Three types of modifications to the text have been implemented:

a. Restructuring of existing text according to proposed class description structure described under II. above.
b. Modification of wording (keeping original thematic content), where original text was ambiguous, or wording and/or sentence structure was unclear / misunderstandable.
c. Additions to original text, where 1) thematic content was missing for the consistent description and/or clear understanding of the class and 2) where regional characteristics were missing; 3) where cross-checking of class descriptions revealed an omitted item.

Step 3: version 10 May 2019

The aim of enhancement was to implement clarifications and corrections found and prosposed as result of CLC2018 mapping activities. Modifications are based on CLC Technical Team and MS proposals and findings.

Feedback

Feedback on content is welcome by authors at barbara.kosztra@lechnerkozpont.hu

Acknowledgement

The authors express their gratitude to the experts who have contributed to the enhancement of the guidelines: Geir-Harald Strand, Linda Aune-Lundberg, Beth Cole, Pekka Härmä, Kevin Lydon, Kolbeinn Árnason and all NRC LCs answering the CLC2018 survey or providing feedback on thematic content.

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CORINE land cover nomenclature illustrated guide

1. Methodology

Visual interpretation is a method of recognizing, identifying and assessing of objects recorded in aerial or satellite images. This method was applied creating the CLC database. It is based on analysis of interpretation elements, of the recorded landscape objects.

1.1. Interpretation of texture and patterns

Further itemisation or updating of CLC database will mean emphasis on analysis of the relation 'landscape object - its manifestation in satellite image'. Analysis of this relation assumes a perfect knowledge of landscape objects, namely their characteristics, which decisively influence reflection and emission capability of electromagnetic radiation. However, emphasis must be laid also on analysis of interpretation elements, by means of which the objects are represented in images. As far as the descriptions of the land cover and its particularities are concerned, the following part of the addendum contains graphic and text presentation of a sum of objects and the characteristics which are part of the CLC classes at scale 1:100 000 from the viewpoint of land cover. This part of the addendum was compiled based on image documentation and comments prepared by experts dealing with the issue of land cover from the European Topic Centre on Land Cover (ETC/LC) and Phare Topic Link on Land Cover (PTL/LC). Every land cover class is characterised (CEC, 1994) and its refinement or extension if necessary, a list of dominating objects comprised in a particular class, typical arrangement of the objects by means of a pattern (Fig. 2 and 3) the dominating textures (Fig. 1), a representative photograph, list of particularities and photographs. The set of characteristics of CLC classes will help the interpreters in image analysis, making use of interpretation elements like texture and pattern. It will also contribute to further understanding of the landscape types of Europe, especially its spatial features.
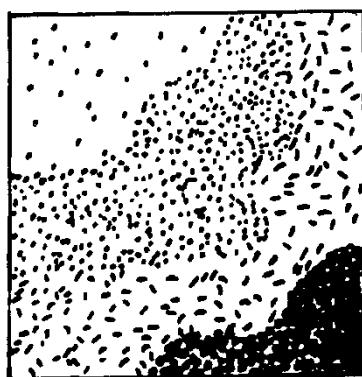

Fig. 1   **Texture – is the area variability in the tone arrangement in the satellite images, representing objects or groups of Earth's surface objects that are too small to be discerned as individual features; the same objects are represented in satellite images of the same type and scale by the same pattern of tones, e.g. very small stripes, circles, points, etc. (Feranec et al. 1995).**

Fig. 2　Pattern – is the spatial arrangement of objects represented in the satellite images by different textures (Feranec et al. 1995). Four variants of pattern created by changing of dots and stripes are on this Fig.
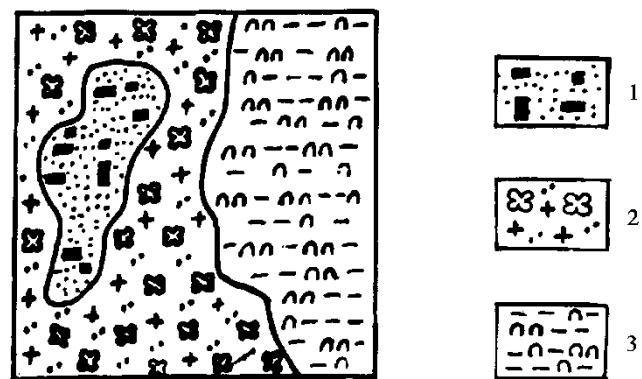

Fig. 3　Pattern types. Land cover cases are determined by significant appearance characteristics of landscape objects, manifesting themselves in the satellite images by means of typical patterns (e.g. 1, 2 and 3), which are formed at least by two textures (Feranec et al. 1995).

1.2 Densities and percentage thresholds

Densities

CLC classes are often defined by densities (percentage) of land cover elements (e.g. buildings, bare surfaces, trees, open water bodies). Assessment of densities requires a certain level of photointerpretation practice and skill. (The figures below illustrate different densities, which can be used as a template for distinguishing classes..
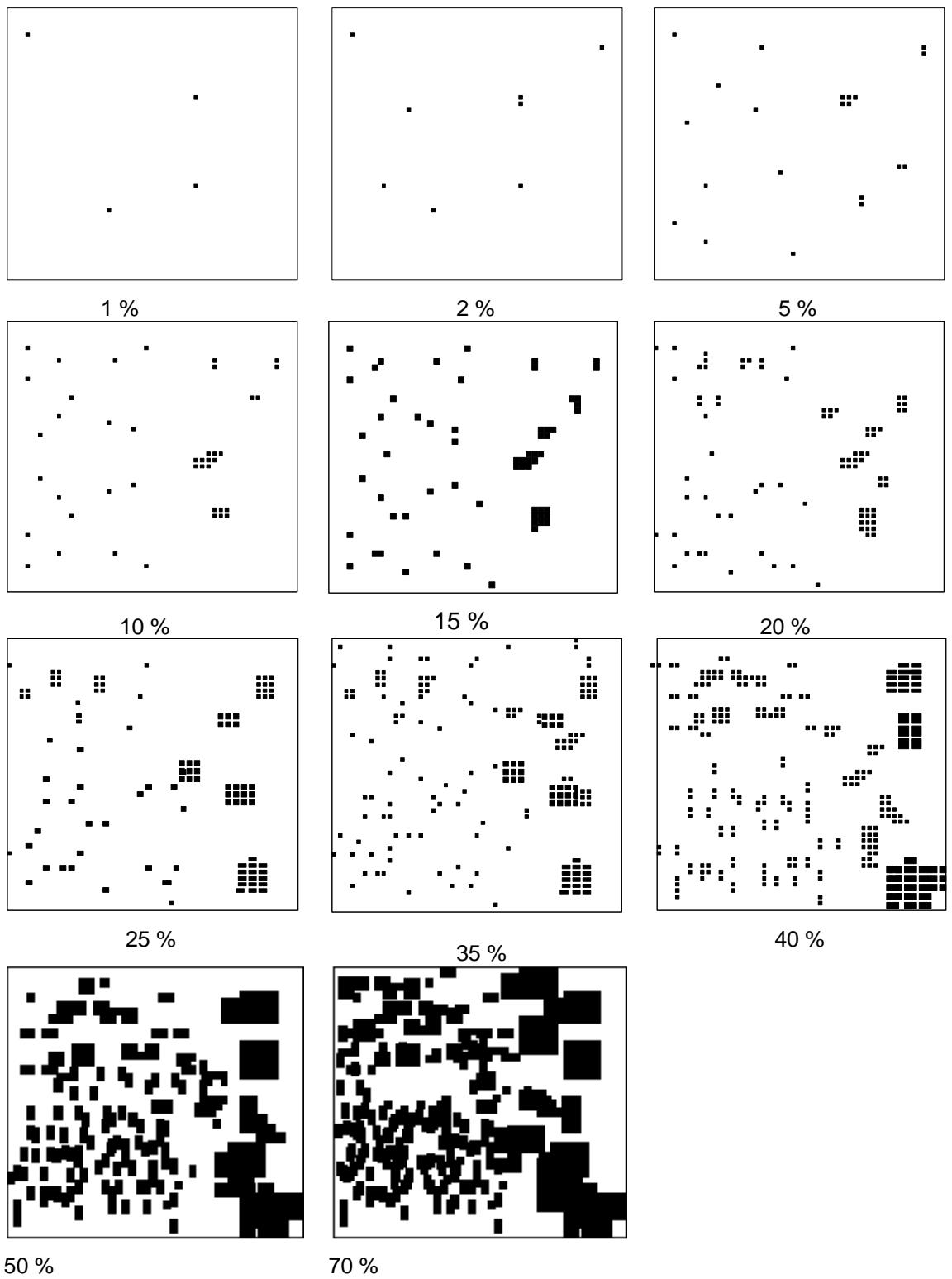

Fig. 4   **Illustration of different densities**

2. Hierarchical CLC Class Definitions

This chapter is the main part of the nomenclature guidelines and contains both the hierarchical order of CLC class levels 1, 2, and 3 as well as the definitions of each CLC class. Each group of CLC classes is briefly introduced on level 1 and 2, followed by the corresponding level 3 classes with detailed definitions and illustrations.

Class 1: Artificial areas

Class 1.1 Urban fabric
Areas mainly occupied by dwellings and buildings used by administrative/public utilities, including their connected areas (associated lands, approach road network, parking lots).

Class 1.2 Industrial, commercial and transport units
Areas mainly occupied by industrial activities of manufacturing, trade, financial activities and services, transport infrastructures for road traffic and rail networks, airport installations, river and sea port installations, including their associated lands and access infrastructures. Includes industrial livestock rearing facilities.

Class 1.3 Mine, dump and construction sites
Artificial areas mainly occupied by extractive activities, construction sites, man-made waste dump sites and their associated lands.

Class 1.4 Artificial non-agricultural vegetated areas
Areas voluntarily created for recreational use. Includes green or recreational and leisure urban parks, sport and leisure facilities.

111 Continuous urban fabric

The continuous urban fabric class is assigned when urban structures and transport networks are dominating the surface area. > 80% of the land surface is covered by impermeable features like buildings, roads and artificially surfaced areas. Non-linear areas of vegetation and bare soil are exceptional.

Clarification:

*This coverage percentage pertains to **real ground surface**. Therefore, identification of the 80% imperviousness threshold requires particular attention to avoid confusion with the apparent vegetation (i.e. visible tree crowns) and permeable surfaces under trees. For example, in the streets bordered with trees, the real ground surface under the trees is mostly covered with asphalt or concrete. So, the vegetation percentage has to be estimated taking into account the shape structure and spatial context visible on the satellite image.*

The occurrence of at least 80 % of soil sealing is not the sole criteria for assigning an area to this class; also land use aspects have to be taken into account. The dominant land use type is residential, which can be also mixed with public services or local governments and commercial or office areas.

This class is applicable for:
- urban centre types and dense ancient suburbs where buildings form a continuous and homogeneous fabric;
- non-vegetated cemeteries inside urban fabric (regardless of size).
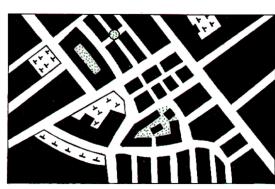
This class includes:
- residential buildings dominating;
- public service and commercial/industrial buildings with their connected areas < 25 ha;
- interstices of non-vegetated or bare surfaces;
- parking lots, concrete or asphalt surfaces;
- transport network <25 ha and <100 m width;
- small squares, pedestrian zones, yards;
- urban greenery (parks and grass areas) <25 ha amounting to maximum 20 % of the polygon area;
- vegetated cemeteries< 25 ha located inside continuous urban fabric.

This class is not applicable for:
- industrial, commercial or public complexes and ports >25 ha, even if those areas are > 80 % sealed (classes 121, 123);
- urban fabric with >20% scattered greenery (class 112).

This class excludes:
No entry.

◣	Texture of buildings
▨	Texture of parking lots
▨	Texture of urban greens
◿	Texture of streets and roads

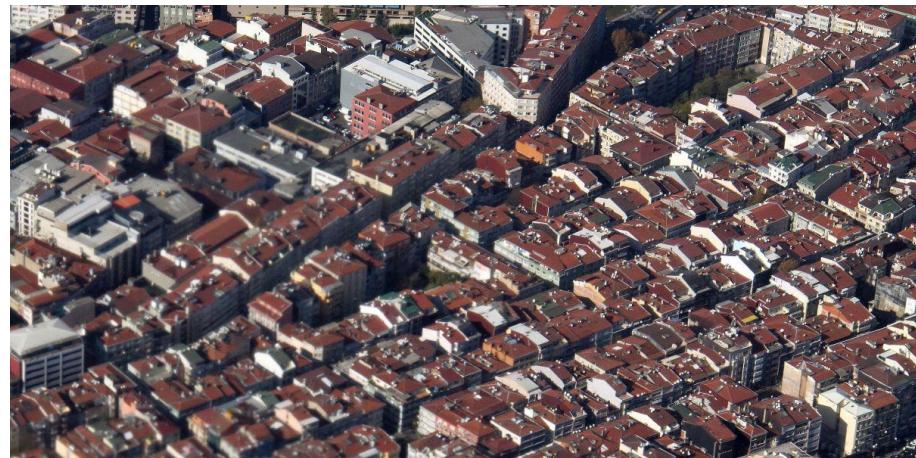Fig. 5   **A generalised pattern of the class 111**

Fig. 6　　**Example 111: Dense urban fabric (*Istanbul*, Turkey). Photo: Gy. Büttner**

Fig. 7　　**Example 111: Dense metropolitan area (Athens, Greece). Photo: Gy. Büttner**

Fig. 8　　**Example 111: Historic city centre (Ljubljana, Slovenia). Photo: B. Kosztra**

Generalisation:
- If two adjacent areas of discontinuous and continuous urban fabric occur, each of them < 25 ha, but in total >> 25 ha, they should be mapped as one single polygon, and discontinuous urban fabric is privileged.

112 Discontinuous urban fabric

The discontinuous urban fabric class is assigned when urban structures and transport networks associated with vegetated areas and bare surfaces are present and occupy significant surfaces in a discontinuous spatial pattern.
The impermeable features like buildings, roads and artificially surfaced areas range from 30 to 80 % land coverage.

Clarification:
The discrimination between continuous and discontinuous urban fabric is set from the presence of vegetation visible in the satellite image illustrating either single houses with gardens or scattered apartment blocks with green areas between them.

The density of houses is the main criterion to attribute a land cover class to the built-up areas or to any other class. For example in case of patchwork of small agricultural parcels and scattered houses (with distance between them less than 300 m), the threshold to be applied for separation between class 112 (discontinuous urban fabric) and class 242 (complex cultivation patterns) is 30 % of urban fabric within the patchwork area. Above that threshold the area should be assigned to class112, below the threshold to class 242.

This class is applicable for:
- permanent residential built-up areas of sparse to significant soil sealing degree.
- residential suburbs made of individual houses with private gardens and/or small squares, private housing estates;
- villages and hamlets with scattered blocks of residential buildings where numerous non-sealed spaces (gardens, lawns) can be distinguished between the houses;
- areas of multi-flat or multi-storey houses forming built-up areas, representing a typical physiognomic uniformity, particularly at the outskirts of urban settlements;
- mixed fabric of residential and industrial / commercial activities (the latter not dominating);
- complex cultivation pattern areas with scattered houses occupying > 30 % of the patchwork area;
- holiday cottage houses with well-developed infrastructure and road network connected residential built-up areas, and visually not separable on the satellite image;
- street-along ('ribbon development') villages if houses with kitchen gardens reach 100 m width;
- troglodyte villages along streets and subterranean housings visible from the satellite image.

This class includes:
- individual houses,
- small and large blocks of flats,
- vegetation and green spaces between buildings (gardens, lawns, flower beds, shrub and tree formations),
- parking areas/lots,
- playgrounds;
- transport network features, squares, streets;
- sports areas < 25 ha;
- buildings with educational, health care and production functions and market places < 25 ha;
- cemeteries (vegetated or non-vegetated) < 25 ha;
- public utilities or community service facilities < 25 ha;

This class is not applicable for:
- holiday cottage areas, holiday parks, permanent/static caravan sites, lodges etc., which are only used for recreational purposes and recognizable as a separate unit in the satellite image (class 142);

This class excludes:

- greenhouses for crop production purposes (classes 211, 212). In this case they are not considered as buildings in the sense of being counted for soil sealing degree.
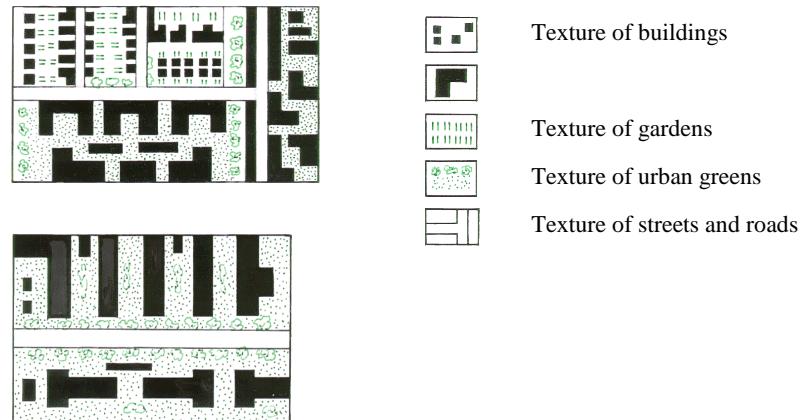

	Texture of buildings
	Texture of gardens
	Texture of urban greens
	Texture of streets and roads

Fig. 9   **Generalised patterns of class 112**

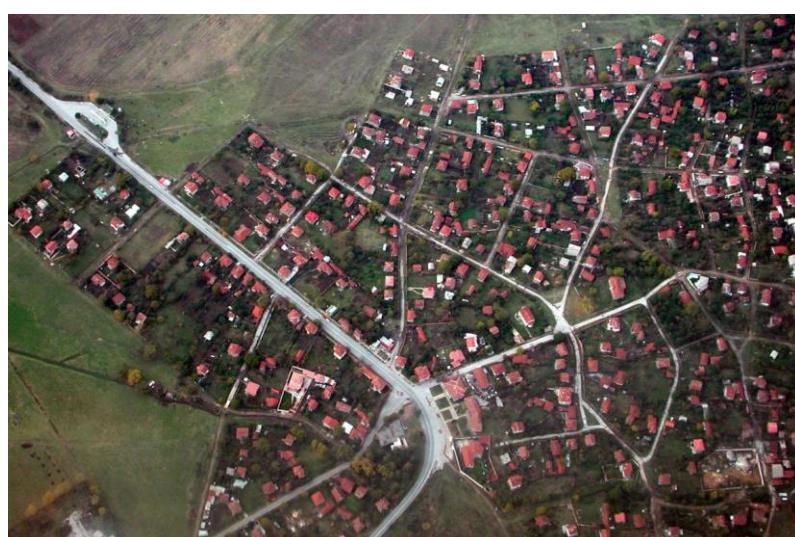Fig. 10   **Example 112: Countryside municipality (*Hamar*, Norway). Photo: Gy. Büttner**

Fig. 11   **Example 112: Village near Sofia (Bulgaria). Photo: Gy. Büttner.**

Fig. 12   Example 112: Street-along village (*near Zenica*, Bosnia) *Generalisation is needed to keep the 100-m width and the continuity of the built-up area*. Photo: Gy. Büttner

Fig. 13   Example 112: Blocks of flats (*Istanbul*,Turkey). Photo: Gy. Büttner
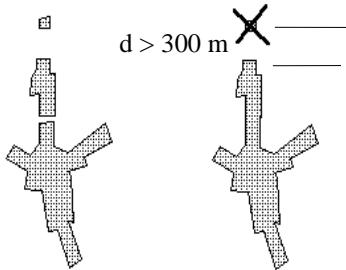

Fig. 14   Example 112: Traditional village structure (*Rimetea/Torockó*, Romania) Photo: B. Kosztra
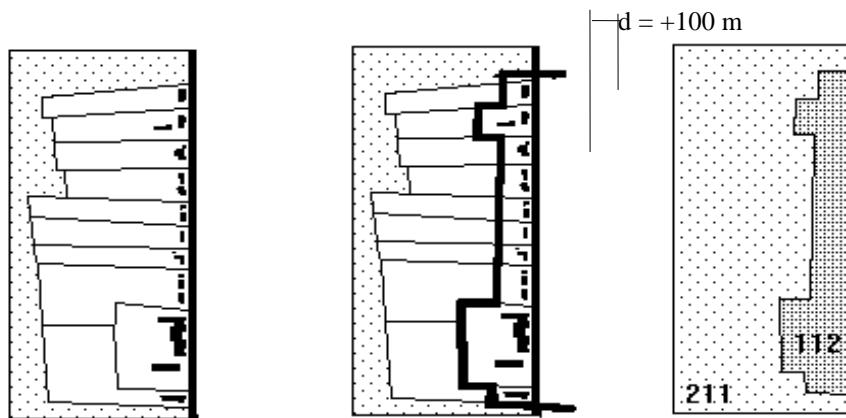
Fig. 15   **Example 112: Green suburbs with villas (*Bolzano*, Italy)
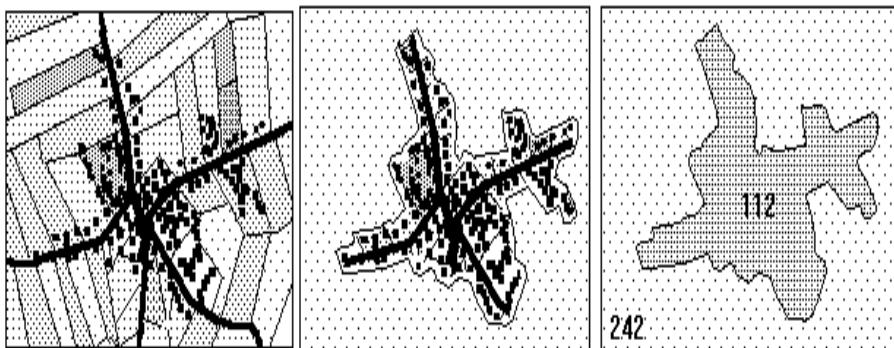Photo: B. Kosztra**

Generalisation:

- 100 m minimum width and 30% minimum built-up density criteria regarding the resulting object should be fulfilled in all generalization operations.
- Generalisation of discontinuous built-up areas located along roads: until 300 m to maintain land cover feature of street-along villages.
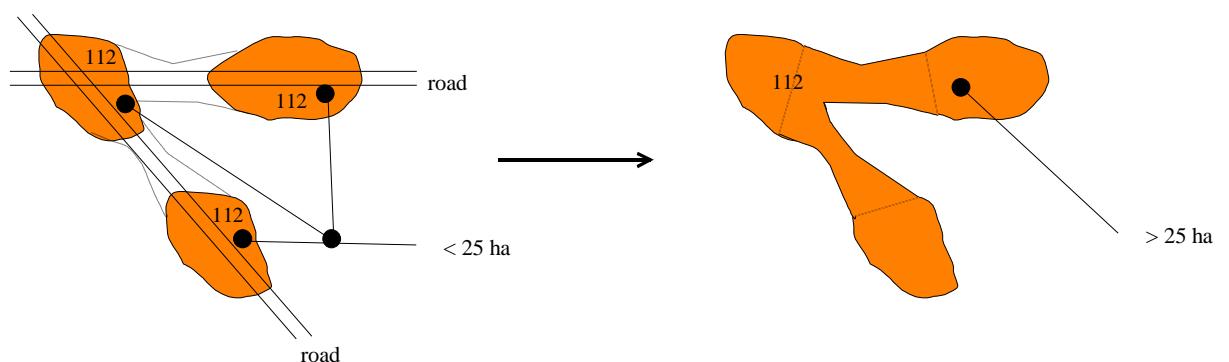

- For housing with large gardens, an arbitrary 100 m – buffer is added around the houses and infrastructure to delimit the artificial surfaces from the surrounding area (often agricultural area).
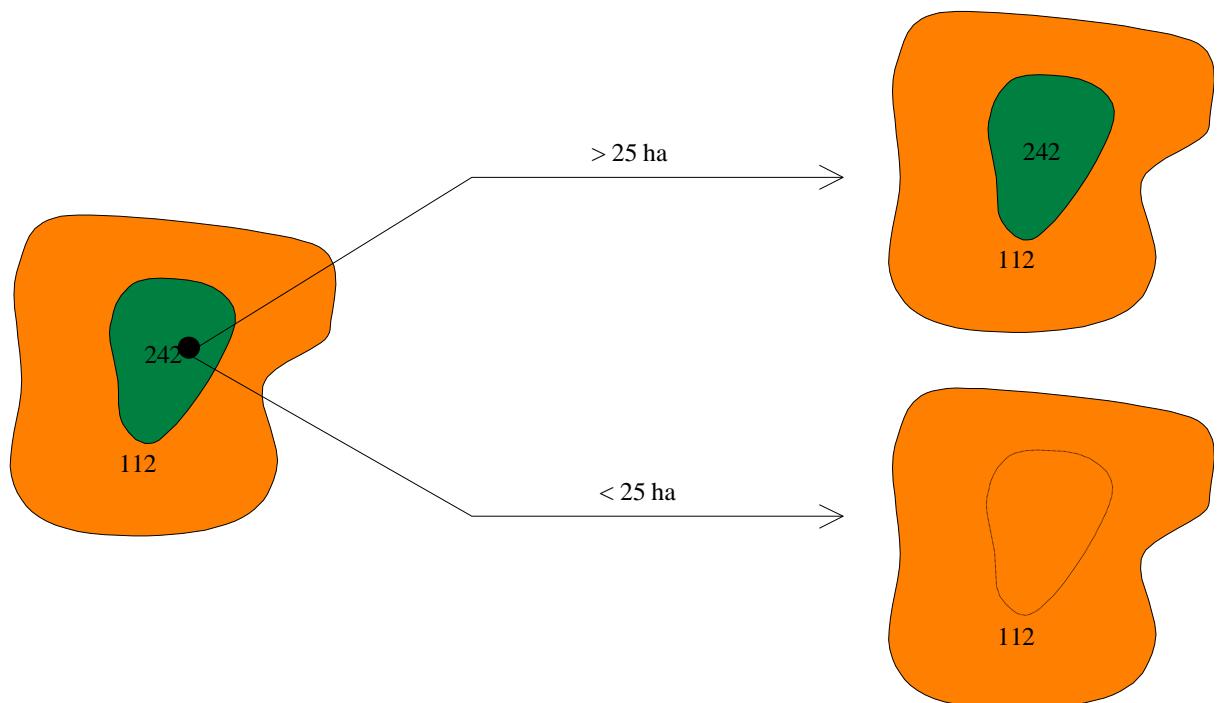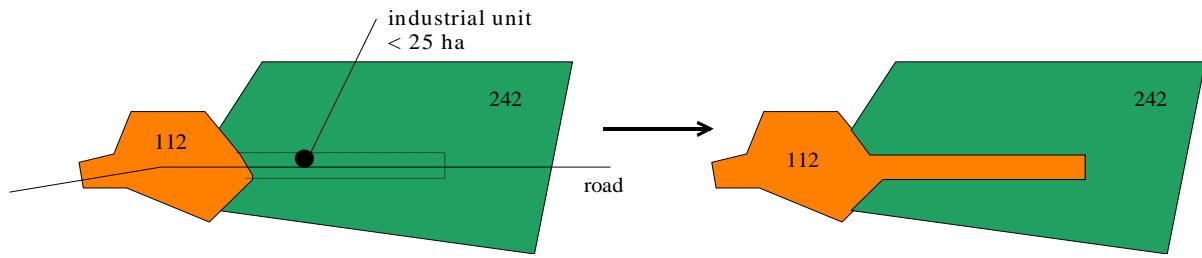
- Small discontinuous urban fabric areas < 25 ha are grouped together if the distance between each of them is < 300 m in order to reach 25 ha. The exterior contour line leans on road network.
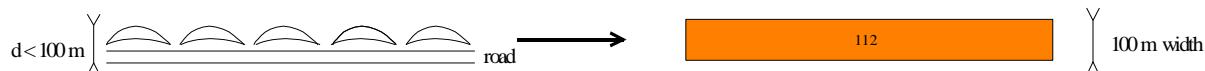

- In case of vegetated space surrounded by discontinuous urban fabric, the non-built-up zone is assigned 242 (agricultural use) or 141 (park or natural vegetation) if its surface is > 25 ha. Otherwise, it should be included in discontinuous urban fabric.

- Extension of villages (112) with mixed fabric of settlement/industrial and commercial activities along the roads need to be added in 112.

industrial unit
< 25 ha

- Mixed residential industrial areas (if both components are <25 ha, but together >25 ha) should be mapped as 112.
- Troglodyte villages along roads, with length over 2.500 m, are mapped as linear urban construction by artificially delimiting a 100 m – linear buffer zone including the road from the house frontage.

121 Industrial or commercial units and public facilities

Buildings, other built-up structures and artificial surfaces (with concrete, asphalt, tarmacadam, or stabilised like e.g. beaten earth) occupy most of the area. It can also contain vegetation (most likely grass) or other non-sealed surfaces. This class is assigned for land units that are under industrial or commercial use or serve for public service facilities

Clarification:
The class 121 has a strong focus on land use information, which is the key criterion to identify this class. In this class many different land cover types can occur, so it does not necessarily indicate precise information on land cover for a particular given situation in landscape, in particular the degree of imperviousness.

This class is applicable for:
- all kinds of industrial and production complexes;
- commercial complexes;
    - exposition sites, fair sites;
    - large shopping centres;
- research and development establishments (laboratories, testing pistes, test fields);
- community services
    - security and law and order services, fire stations, penal establishments,
    - military/defence, including military airfields without sealed runway,
    - science and education (schools, universities),
    - health services (hospitals, spas)
    - social welfare institutions (old people's home, convalescent homes, or-phanages, etc.);
    - refugee camps consisting mainly of non-permanent structures (container houses, tents);
- large scale or industrialized agricultural installations (livestock farms, co-opera-tives);
- on-shore aquaculture facilities;
- energy production and distribution facilities
    - power plants (nuclear, fossil combustibles),
    - renewable energy installations (wind farms if turbines are <300 m dis-tance from each other, solar panels, geothermal plants, biomass, hydro-electric plants and dams, including pumped-storage hydroelectric power stations)
    - electricity transformers;

- utilities
  - waste water treatment plants (industrial or biological), including ponds of biological water treatment plants;
  - recycling centres;
  - drinking water supply facilities,
  - telecommunication networks (relay stations for TV, telescopes, radar stations);
- motor circuits inside industrial unit areas used for test purposes;
- caravan parking used for commercial activities;
- abandoned industrial/commercial/military or any other of the above listed sites where buildings and other artificial structures are still present and associated land that shows traces of corresponding activities;
- industrial and commercial units > 25 ha associated with port activities.

This class includes:
- buildings of all sizes, from single buildings to large halls, which serve for the applicable purposes mentioned above;
- any specific technical structures and facilities (e.g. storage tanks, antennas, refineries, pipelines)
- agro-industrial and on-shore aquaculture structures: storage for crops, fodder or machinery; silos; stables; barns, basins, water tanks;
- parking lots;
- roads and railways inside industrial sites;
- associated open sealed surfaces (e.g. storage areas);
- associated green areas, lay-by areas or unsealed surfaces;
- greenhouses in commercial (garden) centres for product selling purposes;
- mineral extraction sites and dump sites < 25 ha, associated to industrial units;
- raw material waiting to be used, stored inside or next to industrial facilities.

This class is not applicable for:
- residential areas (class 111 or 112);
- mixed fabric of residential and industrial / commercial activities (class 112);
- military outdoor training grounds in use or abandoned; it must be mapped according to its actual land cover (usually classes under forest and semi-natural areas like 31x, 321, 322, 323, 324, 333).
- military ports (class 123) and military airports with sealed runway (class 124)
- extractive industry, extraction sites (class 131);
- oil terminals inside port activities (class 123);
- industrial/public liquid and solid waste (132);
- dockyards (class 123);
- merchant departments belonging to private or public services (class 11x);
- places of worship: convents, monasteries, etc. (class 142).
- off shore (floating) aquaculture facilities for fish, shellfish or macroalgae production (class 512 or 523);
- abandoned industrial/commercial/military or any other of the above listed sites where artificial structures are no longer visible and/or evidence of other use is recognizable (class according to actual cover/use).

This class excludes:
- off-shore aquaculture installations, such as floating cages and tanks, buoy lines (class 512 or 523).
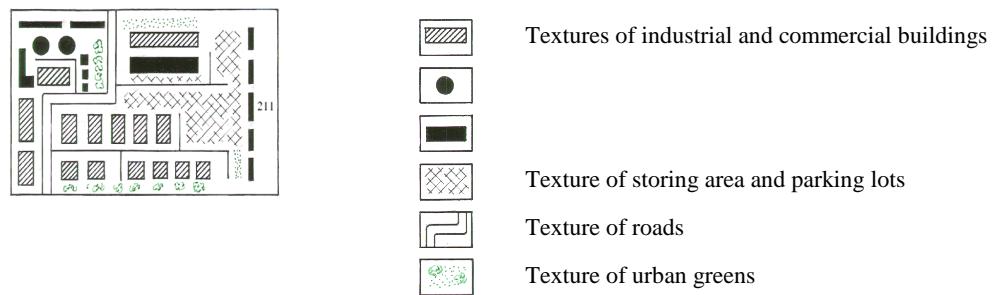
	Textures of industrial and commercial buildings
	Texture of storing area and parking lots
	Texture of roads
	Texture of urban greens

Fig. 16   **Generalised pattern of the class 121**

Fig. 17   **Example 121: Industrial - commercial estates (*suburbs of Rome*, Italy). Photo: Gy. Büttner**

Fig. 18   **Example 121: Electric power distribution facilities (*Bokod,* Hungary). Photo: Márk Krkos**

Fig. 19   **Example 121: Waste water treatment plant (near *Berlin*, Germany). Photo: Gy. Büttner**
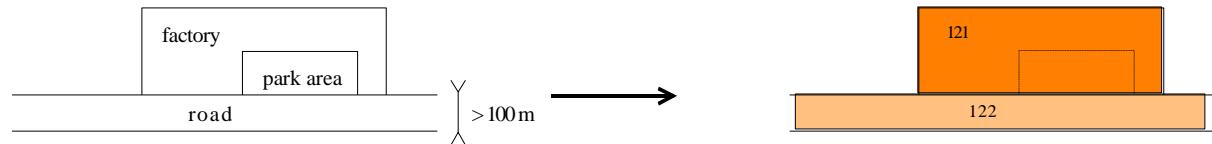

Fig. 20   **Example 121: Electric power plant (*Bokod,* Hungary). *Note unused railway tracks (brownfield) and cooling water reservoir on the left*. Photo: Márk Krkos**

Fig. 21   **Example 121: Geothermal powerplant (*Hellisheiði*, Iceland). *Generalization of associated areas is needed to keep MMU and MMW.* Photo: Wikipedia**

Generalisation:
- Commercial/industrial units < 25 ha which are connected to urban fabric > 25 ha should be assigned as urban fabric.
- Urban fabric units = or > 25 ha inside commercial/industrial units should be mapped.
- Park areas and factory approaches are mapped as industrial units (class 121) even if a road network crosses them.
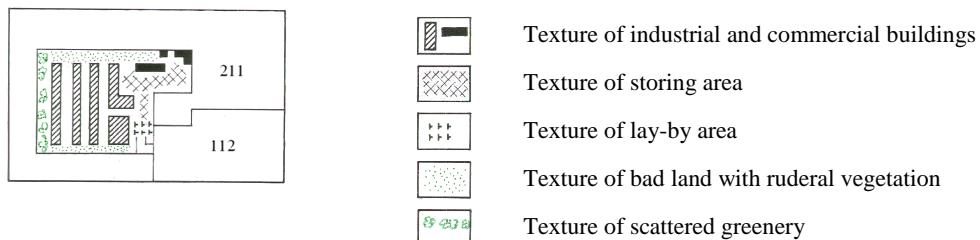

- Wind power installations should be mapped by keeping the area around the access roads and the wind turbines, buffered to only 100 m width.

Particularity of class 121: Agricultural industry

Areas of buildings, in-door spaces, stables, garages, workshops, lay-by and storing areas of agricultural industry, often also bad land with ruderal vegetation, part of farms. Also includes agricultural buildings associated with collectivisation of agriculture.

This class includes:
- buildings, in-door spaces and yards for keeping farm animals;
- garages, workshops, production buildings, lay-by areas for agricultural machinery;
- paved and unpaved storing areas and warehouses;
- bad land with ruderal vegetation.

Texture of industrial and commercial buildings

Texture of storing area

Texture of lay-by area

Texture of bad land with ruderal vegetation

Texture of scattered greenery

Fig. 22   **Generalised pattern of the particularity of class 121**

Fig. 23   **Example particularity of 121: Agricultural industry – animal husbandry and crop storage facilities (*Hungary*) Source: http://static.panoramio.com/photos/large/15988373.jpg**

122 Road and rail networks and associated land

Motorways and railways, including associated installations (stations, platforms, embankments, linear greenery narrower than 100 m). Minimum width for inclusion: 100 m.

Clarification:

The general requirement of 100 m delineation accuracy is not sufficient in mapping 122. The tolerable shift in delineation is maximum 50 m. In delineating 122 a maximum 15-20% exaggeration of width is allowed, meaning that real width of the road including associated land should be at least 80 m to be included in CLC. In such cases the exaggerated width should be as close as possible to 100 m.

This class is applicable for:
- road transport networks and associated land;
- motorway rest areas, service stations, services and maintenance activities for roads;
- railway transport networks and associated land;
- park and ride facilities related to public transport connections;
- tramways networks;
- cableway networks
- abandoned transport network where artificial structures are still present and no evidence of other use is recognizable.
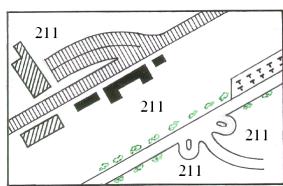
This class includes:
- roads of any artificial paved surface material (asphalt, concrete, macadam) (minimum width 100 m);
- railways, funiculars (minimum width 100 m);
- parking areas, haulage depots connected on motorway networks, tollbooths;
- buildings connected to rest areas, service stations and road maintenance activities;
- marshalling yards, perimeter of stations, services and maintenance activities for trains;
- vegetated areas associated to and /or surrounded by transport networks, including dikes, protecting or decorative vegetation belts, rows of trees;
- compounds of large crossroads with minimum area 25 ha;

This class is not applicable for:
- roads and railways inside industrial units (class 121) or inside ports (class 123);
- motorways and high-speed train tracks under construction (class 133)abandoned transport networks where artificial structures are no longer visible and/or evidence of other use is recognizable (class according to actual cover/use)..

This class excludes:
No entry

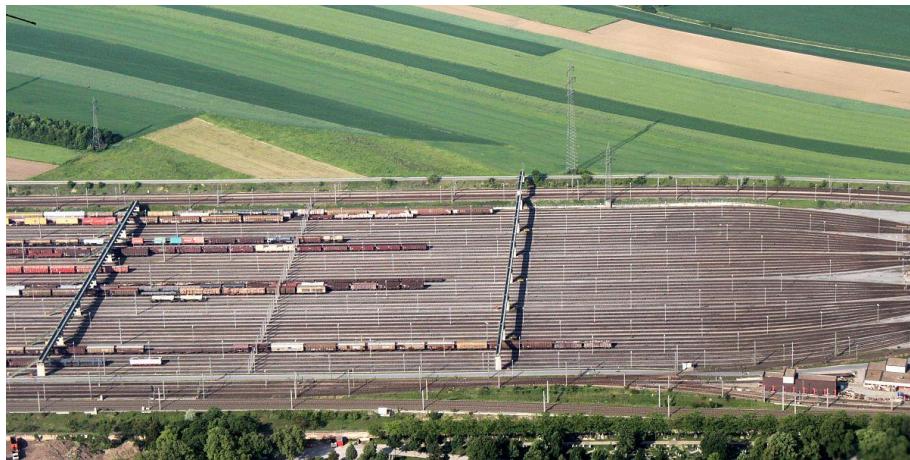|	
	Texture of railway
	Texture of stores and service buildings
	Texture of station buildings
	Texture of road
	Texture of parking lot
	Texture of linear greenery

Fig. 24   **Generalised pattern of the class 122**
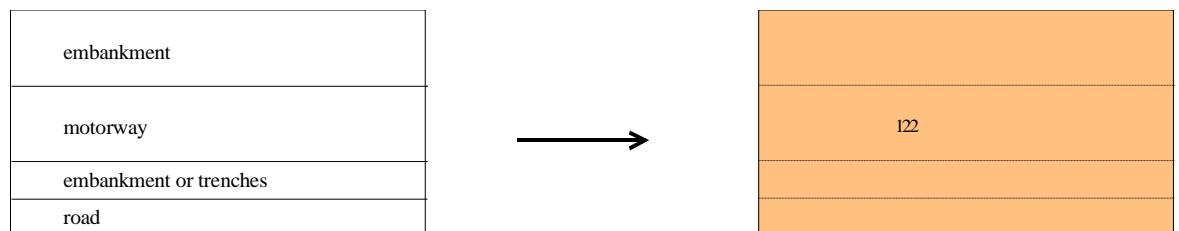
Fig. 25   **Example 122: road crossing (Germany). Associated green areas should be generalised to the road-network. Photo: B. Kosztra**
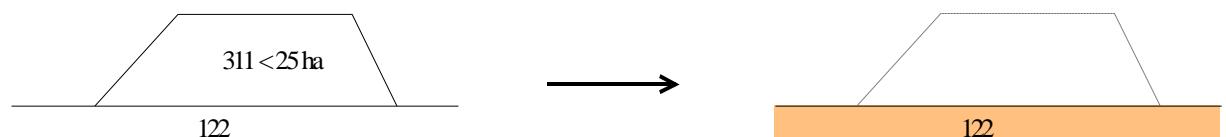

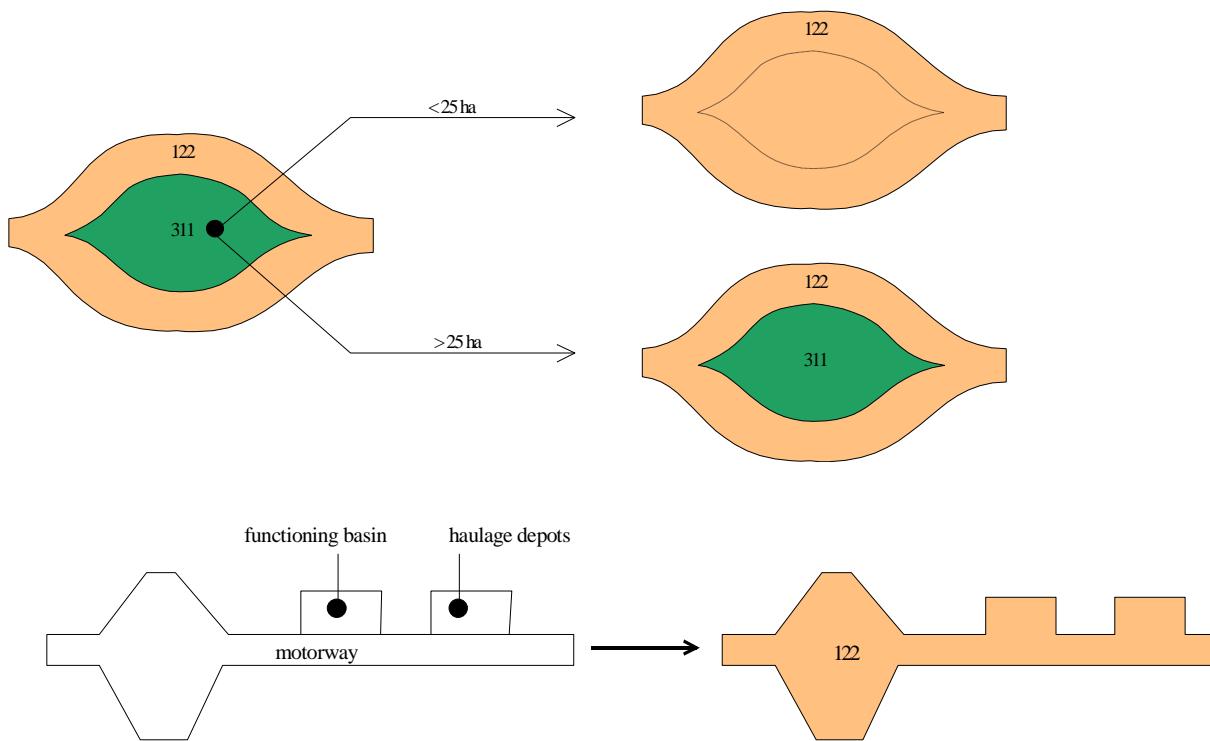Fig. 26   **Example 122: Rail shunting yard (Austria). Photo: Gy. Büttner**

Generalisation:

- The 100 m minimum width refers to the real linear coverage of the network including vegetated trenches and/or embankment slopes. The minimum real length should be 2.500 m.

- Railways have a higher priority than urban fabric and roads have a lower priority than urban fabric.
- In case of complex transport networks and associated lands, associated land should be restricted to those areas that are clearly isolated by roads or railways.

22

Particularity of class 122:

No particularity was identified in this class.

123 Port areas

Infrastructure of port areas (land and water surface), including quays, dockyards and marinas.

This class is applicable for:
- sea ports, river ports, lake ports
- commercial and military ports;
- shipyards;
- fishing ports;
- yachts ports, sport and recreation ports;
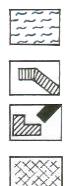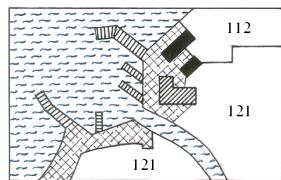- oil terminals inside port area.

This class includes:
- shipping and infrastructure port facilities;
- harbour stations, dock houses, buildings associated to port activities;
- tanks and pipelines;
- dockyards, wet and dry docks;
- roads, railways and parking lots within the port area;
- sealed or non-sealed storage and loading areas;
- piers, quays and breakwaters wider than 100 m;
- harbour basins shirted by quays if the area of infrastructure of the port (firm land part) is smaller than 25 ha
- strips of industrial units below 25 ha adjacent to the harbour.

This class is not applicable for:

- industrial and commercial units > 25 ha associated with port activities (class 121).

This class excludes:

- water surfaces inside port areas > 25 ha or wider than 100 m (class 511 or 512 or 523).

	Texture of water surface
	Texture of quays
	Texture of port area infrastructure (buildings)
	Texture of storing and loading areas

Fig. 27   **Generalised pattern of class 123**

Fig. 28   **Example 123: Seaport with docks, container and oil terminal (Germany). Photo: B. Kosztra**
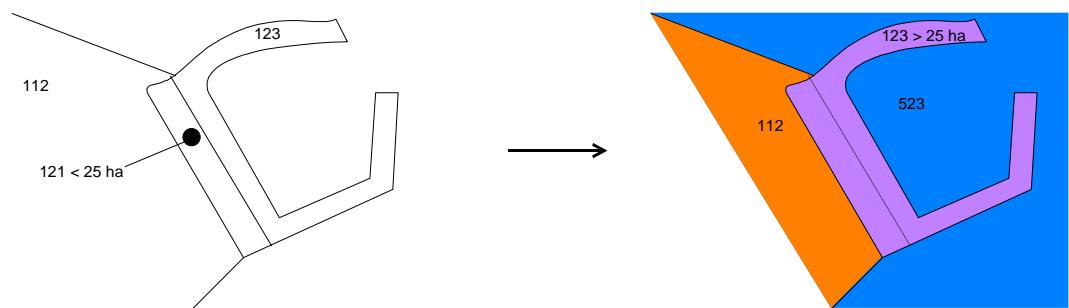

Fig. 29   **Example 123: Fishing, ferry and yacht port (Faroe Islands). Photo: B. Kosztra**

Fig. 30   **Example 123: Yacht port (near *Barcelona*, Spain). Photo: Gy. Büttner**

Generalisation:

- Water surfaces associated to ports can be included in the port area polygon to reach the total size of 25 ha. This is only allowed when this water surface (harbour basin, docks) is surrounded by protective structures like piers or quays.
- In port areas where only artificial surfaces are large enough to reach the size of 25 ha, water surfaces associated to ports must not be generalised into the port area.
- Narrow strips of industrial units below the area threshold contiguous to the harbour are included in the harbour area.

124 Airports

Airports installations: runways, buildings and associated land. This class is assigned for any kind of ground facilities that serve airborne transportation.

This class is applicable for:

- civil and military airports with sealed runway;
- sport airports with concrete or asphalt runways;
- flying schools used for pilot's training programme of civil aviation;
- abandoned airports where artificial structures are still present and no evidence of other use is recognizable.

This class includes:

- take-off and landing runways (concrete, asphalt)
- terminals, hangars, service and storing buildings and in-door spaces;
- technical installations (radars, antennas, towers);
- parking lots and lay-by areas;
- adjacent grass areas, or dispersed trees and shrubs within fenced buffer zone of airport.

This class is not applicable for:

- airports with non-sealed (usually grass-covered) runways used for sports, agriculture and forestry (e.g. spreading of fertilizers and chemical materials) (class 142).
- military airfields without sealed runway as part of military infrastructure (class 121);
- abandoned airports where artificial structures are no longer visible and evidence of other use is recognizable (class according to actual cover/use).
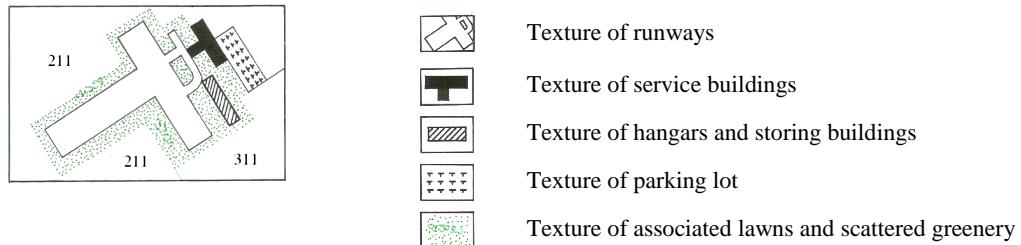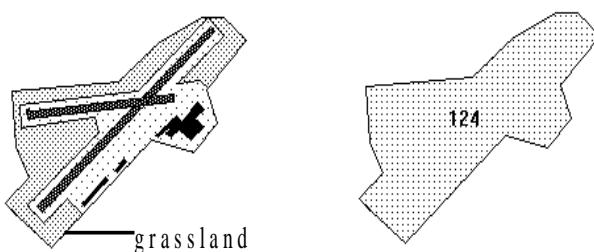
This class excludes:
No entry

	Texture of runways
	Texture of service buildings
	Texture of hangars and storing buildings
	Texture of parking lot
	Texture of associated lawns and scattered greenery

Fig. 31 **Generalised pattern of class 124**

Fig. 32 **Example 124: Commercial airport (*Gatwick*, UK). *Note the associated buildings, hangars, parking lots, green surfaces.* Source: Wikipedia**

Generalisation:

- All land cover features located inside the airport territory such as terminal buildings, runways, parking lots, hotels etc. should be generalised as airport area 124.

- In case airport area is not separated by fence from public access, at least a buffer zone of 100 m should be delineated around the runways.

26

131 Mineral extraction sites

Open-pit extraction sites of construction materials (sandpits, quarries) or other minerals (open-cast mines). Includes flooded mining pits.

This class is applicable for:
- open-pit extraction sites of construction material (stone, gravel, sand or clay) or ore / non-ore mineral material (iron, manganese ores, magnesite, lignite, brown coal, kaolin, etc.);
- rock salt pits;
- sand extraction sites inside coastal dune areas;
- extraction sites of petroleum (crude oil), natural gas and shale gas (fracking sites).

This class includes:
- consolidated or non-consolidated surfaces of mineral materials under active open-pit extraction;
- heaps of extracted material piled up on storage areas ;
- infrastructure of buildings and installations serving for extraction, or primary processing of the quoted material and minerals (extractive industry);
- transport networks associated with areas of open-pit extraction;
- lay-by areas belonging to the mine area;
- water bodies (smaller than 25 ha), usually associated with open pit extraction of gravel, sand, etc.

This class is not applicable for:
- exploited peat bogs (class 412);
- associated land of mines where barren materials are dumped (coal tips, slag dumps) (class 132);
- coastal and inland salinas (class 422);
- natural outcrops of rocks or minerals, scree-covered areas (class 332);
- extraction sites reconverted to leisure areas (class 142);
- disused mineral extraction pits filled with water (class 512);
- river bed material extraction without permanent infrastructure (class 331 or 511);
- abandoned or reclaimed extraction sites, which are to be mapped according to their actual land cover (e.g. 231, 324, 333).

This class excludes:

No entry

Fig. 33   **Example 131: Mineral extraction site with processing installations (The Netherlands). Photo: G. Hazeu**

Fig. 34   **Example 131: Quarry (near Athens, Greece). Photo: Gy. Büttner**

Fig. 35   **Example 131: Gravel extraction site (close to Budapest, Hungary).** *Note the different colour of water bodies: light blue water is rich in sediments due to the ongoing gravel extraction (131). The lakes with dark colour are not anymore used for mining and should be classified as water (512).* **Photo: Gy. Büttner**

Generalisation:

- Flooded mineral extraction surfaces are included if < 25 ha. The flooded areas should be isolated and assigned as water bodies (class 512) if > 25 ha. The water surfaces and their visible extraction surrounds are connected together to create a single polygon 131 > 25 ha.

Coding of adjacent mineral extraction site and flooded mine (water)

Size extraction site	Size water surface	CLC code
>25 ha	<25 ha	131
<25 ha	>25 ha	512
<25 ha	<25 ha	131, if total area >25 ha
>25 ha	>25 ha	131 and 512 mapped separately

How to map mineral extraction sites associated to industrial areas if both polygons are < 25 ha?

Coding of adjacent industry (e.g. processing facility) and mineral extraction site

Size industry	Size extraction site	CLC code
>25 ha	<25 ha	121
<25 ha	>25 ha	131
<25 ha	<25 ha	121, if total area >25 ha
>25 ha	>25 ha	121 and 131 mapped separately

132 Dump sites

Public, industrial or mine dump sites.

This class is applicable for:
- dump sites of public, communal waste (landfills);
- dump sites of industrial waste - waste rock after processing of various raw materials;
- dump sites of waste material from wastewater treatment plants (sewage sludge);
- pools of waste water/liquid waste, products of various chemical processes;
- associated land of mines where barren materials are dumped (coal tips, slag dumps).
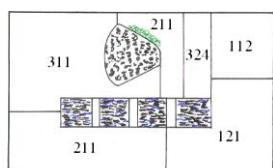
This class includes:
- surface of dumped material (solid or liquid)
- protecting dikes;
- line vegetation belts, part of buffering/protective zones around the dump sites;
- buildings, transport networks including parking lots, associated with dump site;
- non-vegetated slag heaps.

This class is not applicable for:
- decanting basins of biological water treatment plants by means of lagoonage processing; recycling centres(class 121);
- dump sites abandoned and reconverted to leisure areas (class 142);
- abandoned or reclaimed dump sites, which are to be mapped according to their actual land cover (231, 324, 333).

This class excludes:

No entry

Texture of solid waste dump site

Texture of liquid waste dump

Texture of linear greenery

Fig. 36   **Generalised pattern of class 132**

Fig. 37   **Example 132: Communal waste dump site (Poland). Source: Wikipedia**

Fig. 38   **Example 132: Iron ore mine's waste dump (Kiruna, Sweden). Photo: Gy. Büttner**

Fig. 39   **Example 132: Liquid waste pond (Bulgaria). Photo: Gy. Büttner**

133 Construction sites

Spaces under construction development, soil or bedrock excavations, earthworks. This class is assigned for areas where landscape is affected by human activities, changed or modified into artificial surfaces, being in a state of anthropogenic transition

This class is applicable for:
- construction sites of any kind, e.g. for residential areas, public and industrial structures and facilities, transportation infrastructures, water dams/reservoirs;
- residential fabric under construction with road infrastructure already finished, but buildings still under construction;
- green areas, golf courses, nature reconstruction areas under the process of creation.

This class includes:
- bare surfaces of soil or bedrock as an intermediate state resulting from construction activities;
- sealed or unsealed surfaces (e.g. roads, tracks, storage areas) temporarily associated to construction activities;
- vegetated or bare areas surrounded by or neighbouring construction areas, waiting to be used;

- piled up construction material or removed topsoil;
- scattered finished buildings/structures <25 ha covering <30% of 133 patch.

This class is not applicable for:
- abandoned construction sites, which are to be mapped according to their actual land cover (e.g. 231, 322/323/324, 333).

This class excludes:
- completed buildings, other structures already in use (classes 11x, 12x, 14x);
- completed parts of transport networks when they are larger than 25 ha (class 122).
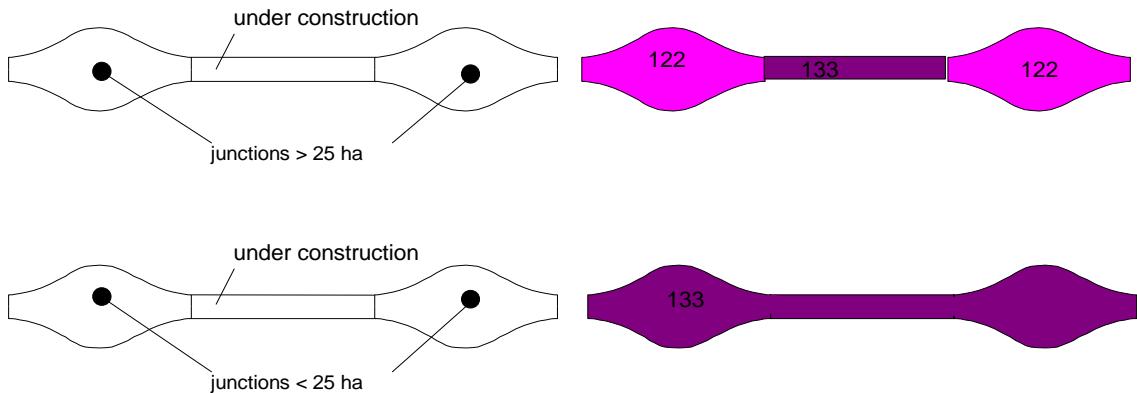

Fig. 40   **Example 133: Construction of a new housing estate (*Ankara, Turkey*). Photo: Gy. Büttner**

Fig. 41   **Example 133: Highway construction near Istanbul (Turkey).** *Note that the construction area is larger than the completed road.* **Photo: Gy. Büttner**

Generalisation:
If structures for crossing and/or junctions are already present and visible on the satellite image along traces of transport networks under construction, then the following scheme should be applied according to the size of structure elements.

under construction

junctions > 25 ha

122 133 122

under construction

junctions < 25 ha

133

Particularity of class 133: Construction / re-construction of nature areas

Cultivated land that turned into uncultivated land due to the creation of new nature areas. It is often bare soil for a while as it is land in transition from land with often an agricultural function into land with a nature function. Finally, the land cover class will transform into classes 321, 322, 333, 411, 412, 511 and 512.

The construction of new nature is intended, inter alia, to fulfil the national or European ecological networks (Natura2000), to increase water storage capacity and/or as compensation. In the latter case, it usually involves compensation for the conversion of a rural area into land with an urban function (urbanisation).

The construction of new nature areas can include one or more of the following measures:

- To increase the water level
- To remove the nutrient rich topsoil and/or vegetation
- To enlarge waterways or create new waterways or lakes

It has often as objective amongst others to increase the biodiversity, to bring soil in accordance with the desired condition regarding moisture, food richness and acidity of the soil, to improve water conditions, to enlarge the waterways and construct nature friendly shores, and to enlarge water bearing capacity of river floodplains.

The more gradual change from agricultural land into nature is not included in this class as it is difficult to observe on remote sensing imagery. It comprises the gradual change of agricultural land into natural areas due to abandonment or extensification (no fertilizers, restricted mowing etc.).

Fig. 42 **Example particularity of 133. Construction of new nature areas (Utrecht, the Netherlands). Photo: G. Hazeu**

141 Green urban areas

Areas with vegetation within or partly embraced by urban fabric. This class is assigned for urban greenery, which usually has recreational or ornamental character and is usually accessible for the public.

This class is applicable for:
- parks inside settlements, with or without public access;
- ornamental gardens;
- mansions' green grounds,
- botanical and zoological gardens situated inside settlements (urban fabric - 112) or in contact-peripheral zone of settlement;
- city squares with greenery;
- inner spaces of city blocks;
- cemeteries with vegetation inside or directly attached to settlements;
- vegetated areas that can potentially be used for recreational purpose even if it is not their main utilisation, such as woods inside urban fabric.
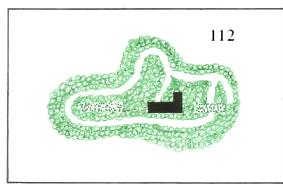
This class includes:
- vegetated areas of parks, lawns, flower beds, bushes, trees;
- park ponds, lakes, fountains;
- lanes and paths (paved or non-paved) in parks or other vegetated recreational areas;
- buildings and service facilities associated to parks and botanical or zoological gardens;
- small sport grounds and facilities <25 ha inside city parks.

This class is not applicable for:
- non-vegetated cemeteries inside urban fabric (class 11x).
- allotment gardens within or around settlements (class 142)
- vegetated cemeteries outside urban fabric (class 142);
- parks, public gardens, leisure parks, botanical or zoological gardens outside settlements (class 142);
- sport grounds (public golf courses, tennis courts, football pitches etc.) ,>25 ha in city parks (class 142);
- vegetated areas that are in contact with settlements but have agricultural production function (classes 2xx);
- grass-covered parcels between buildings or at the edge of settlements waiting to be used, as well ground with ruderal, degraded vegetation between construction parcels (class 231)
- kitchen gardens in settlements with purpose of agricultural production for own consumption (class 242).

This class excludes:
No entry.

	Textures of urban greenery
	Texture of gravel, sand
	Texture of pavements
	Texture of recreation and service facility

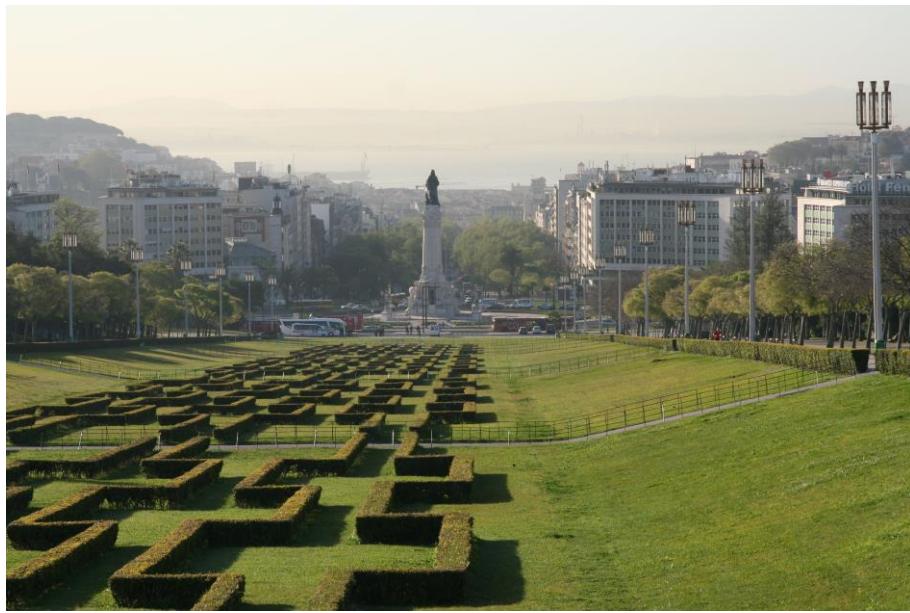Fig. 43   **Generalised pattern of class 141**

Fig. 44   **Example 141: City park (*Lisbon*, Portugal). Photo: B. Kosztra**

Fig. 45   **Example: 141: The multifunctional park of Városliget (*Buda-pest*, Hungary). Photo: Gy. Büttner**

Fig. 46   **Example 141: Vegetated cemeteries (*Istanbul*, Turkey). Photo: Gy. Büttner**

142 Sport and leisure facilities

This class is assigned for areas used for sports, leisure and recreation purposes. Camping grounds, sports grounds, leisure parks, golf courses, racecourses etc. belong to this class, as well as formal parks not surrounded by urban areas.

Clarification:
The criterion for assigning this class is the use of land. Areas of any land cover type can belong to this class if the purpose and use of it is sport, leisure or recreation. Delineation should follow functional boundaries; such areas are often surrounded by fences.

This class is applicable for:
- areas of sport compounds (football stadiums, hockey halls, swimming pools, grass or hard tennis courts, cycling stadiums, athletic halls and stadiums, etc.) with the corresponding infrastructure, located within or outside settlements;
- sport shooting-ranges;
- golf courses;
- racecourses (horse, greyhound, running, bike);
- ski resorts (ski pistes only where artificial snowmaking is present);
- motor racing circuits;
- small sport airports with non –sealed (not concrete or asphalt) runways;
- equestrian centres (horse riding);
- visitor centres of national parks;
- camping sites;
- cottage areas, holiday parks, hotel complexes, holiday resorts, permanent/static caravan sites, lodges etc. used for recreation and leisure activities, usually outside settlements only for temporary residence (regardless of built-up density);
- leisure parks, zoological and botanical gardens out of settlements;
- compounds of disclosed/open archaeological sites;
- museums and other culture and entertainment items;
- allotment gardens within or around settlements;
- vegetated cemeteries situated outside settlements;
- formal parks outside settlements (e.g. castle parks);
- places of worship: convents, monasteries, etc.;
- abandoned or reclaimed mineral extraction sites and dump sites reconverted to leisure areas.
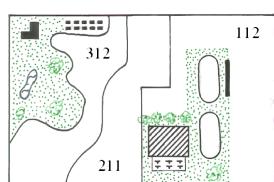
This class includes:

- buildings and other structures of sport and recreation facilities;
- corresponding infrastructure of sport facilities (roads, parking lots);
- green surfaces (grass, bushes, trees) used for or associated to sport or leisure facilities, either of functional (e.g. football lawn, golf greens) or decorative purposes;
- ski pistes with infrastructure for artificial snow-making, where ground may be levelled;
- sealed (asphalt, concrete) or non-sealed (crushed stone, bare soil, sand, cinder) surfaces used for sport or recreation activities (e.g. race tracks, tennis courts) or associated to them;
- associated water bodies < 25 ha (in e.g. golf courses, botanical gardens).

This class is not applicable for:

- motor circuits inside industrial unit areas used for test purposes (class 121);
- caravan parking used for commercial activities (class 121);
- beaches (class 331);
- stud farms for animal husbandry (class 121);
- vegetated cemeteries inside or directly attached to settlements (class 141);
- ski pistes where artificial snow making is not present. They are to be mapped according to their actual land cover in the vegetation period (e.g. class 231, 322, 333)
- yacht ports, sport and recreation ports (class 123);
- sealed runways (class 124) and non-sealed runways of military airports (class 121).
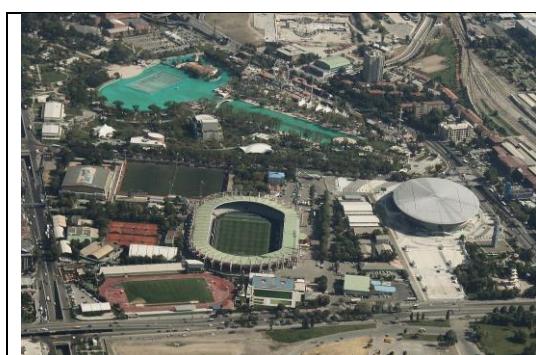
This class excludes:

- No entry

⬭	Textures of sport and service facilities
⬚	Texture of associated grass surface
◼⬚	Texture of buildings
⬚	Texture of water surface
⬚	Texture of parking lot

Fig. 47   **Generalised pattern of class 142**

Fig. 48a: Stadiums and sport fields in *Istanbul* (Turkey)	**Fig. 48d: Seaside resort area in *Jurmala* (Latvia)**

36

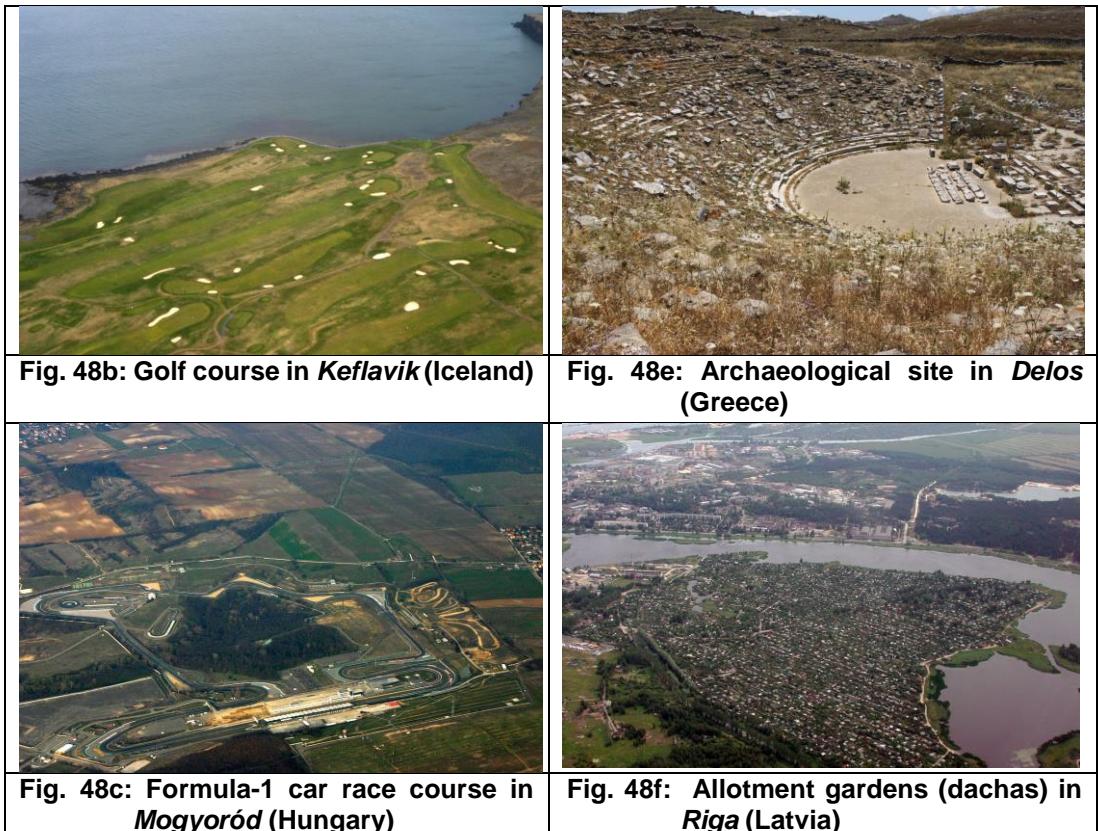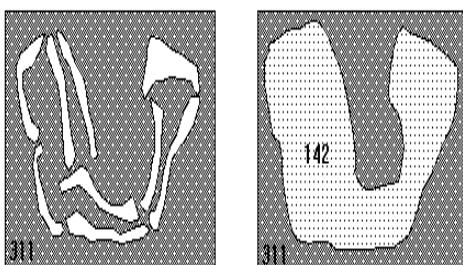| Fig. 48b: Golf course in *Keflavik* (Iceland) | Fig. 48e: Archaeological site in *Delos* (Greece) |
| Fig. 48c: Formula-1 car race course in *Mogyoród* (Hungary) | Fig. 48f: Allotment gardens (dachas) in *Riga* (Latvia) |

Fig. 48   **Examples of sport and leisure facilities in Europe. Photos: Gy. Büttner**

Generalisation:

- In case of recreational/leisure strip areas surrounding lakes are < 25 ha, the water surface and leisure facility areas should be grouped together to reach a 142 polygon > 25 ha.

Particularity of class 142: Ski resorts with artificial snowmaking

In recent years many ski resorts have been equipped with facilities producing artificial snow (snow canons). Essential part of this infrastructure is a pond providing water. Sometimes the slopes are fully changed, the uneven ground is leveled, rocks are removed, etc. Due to the artificial snow the length of the skiing season is about doubled, lasting from November to April also in lower mountain regions (like in Germany, Austria, Switzerland, France, Italy). Chemicals may also be mixed into the artificial snow to assure higher melting point. The increasedr human impact on the environment explains the inclusion of such areas under artificial surfaces.

Class 2: Agricultural areas

Class 2.1 Arable land
Lands under a rotation system used for annually harvested plants and fallow lands, which are rain-fed or irrigated. Includes flooded crops such as rice fields and other inundated croplands.

Class 2.2 Permanent crops
All surfaces occupied by permanent crops, not under a rotation system. Includes ligneous crops of standards cultures for fruit production such as extensive fruit orchards, olive groves, chestnut groves, walnut groves shrub orchards such as vineyards and some specific low-system orchard plantation, espaliers and climbers.

Class 2.3 Pastures
Lands that are permanently used (at least 5 years) for fodder production. Includes natural or sown herbaceous species, unimproved or lightly improved meadows and grazed or mechanically harvested meadows. Regular agriculture impact influences the natural development of natural herbaceous species composition.

Class 2.4 Heterogeneous agricultural areas
Areas of annual crops associated with permanent crops on the same parcel, annual crops cultivated under forest trees, areas of annual crops, meadows and/or permanent crops which are juxtaposed, landscapes in which crops and pastures are intimately mixed with natural vegetation or natural areas.
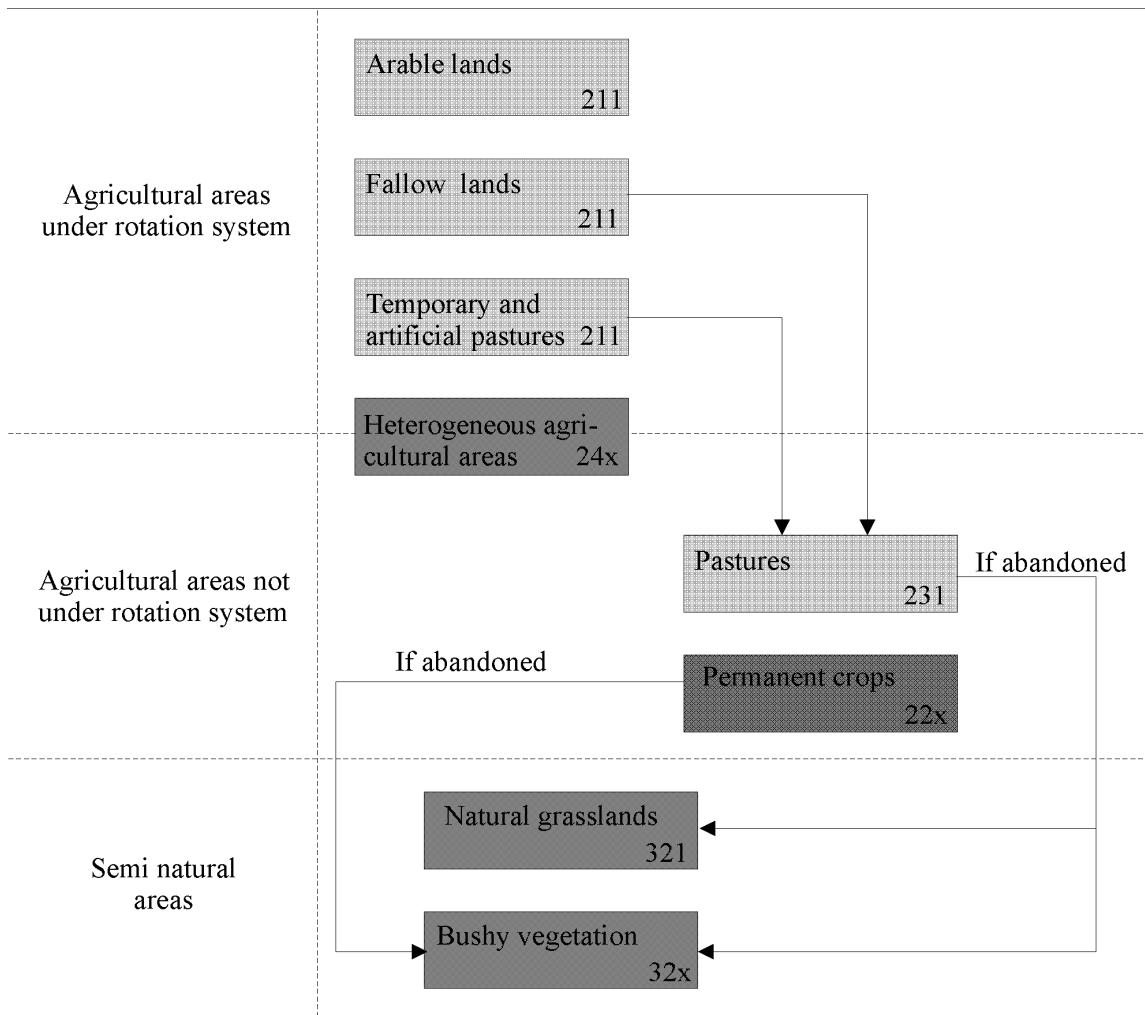

Fig. 49   **Decision scheme for agricultural areas in relation to semi-natural areas**

211 Non-irrigated arable land

Cultivated land parcels under rainfed agricultural use for annually harvested non-permanent crops, normally under a crop rotation system, including fallow lands within such crop rotation. Fields with sporadic sprinkler-irrigation with non-permanent devices to support dominant rainfed cultivation are included.

This class is applicable for:
- cultivated land under crop rotation;
- temporary (1-3 years) fallow land under rotation system, where the below quoted agricultural crops were cultivated;
- weeded crops;
- fragmented agricultural land use resulting in juxtaposition of different annual crops;
- drained arable land;
- abandoned irrigated arable land when the irrigation channel network is still visible in the satellite image;
- flooded crops as water cross beds;
- nurseries of fruit trees and fruit shrubs.

This class includes:
- cultivated herbaceous plants and low growing shrubs like:
  - regular annual crops, such as cereals, root crops, leguminous crops, oil crops;
  - fodder crops, annual or multiannual grown as part of the crop rotation (alfalfa, sown grass for silage or hay production);
  - vegetables;
  - multi–year plants as asparagus and chicory;
  - semi-permanent crops as strawberries;
  - non-permanent industrial crops as textile plants, oleaginous plants (e.g. cotton, flax);
  - tobacco;
  - condiment plants (e.g. mustard);
  - sugar cane;
  - flowers under a rotation system;
  - industrial flower crops as lavender species;
  - aromatic and medicinal plants;
- bare soil of cultivated land;
- weeds;
- stubble of harvested arable crops;
- ligneous crops (fruits and berries) or permanent grass occupying altogether < 25% of area;
- dispersed, mostly linear semi-natural or ruderal vegetation between parcels;
- dirt roads between parcels;
- hedgerows or stone walls separating parcels;
- greenhouses ((plastic or glass) out of the Mediterranean climate zone;
- temporary deposits of harvested crops or crop residues (e.g. straw);
- patches < 25 ha of other cultivation types (e.g. pastures, plantations), given that > 75 % of the total area is under a rotation system.
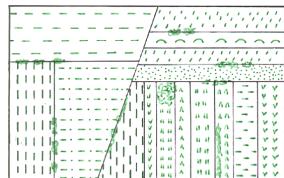
This class is not applicable for:
- city gardens (class 242);
- allotment gardens within or around settlements (142);
- lands that lay fallow for at least three years (classes 231 or 32x);
- hop plantations (class 222);
- rice field (class 213);
- fruit trees and berry plantation under glass greenhouses (class 222);
- willow trees for wicker production (class 222);
- greenhouses (plastic or glass) in the Mediterranean climate zone (class 212);
- permanent plantations of roses (class 222);
- wine-growing nurseries (class 221);
- pastures and meadows / permanent grassland under agricultural use (class 231);

- arable land abandoned for > 3 years, being in the process of succession by herbaceous vegetation (class 231) or shrubs (class 323 or 324);
- areas where intermixed other cultivation types (permanent crops or pastures) occupy > 25% of area, but none of them predominates (class 242);
- areas where a mosaic of parcels <25ha of agricultural land (arable crops, pasture, permanent crops) are intermixed with natural vegetation and natural areas (<25ha) that occupy >25% and <75% of the area (class 243);
- arable crops with dispersed forestry trees in an agro-forestry system (class 244).

This class excludes:

No entry.

	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Textures of different agricultural annual crops
	Texture of glass and plastic greenhouses
	Texture of scattered semi-natural vegetation

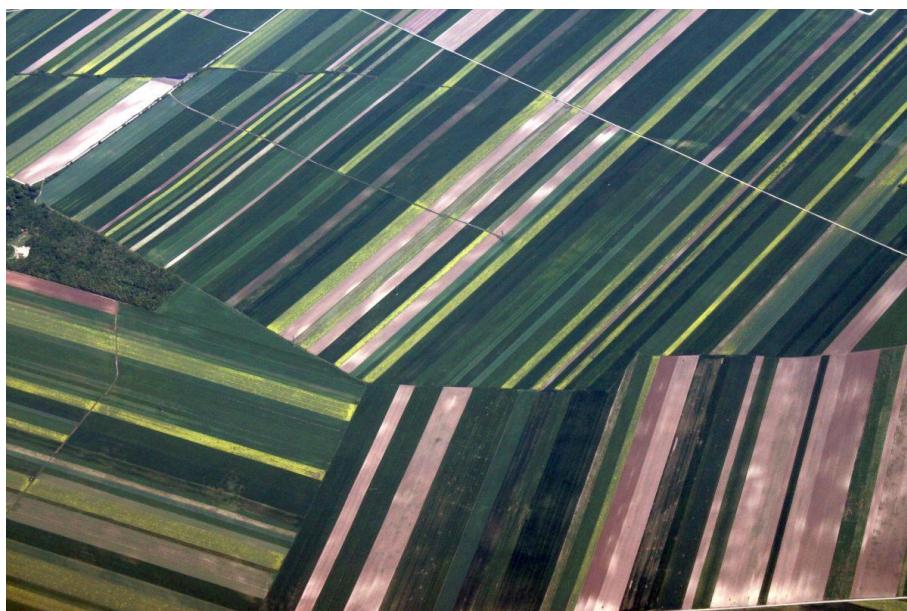Fig. 50   **A generalised pattern of the class 211**

Fig. 51   **Example 211: Small-parcel arable land (near *Vienna*, Austria). Photo: Gy. Büttner**

Fig. 52   **Example 211: Large-scale arable land (*Flevoland*, the Nether-
lands). Source: https://brandportal.wur.nl/media/**

Fig. 53   **Example 211: Arable land with scattered farmsteads (near
Malmö, Sweden). Photo: Gy. Büttner**

Fig. 54   **Example 211: Arable parcels separated by stone walls (Malta).
Photo: B. Kosztra**

Fig. 55   **Example 211: Greenhouses in Zuid-Holland, Westland (the Netherlands).** *Permanent greenhouses are a particular form of class 211, without detectable crop rotation and giving a permanent sealing of the soil.* **Source: https://brandportal.wur.nl/media/**

212 Permanently irrigated arable land

Cultivated land parcels under agricultural use for arable crops that are permanently or periodically irrigated, using a permanent infrastructure (irrigation channels, drainage network and additional irrigation facilities). Most of these crops cannot be cultivated without artificial water supply. Does not include sporadically irrigated land.

This class is applicable for:
- arable land or sown grassland (as part of crop rotation) under permanent irrigation with
  - spray sprinkler line;
  - rotary sprinkler;
  - irrigation channels.

This class includes:
- arable crops;
- non-permanent grass;
- irrigation infrastructure (channels, technical structures, ponds);
- greenhouses in Mediterranean climate areas.

This class is not applicable for:
- arable crops irrigated only sporadically (classes 211, 242);
- permanent crops under permanent irrigation (classes 22x);
  - vineyards (class 221);
  - orchards (class 222);
  - olive groves (class 223);
- agricultural land with drainage network intended to dry up wet soils (classes 211, 22x, 231 or 242);
- arable land, pastures or mixed agriculture under irrigation from superficial water supplies with pumping infrastructure (classes 211, 231 or 242);
- areas irrigated by underground irrigation pipes and above ground pipes and furrows (classes 211, 22x, 231 or 242);
- spray sprinkler line used only sporadically (classes 211, 22x, 231 or 242);
- land under irrigation with drop by drop system (classes 211, 22x, 242);

- arable land with abandoned irrigation system even the irrigation channel network is still visible in the satellite image (class 211);
- permanent grasslands, pastures, meadows under permanent irrigation (class 231).

This class excludes:
- crops under greenhouses outside Mediterranean climate zones (classes 211 or 222);
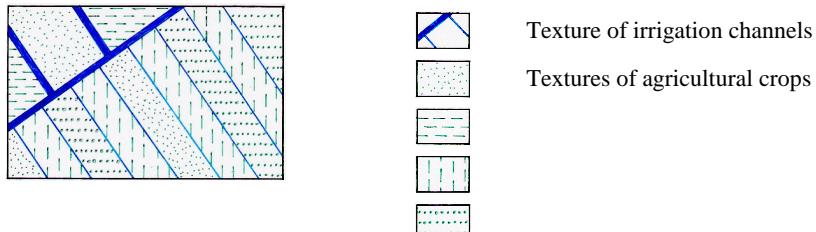- rice fields (class 213).

	Texture of irrigation channels
	Textures of agricultural crops

Fig. 56   **Generalised pattern of the class 212**
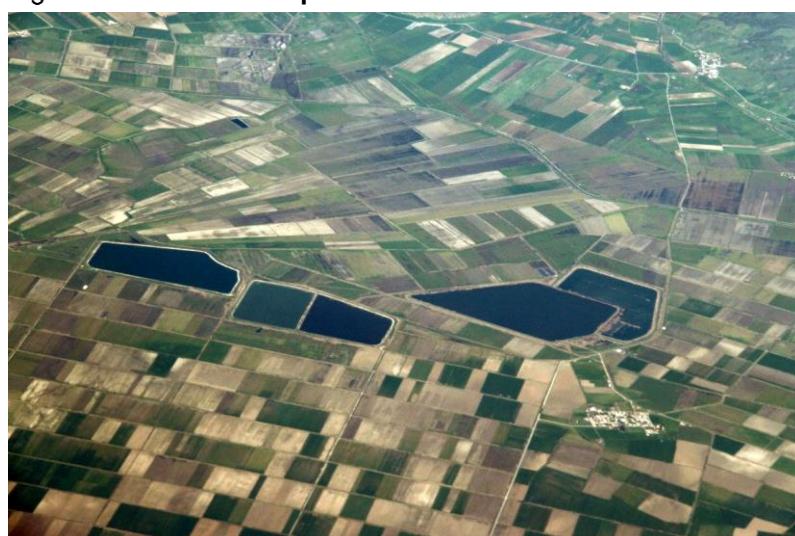
Fig. 57   **Example 212: Irrigated arable land (around Larissa, Greece). Note the water storage ponds and the irrigation system as permanent infrastructures. Photo: Gy. Büttner**

Fig. 58   **Example 212: Irrigated arable land (*Anatolia*, Turkey). *Note the striking difference in biomass compared to non-irrigated land on left side of image*. Photo: GoogleEarth**

213 Rice fields

Cultivated land parcels prepared for rice production, consisting of periodically flooded flat surfaces with irrigation channels.

Clarification:

As part of regular cultivation cycle, rice fields are occasionally left fallow for 1-3 years. These parcels are considered to be rice fields, too.

This class is applicable for:
- paddy fields for rice cultivation in use;
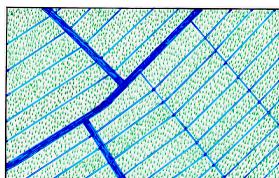- rice fields temporary (1-3 years) left fallow.

This class includes:
- rice plant;
- open water surfaces on fields;
- stubble of rice;
- irrigation channels;
- embankments between rice fields.

This class is not applicable for:
- ancient rice fields with irrigation channels still visible should be mapped according to their actual land cover (mainly classes 211 or 231);
- abandoned rice fields (class 2xx).

This class excludes:
No entry

Texture of irrigation channels

Texture of rice fields

Fig. 59   **Generalised pattern of class 213**

Fig. 60   **Example 213: Rice paddy fields. Note the irrigation channels between parcels. Source: Wikipedia**

221 Vineyards

Areas planted with vines, vineyard parcels covering >50% and determining the land use of the area.

This class is applicable for:
- vineyards for wine production;
- vineyards for consumer grapes and raisins;
- complex cultivation pattern mosaics where vineyard parcels cover at least 50 % of the area;
- permanently irrigated vineyards;
- recently abandoned vineyards that still preserve characteristic alignment or installations;
- vine-growing nurseries inside vineyard areas;
- vine plantations established recently, after clearing of semi-natural vegetation.
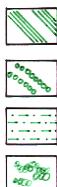
This class includes:
- vine plants;
- bare soil or grass cover among vine plants;
- patches of orchards or annual crops, occupying < 50% of territory;
- scattered patches or rows of (semi-) natural vegetation
- constructions supporting crops (espaliers, climbers, canes);
- access roads inside plantations;
- stone walls separating parcels or terraces;.

This class is not applicable for:
- vineyards mixed with arable land and/or meadows within a single parcel (class 241);
- single vineyard parcels < 25 ha in mosaic with arable land and/or meadows interspersed with significant natural vegetation where the vineyards themselves cover < 50 % of the area (class 243)
- complex cultivation pattern where vines occupy < 50% of area, intermixed with other cultivation types in a mosaic (class 242).

This class excludes:
No entry.

Texture of vineyards

Texture of orchard

Texture of agricultural crop

Texture of scattered greenery

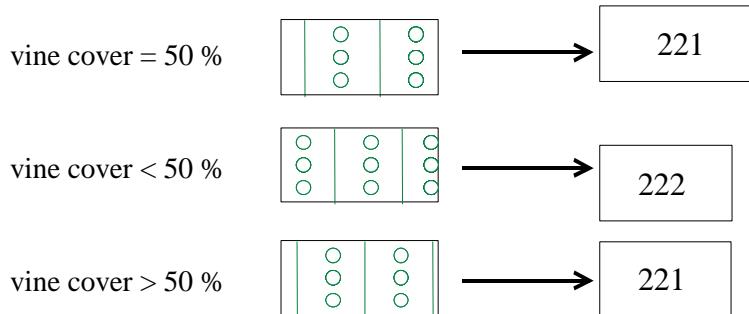Fig. 61   **Generalised pattern of class 221**

Fig. 62   **Example 221: Vineyards on lowland (near *Podgorica*, Monte-
negro). *Note the regular network of service roads inside the planta-
tion.* Photo: Gy. Büttner**

Fig. 63   **Example 221: Vineyards on the slopes of Bolzano (Italy).
*Grape cultivation on slopes is more difficult to identify, in-situ data
often needed.* Photo: B. Kosztra**

Generalisation:

Mapping vines associated with fruit trees within a single parcel: in this case, the dom-
inance of each permanent crop should be considered. In general, priority will be given
to vineyard if occupancies are approximately the same. Otherwise the dominating per-
manent crop will be represented.

- In case of vines associated to olive trees within a single parcel, priority will be given to class 221.

222 Fruit tree and berry plantations

Cultivated parcels planted with fruit trees and shrubs, intended for fruit production, including nuts. The planting pattern can be by single or mixed fruit species, both in association with permanently grassy surfaces.

This class is applicable for:
- plantations of berry shrubs;
- plantations of orchards;
- plantation of citrus fruit trees;
- groves of nut crops;
- plantations of tropical fruit trees;
- permanent industrial plants;
- hop plantations;
- willow plantation for wicker production;
- permanent florist plantations of roses;
- complex cultivation pattern mosaics where fruit parcels cover at least 50 % of the area;
- plantation of vines associated to fruit trees within the same parcel where vines cover < 50 % of the surface;
- recently abandoned orchards which still preserve characteristic alignment or installations (espaliers and climbers);
- permanently irrigated orchards and hop plantations.

This class includes:
- woody permanent crops such as
  - berry shrubs: black and/or red currants, raspberries, gooseberries, blackberry;
  - orchards: apples, pears, plums, apricots, peaches, cherries, quinces, other rosaceae and figs;
  - citrus species : oranges, lemons, mandarins, tangerines, grape fruits, pomelos;
  - nut crops: chestnut, walnut, almond, hazelnut, pistacia;
  - tropical fruit species: avocados, bananas, guavas, mango, kiwis, passion fruits, papayas, pineapples, pomegranates, brazil nuts, cashew nuts, coconuts, nutmegs;
  - industrial plants: coffee, cacao, mulberry, tea
- bare soil or grass among woody crops;
- fruit trees under greenhouses;
- scattered greenery, and natural vegetation <25% among plantations;
- constructions supporting crops (espaliers, climbers, canes);
- access roads inside plantations;
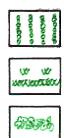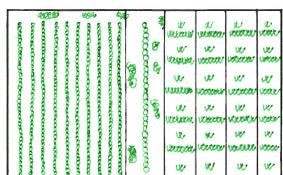- irrigation ponds and pools < 25 ha;

47

- buildings, sealed or non-sealed storage areas associated to fruit production < 25 ha.

This class is not applicable for:
- strawberry plantations (class 211);
- cotton plantations (class 211)
- multi–year plants as asparagus (class 211);
- olive groves (class 223);
- vineyard and areas dominated by vine plantations, >50% share (class 221);
- fruit tree nurseries (class 211);
- carob tree plantations (class 311);
- chestnut and walnut groves intended for wood production (class 311);
- short (8-20 years) rotation forestry and coppice areas grown for pulpwood or as energy crop (classes 31x);
- abandoned orchards where plantation structures have disappeared (class 324);
- non-permanent crops (arable land) associated with permanent crops on the same parcel, with occupation rate of non-permanent crops > 50 % (class 241);
- complex cultivation patterns where fruit parcels cover < 50 % of the area in mosaic with other crops;
- complex cultivation pattern mosaics where patches of natural vegetation cover >25% and < 75% (class 243).

This class excludes:
No entry

Texture of fruit trees

Texture of berry plantations

Texture of scattered greenery

Fig. 64   **Generalised pattern of class 222**

Fig. 65   **Fruit tree plantation (*Limburg*, the Netherlands). Photo: G. Hazeu**

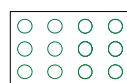Fig. 66   **Example 222: Orange plantation around *Larnaca* (Cyprus). Photo: Gy. Büttner**

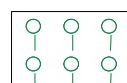Fig. 67   **Example 222: Banana plantation (*Teneriffe*, Spain, Canary Islands). Photo: Gy. Büttner**

Generalisation:

When fruit trees are associated to vines on the same parcel, the occupancy of each permanent crop should be considered.

- In case of equal density, priority will be given to vineyard (class 221). The generalisation scheme adopted for class 221 should be also applied for class 222.
- In case of fruit trees associated to olive trees on the same parcel, the occupancy of each permanent crop should be evaluated and priority will be given to class 223 when no dominance is visible.
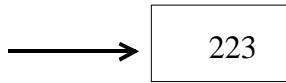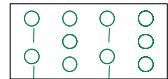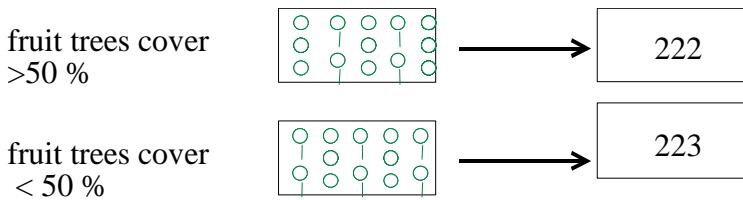

fruit trees   olive trees

fruit trees cover = 50 %   223

| fruit trees cover >50 % | | → | 222 |
| fruit trees cover < 50 % | | → | 223 |

Particularity of class 222: Hop plantations

Areas of arable land where hop is cultivated with tall supporting construction.

This class is applicable for:
- hop-garden plots with or without plants.

Fig. 68   **Example particularity of 222: Hop plantation. (*near Prague*, Czechia) Photo: Gy. Büttner**

223 Olive groves

Cultivated areas planted with olive trees.

This class is applicable for:
- homogeneous olive groves: plantations of *Olea europaea ssp. europaea*;
- olive groves intermixed with vines or fruit trees, with >50% occupancy of olives;
- olive groves intermixed with annual crops, with >50% occupancy of olives;
- rainfed as well as permanently irrigated olive groves;

This class includes:
- olive trees;
- vines or fruit plants intermixed with olives;
- bare soil or herbaceous vegetation among olive trees;
- scattered patches of semi-natural vegetation (greenery);
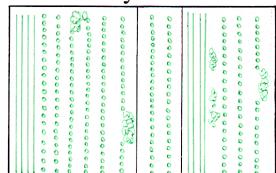- interspersed annual crops occupying < 50%;
- irrigation ponds.

This class is not applicable for:
- non-permanent crop areas shaded by a canopy of olive trees on the same parcel, with non-permanent crops occupying > 50% of area (class 241);
- parcels of olive trees intermixed in a mosaic with non-permanent crops (arable land), the latter occupying > 50% (class 242);
- olive trees (Olea europaea ssp. sylvestris) as part of evergreen forest areas (class 311);

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- wild olive trees (Oleaster spp.) as part of sclerophyllous vegetation areas (class 323);
- abandoned olive groves (class 323 or class 322 – only in Northern Iberian Peninsula).

This class excludes:
- No entry

	Texture of olive trees
	Texture of vines
	Texture of scattered greenery

Fig. 69   **Generalised pattern of the class 223**

Fig. 70   **Example 223: Olive groves in Castilla La Mancha (Spain). Photo: Gy. Büttner**

Fig. 71   **Example 223: Extensively cultivated olive grove (Montenegro). Photo: B. Kosztra**

231 Pastures, meadows and other permanent grasslands under agricultural use

Permanent grassland characterized by agricultural use or strong human disturbance. Floral composition dominated by graminacea and influenced by human activity. Typically used for grazing - pastures, or mechanical harvesting of grass – meadows.

Clarification:
Pastures can be described as extensively or intensively grazed permanent grasslands with presence of farm infrastructure such as: fences, shelters, enclosures, watering places, drinking trough, and/or regular agricultural measures and works: mowing, drainage, hay making, seeding, manuring, shrub clearance. Typical visible signs of use are regular parcel structure and/or animal paths.

This class is applicable for:
- permanent grasslands under grazing by domestic animals;
- permanent grasslands (not part of the crop rotation) used for harvesting the grass (in form of hay or silage) by mowing;
- abandoned arable land (after 3 years), arable land abandoned for more than 3 years, being in the process of succession by herbaceous vegetation ;
- permanent grasslands under strong human disturbance, degraded grasslands, ruderal areas dominated by grass cover;
- humid meadows with dominating grass cover. Hygrophyle species, such as sedges, rushes, thistles, nettles cover < 25 % of the parcel surface;
- pastures with scattered trees and shrubs, woody vegetation covering <30% of the ground
- herbaceous vegetation cover of abandoned or reclaimed mineral extraction sites and dump sites;
- grass-covered ski-pistes used as pasture most of the year;
- grassland areas with hedges (*bocage*);
- drained wetlands, in particular peatlands, converted to pasture;
- heavily grazed semi-natural grasslands such as machair plains at the rear of sand dunes.

This class includes:
- herbaceous vegetation;
  - grasses (graminacea) that dominate the botanical composition,
  - herbs (Taraxacum officinale, Ranunculus spp., Chrisanthemum leucantemum, Knautia arvensis, Achillea millefolium, Salvia spp., etc.);
- scattered woody vegetation, trees covering not more than 30% of area;
- hedgerows;
- stone walls separating parcels;
- draining ditches;
- installations of farming infrastructure (fences, shelters, enclosures, watering places, drinking trough).

This class is not applicable for:
- grass covered surfaces of airports (class 124);
- lawns inside city parks (class 141) or sport and leisure facility areas (class 142);
- sown grass grown as annual crop under the crop rotation system (for silage or hay production) (class 211);
- arable fodder crops other than grass (e.g. alfalfa) (class 211);
- military exercising grass fields (without grazing) (class 321);
- high-productive natural alpine meadows far from houses and/or crops (class 321);
- derelict (poorly or not maintained) grassland where semi-ligneous/ligneous vegetation covers at least 25 % of the parcel (class 322, 323, 324);
- humid meadows where hygrophyle plant species cover at least 25 % of the parcel (class 411);
- salt meadows (class 421).

This class excludes:
- herbaceous grass cover composed of non-palatable and undesirable species for cattle such as Molinia spp. and Brachypodium spp. (class 321).
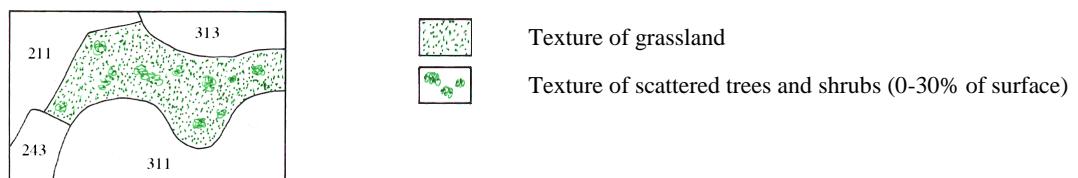

	Texture of grassland
	Texture of scattered trees and shrubs (0-30% of surface)

Fig. 72   **Generalised pattern of the class 231**

Fig. 73   **Example 231: Intensively used pastures (near Rotterdam, the Netherlands). Photo: G. Hazeu**

Fig. 74   **Example 231: Intensely cultivated meadow with silage bales (Sweden). Photo: Gy. Büttner**

Fig. 75   **Example 231: Extensively cultivated hayfields with scattered woody vegetation in the Carpathian Mountains (Romania). Photo: Gy. Büttner**

Fig. 76   **Example 231: Improved pasture (Hungary). Photo: B. Kosztra**

Fig. 77   **Example 231: Intensively grazed pasture with animal shelter in the Carpathian mountains (Romania). Photo: B. Kosztra**

Particularity of class 231: Grassland on abandoned arable land

Uncultivated parcels that turned into grassland by not using arable land for more than three years. Identification of the quoted grassland requires application of multi-temporal (multiannual) satellite imagery.

This class is applicable for:
- areas of grassland representing succession of natural overgrowth of arable land by prevailingly herbaceous vegetation;

This class includes:
- herbaceous vegetation dominated by grasses
- sporadically occurring shrubs.

Fig. 78   **Example particularity of 231: pasture on abandoned arable land in Latvia. Source: Jan Feranec**

Particularity of class 231: Wooded meadows

Meadows where dispersed woody vegetation occupy up to 50% of surface. These meadows are characterised by rich floristic composition.

This class is applicable for:
- areas of grassland used primarily for hay production (mowing) with scattered trees and shrubs occupying 30% - 50%.

This class includes:
- herbaceous vegetation partially covered by tree crowns;
- scattered shrubs
- scattered forestry trees not occupying > 30% of total area.

This class is not applicable for:
- areas of grassland with >30% tree cover (class 311, 312, 313);
- fruit trees mixed with meadows within a single parcel (class 241);
- pastures (grazing land) with dispersed forestry trees in an agro-forestry system (class 244).
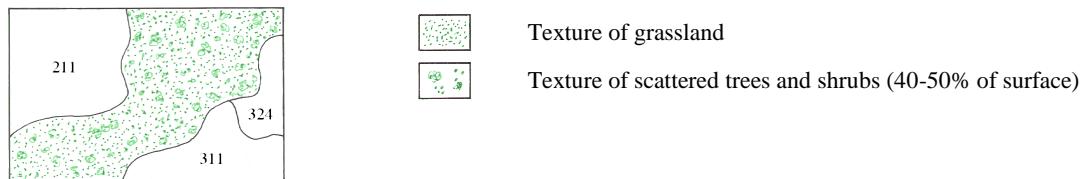
This class excludes:
- fruit trees.

| | Texture of grassland |
| | Texture of scattered trees and shrubs (40-50% of surface) |

Fig. 79   **Generalised pattern of the particularity of class 231**

Fig. 80   **Example particularity of 231: Laelatu Wooded meadow (near *Virtsu*, Estonia). Source: Wikipedia**

Particularity of class 231: non-used parcels between buildings and around settlements

This class is applicable for:
- grass covered parcels (possibly with scattered shrubs) inside or at the edge of settlements that are likely to be used for construction of houses but have not yet been converted to dwelling ground
- grass covered areas of abandoned or temporarily stopped construction sites, without any particular use.

This class includes:
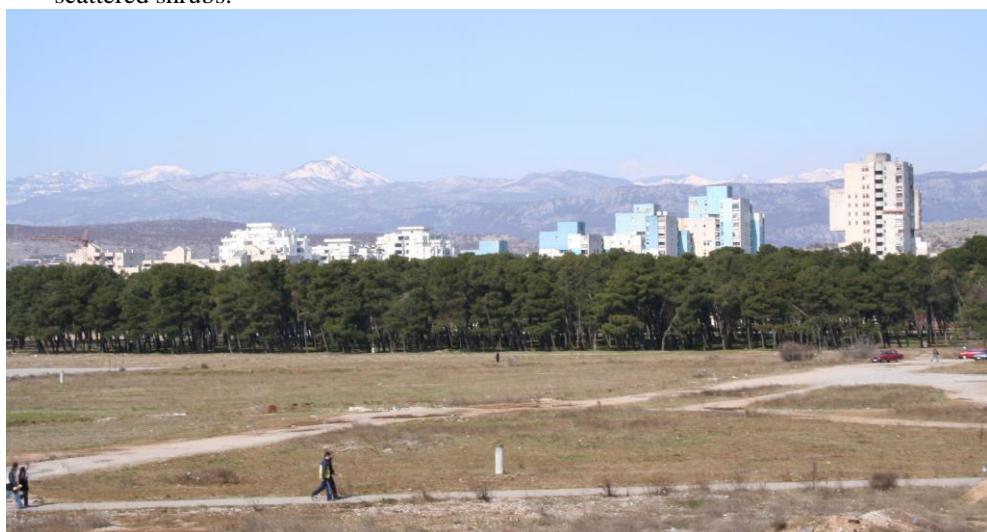- grass and ruderal vegetation;
- scattered shrubs.

Fig. 81   **Example particularity of 231: Unused land with grassy vegetation in suburban area (*Podgorica*, Montenegro). Photo: B. Kosztra**

241 Annual crops associated with permanent crops

Cultivated land parcels with non-permanent crops (mostly arable land) associated with permanent crops (fruit trees or olive trees or vines) on the same parcel.

Clarification:
Permanent crops (fruit trees or olive trees or vines) are either in juxtaposition with arable crops or located along the border of the parcels. The occupation rate of non-permanent crops is > 50 %.

This class is applicable for:
- non-permanent crop areas shaded by a fairly closed canopy of fruit trees or olive trees or vines;
- non-permanent crop areas that are bordered by a reticulated structure of fruit tree lines, vine lines;
- vines mixed with arable land and/or meadows within a single parcel.

This class includes:
- woody crops (fruit trees or shrubs, olives) in combination with
    - either non-permanent crops;
    - or permanent grass surfaces;
    - optionally with scattered patches of greenery.

This class is not applicable for:
- permanent crops associated with fruit trees (classes 22x);
- non-permanent crops associated with forest trees in an agro-forestry system (class 244);
- mosaic of permanent crop and non-permanent crop parcels where none of the constituents occupy >75% (class 242);
- mosaic of fruit trees or vineyards or olives and non-permanent crops, where one of the permanent crops occupy > 50% (classes 22x)
- meadows or pastures with scattered forest trees (class 231).

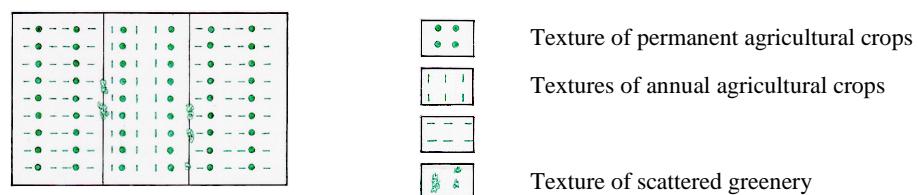**This class excludes:**
No entry

	Texture of permanent agricultural crops
	Textures of annual agricultural crops
	Texture of scattered greenery

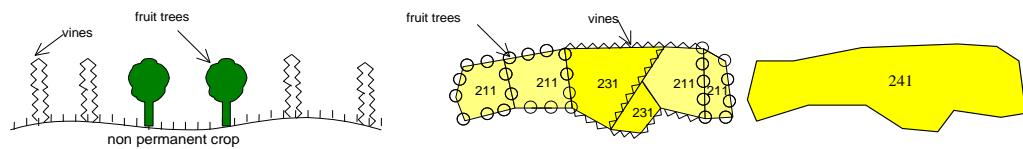Fig. 82   **Generalised pattern of class 241**

Fig. 83   **Example 241: Olive trees on arable land (near *Ragusa*, Sicily, Italy). Photo: B. Kosztra**
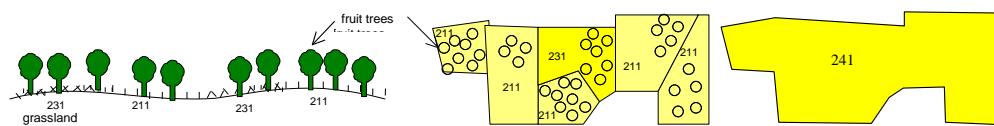
Generalisation:

According to the bio-climatic zone, the class could be described under two illustrations:

- reticulated landscapes.

- small plot and orchard patterns.

242 Complex cultivation patterns

Mosaic of small cultivated land parcels with different cultivation types - annual crops, pasture and/or permanent crops -, eventually with scattered houses or gardens.

This class is applicable for:
- mosaic of land parcels < 25 ha of at least two of the following three cultivation types: arable crop land, pasture and permanent crop land, none of them occupying > 75% of the area;
- mosaic of parcels of permanent crops (fruit trees, berry plantations, vineyards and olive groves);
- agricultural mocaics with scattered houses, or garden huts (covering < 30% of the patchwork area), situated in proximity of rural or urban settlements and used for growing agricultural crops, fruit, and vegetable for own consumption;
- hobby/city gardens primarily for agricultural production use;
- vineyards occupying between 25% and 50% of area, intermixed with other cultivation types (242) in a mosaic pattern.

This class includes:
- parcels of arable crops (occupying < 75% of the area)
- parcels of permanent crops, such as vineyards, fruit orchards, olives (each type occupying < 50% of the area);
- parcels of permanent grassland (pastures, meadows);
- kitchen gardens;
- regular buildings, huts (occupying < 30% of the area),
- sealed or non-sealed (dirt or tar macadam) roads.

This class is not applicable for:
- market gardening (class 211);
- nurseries cultivation (class 211);
- in spite of strong fragmentation, the areas with > 75% of area under rotation system (class 211);
- areas of agricultural mosaics with scattered houses occupying > 30% of the patchwork area (class 112);
- city gardens, allotment gardens primarily for recreational use (class 142);
- mosaic of parcels where a single permanent crop type (vineyard, fruit plantation, olive groves) occupy > 50% of area (classes 22x);
- arable and permanent crops located on the same parcel in an intermixed pattern (class 241);complex cultivation areas where patches of natural or semi-natural components occupy > 25% of the area (class 243).

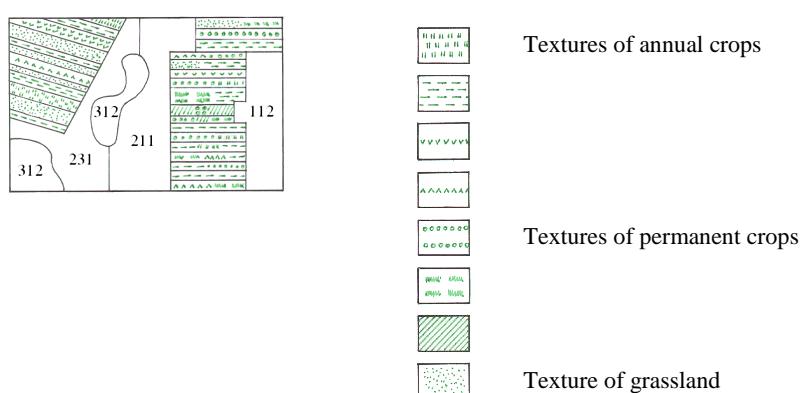**This class excludes:**
No entry

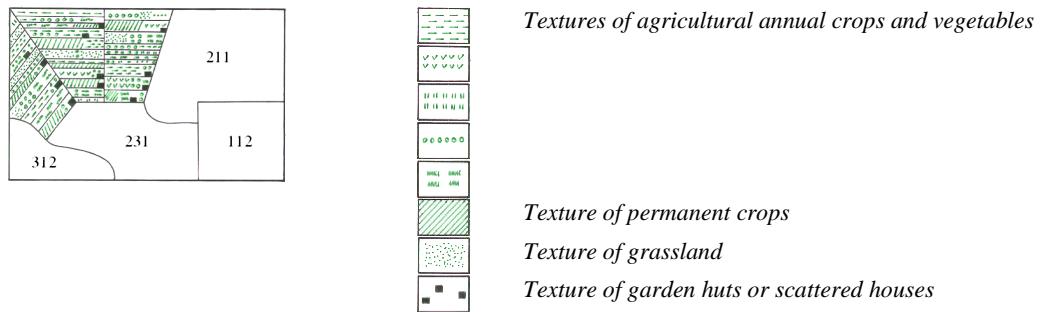Fig. 84   **Generalised pattern of the class 242**

Fig. 85   **Example 242: Complex cultivation pattern (central part of the Netherlands). Photo: G. Hazeu**

Fig. 86   **Example 242: Complex cultivation pattern (Romania).** *Mosaic of small (<25 ha) hayfields and arable land.* **Photo: B. Kosztra**

Fig. 87 **Example 242: Complex cultivation pattern surrounded by trees (near *Rome*, Italy). Photo: Gy. Büttner**

Textures of agricultural annual crops and vegetables

Texture of permanent crops

Texture of grassland

Texture of garden huts or scattered houses

Fig. 88 **Generalised pattern of class 242 with scattered houses**

Fig. 89 **Example 242: Complex cultivation pattern (arable land, fruit orchards and hayfields) with scattered houses in the Ghimeș valley (Romania). Photo: B. Kosztra**

243 Land principally occupied by agriculture, with significant areas of natural vegetation

Areas principally occupied by agriculture, interspersed with significant natural or semi-natural areas (including forests, shrubs, wetlands, water bodies, mineral outcrops) in a mosaic pattern.

This class is applicable for:
- mosaic of <25 ha parcels of agricultural land (arable crops, pasture, permanent crops) and scattered patches of natural/semi-natural areas, the latter occupying > 25% but < 75% of the area;
- hortillonage (vegetable crops and canals);
- agriculture and scattered heaps of stones;
- vineyards mixed with arable land and/or meadows interspersed with significant natural vegetation, vineyard parcels covering < 50 % of the area;
- linear structures of trees organised for truffle production.

This class includes:
- agricultural crops
  o parcels of arable land and/or
  o parcels of pasture and /or
  o parcels of orchards, vineyards and berry plantations;
- in combination with patches of natural vegetation
  o parcels of natural forests, groups of trees and shrubs and/or
  o patches of natural grassland and/or
  o small water bodies, water flows or wetlands and/or
  o small natural non-vegetated or sparsely vegetated areas;
- optionally with sporadically occurring houses of rural settlement, or farm buildings.

This class is not applicable for:
- agricultural land associated with small plots of fruit trees/olive groves without significant natural vegetation (class 242);
- mosaic of parcels where a single permanent crop type (vineyard, fruit plantation, olive groves) occupies > 50% of area (classes 22x);
- areas in which the share of agricultural areas is above 75 % (classes 21x, 23x, 242);
- areas in which semi-natural areas predominate with > 75 % occupancy(classes 3xx).
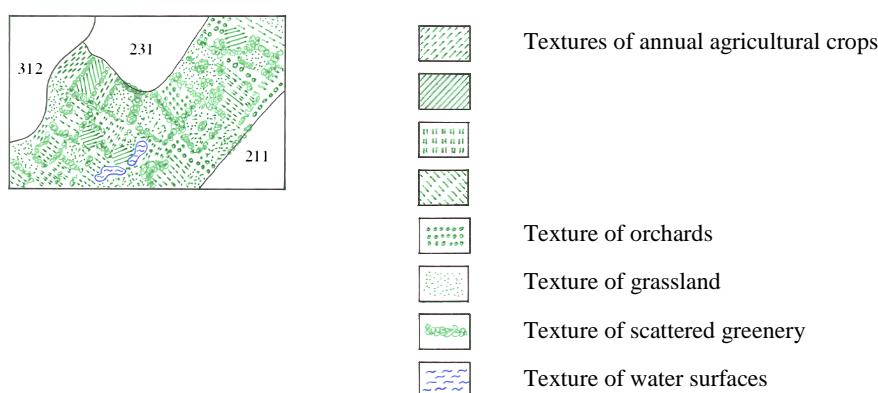
This class excludes:
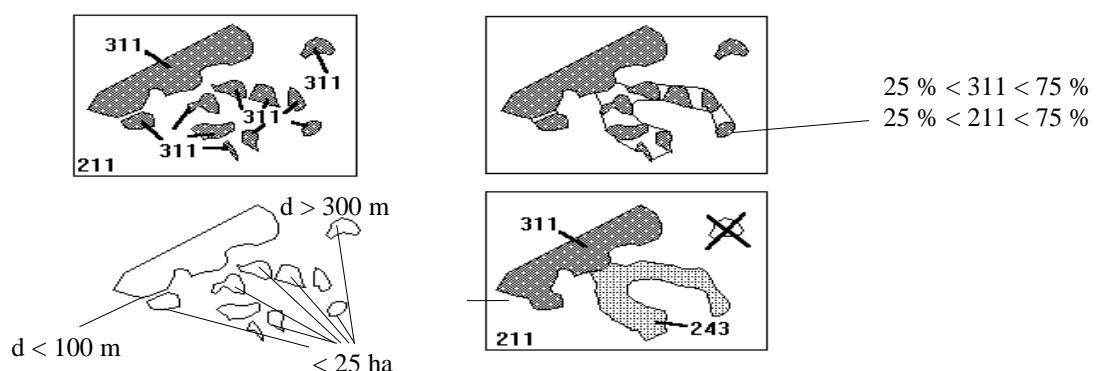No entry

Fig. 90   **Generalised pattern of class 243**

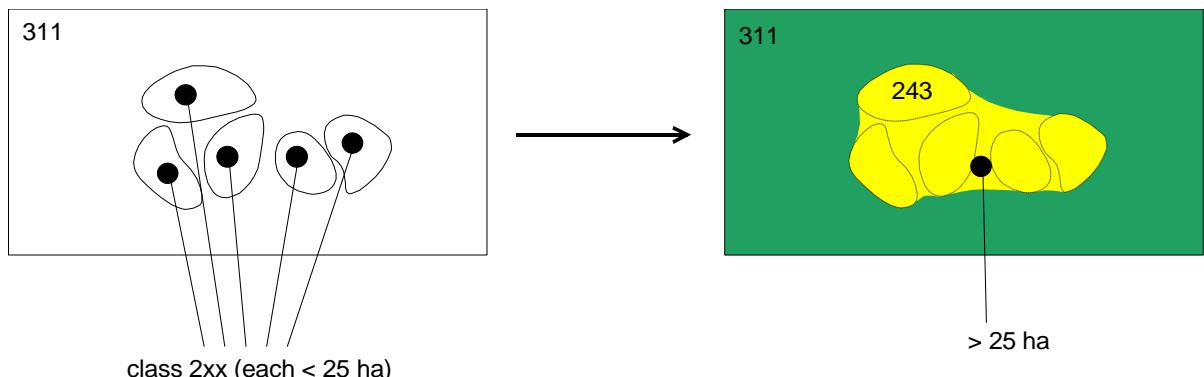Fig. 91   **Example 243: Agriculture area on steep slope with scattered trees (Romania) Photo: B. Kosztra**

Fig. 92   **Example 243: Agriculture area with arable land and scattered forests near Oslo (Norway). Photo: Gy. Büttner**

Generalisation:

25 % < 311 < 75 %
25 % < 211 < 75 %

- Class 2.4.3 should be used for example in case of small agricultural units located within forest areas.

class 2xx (each < 25 ha)

> 25 ha

244 Agro-forestry areas

Annual crops or grazing land under the wooded cover of forestry species.

This class is applicable for:
- Mediterranean agro-forestry systems, typical of the Iberian Peninsula (named *dehesa* in Spain and *montado* in Portugal): agricultural land (arable land, pastures) shaded with forestry trees with crown coverage of usually 10-30%. Primary use is either grazing (with cattle, sheep, goat, pigs) or arable production, which can be accompanied by harvesting of <u>non-timber</u> forest products such as wild game, mushrooms, honey, cork, and firewood. The tree component is primarily oaks. The understorey is usually cleared every 7 to 10 years, to prevent natural succession with shrubs;
- agricultural land shaded by palm trees in Mediterranean context;
- areas of forest trees intermixed with fruit trees/olive trees, none of them dominating.
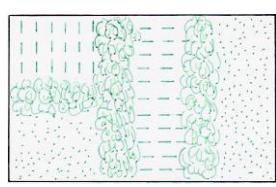
This class includes:
- arable crops or permanent grassland (pasture);
- in obligatory combination with trees, usually oaks, namely holm (*Quercus ilex*) and cork (*Quercus suber*), but also carob, beech, pine or palm trees;
- optionally shrubs.

This class is not applicable for:
- meadows with dispersed forest trees and shrubs occupying up to 50% of area, not under agro-forestry use (class 231 particularity: wooded meadows)
- arable land or pasture shaded by fruit trees or olives intermixed on the same parcel (class 241);
- abandoned agro-forestry areas where arable land or pasture is overgrown with shrubs (class 323 or 324).
- agro-forestry areas with > 30% occupancy of trees (classes 31x);

This class excludes:
No entry

Texture of forestry species

Textures of annual or permanent agricultural crops

Fig. 93   **Generalised pattern of the class 244**

Fig. 94   **Example 244: Agroforestry area near Madrid (Spain). The pasture or arable land with scattered broadleaved trees (244) - called *dehesa* in Spain - is in sharp contrast with the treeless arable land (211). Photo: Gy. Büttner**

Fig. 95   **Example 244: Agroforestry area – called *montado* in Portugal – with pasture under oak trees (Portugal). Photo: B. Kosztra**

Fig. 96   **Example 244: Agroforestry area – called** *montado* **in Portugal – with arable land under scattered oak trees (Portugal). Photo: B. Kosztra**

Class 3: Forest and semi-natural areas

Class 3.1 Forests

Areas occupied by forests and woodlands with a vegetation pattern composed of native or exotic coniferous and/or broad-leaved trees and which can be used for the production of timber or other forest products. The forest trees are under normal climatic conditions higher than 5 m with a canopy closure of 30 % at least. In case of young plantation, the minimum cut-off-point is 500 subjects by ha.

The 30 % minimum threshold to be considered can be illustrated by the three following figures.

Figs. 65 A and C correspond to random distribution of the coverage and Fig. B illustrates a regular distribution.
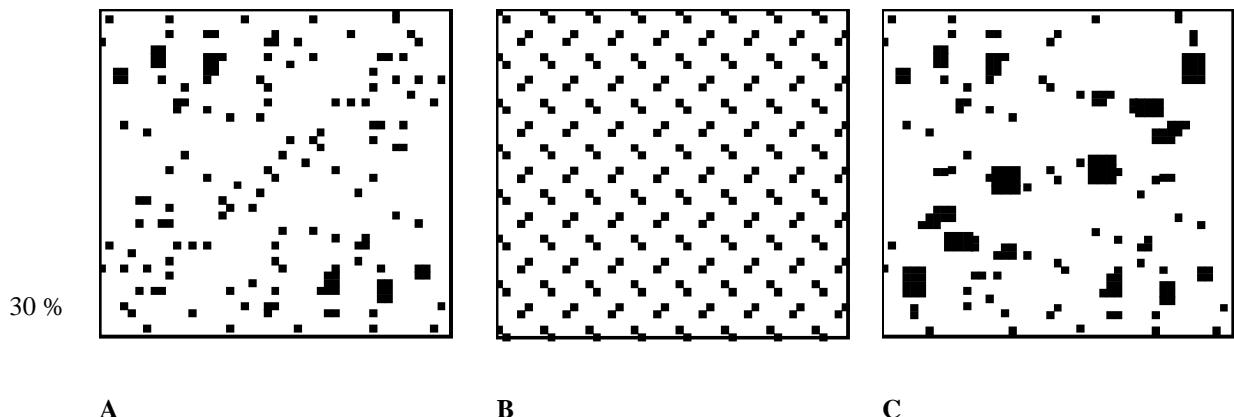
30 %

A   B   C

Fig. 97   **Random distribution of the forest trees coverage (A, C) and regular distribution (B).**

Boreal Scandinavian forest

Boreal forest in the northern part of Scandinavia where the canopy closure in climax stage of development is < 30 % (but > 15 %) and the height of trees is > 5-7 m (very frequently composed of *Picea spp.* and/or *Pinus spp.* concerning coniferous species with shrubby understorey, part of which are *Vaccinium spp.*, dwarf forms of *Salix spp.* and *Betula spp.*, *Empetrum migrum,* etc.) should be classified as **coniferous forests** (312).

The above criteria should be accepted also for the CLC class 311 – **broad-leaved forest** (most frequently composed of *Betula spp.*, *Quercus spp.*, *Fagus silvatica*, but also with the possible occurrence of other deciduous species such as *Populus tremula, Alnus spp., Salix caprea, Fraxinus excelsior, Ulmus spp., Tilia cordata and Acer platanoides*).

When the coniferous tree species are mixed with broad-leaved deciduous tree species (see species listed in the respective definitions) and their height is > 5-7 m and the canopy closure is around 30 % (always > 15 %), then this vegetation formation should be classified as **mixed forest** (313).

When vegetation formation of the above-mentioned composition of broad-leaved deciduous and coniferous trees (with the canopy closure only around 10 %) and shrubs represent some transitional stage of forest development, then it should be classified as **transitional woodland/shrub** (324).

Class 3.2 Shrubs and/or herbaceous vegetation associations

• Temperate shrubby areas with Atlantic and Alpine heaths, sub -Alpine bush and tall herb communities, deciduous forest re-colonisation, hedgerows, dwarf conifers.

• All transitional forest development stages (regenerative and degenerative: natural development of forest – bushy formations on abandoned meadows, pastures or forest clear cut and also forest after calamities of various origin) should be classified as 324.

- Shrubby formation with sparse trees (< 15 % canopy closure in climax stage and the height of trees can be > 5-7 m) composed of dwarf forms of *Betula spp.* and *Salix spp.,* plus *Vaccinium spp. Empetrum migrum, Ledum palustre, Carex spp., Cladonia spp.,* etc. (cover > 50 % of surface) frequently interrupted by rock outcrops (typical of Scandinavia and the Northern Atlantic) should be classified as **moors and heathland** – tundra (322).
- Mediterranean and sub-Mediterranean evergreen sclerophyllous bush and scrub (maquis, garrigue, matorral, phrygana sensu lato), re-colonisation and degradation stages of broad-leaved evergreen forests.
- Dry thermophilous grasslands of the lowlands, hills and mountain zone. Poor Atlantic a sub-Atlantic mat-grasslands of acid soils; grasslands of decalcified sands; Alpine and sub Alpine grasslands. Humid grasslands and tall herb communities; lowland and mountain mesophile pastures and hay meadows.

Class 3.3 Open spaces with little or no vegetation
Natural areas covered with little or no vegetation, including open thermophile formations of sandy or rocky grounds distributed on calcareous or siliceous soils frequently disturbed by erosion, steppic grasslands, perennial steppe-like grasslands, meso- and thermo-Mediterranean xerophile, mostly open, short-grass perennial grasslands, alpha steppes, vegetated or sparsely vegetated areas of stones on steep slopes, screes, cliffs, rock fares, limestone pavements with plant communities colonising their tracks, perpetual snow and ice, inland sand-dune, coastal sand-dunes and burnt natural woody vegetation areas.

311 Broad-leaved forest

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

Clarification:
The predominant classifying parameter for this class is a crown cover density of > 30 % or a minimum 500 subjects/ha density, with broad-leaved trees representing > 75 % of the formation. The minimum tree height is 5 m.

This class is applicable for:
- mature forests of natural or anthropogenic origin like the following:
    - pure or mixed stands of beech (*Fagus*), oak (*Quercus*), hornbeam (*Carpinus*), lime (*Tilia*), maple (*Acer*), ash (*Fraxinus*), poplar (*Populus*), birch (*Betula*) species among others;
    - riparian and gallery woodlands, with dominant *Alnus*, *Betula*, *Populus* or *Salix*
    - thermophyllous deciduous broad-leaved woodland (dominated by *Quercus pubescens*)
    - evergreen broad-leaved woodlands composed of sclerophyllous trees (mainly *Quercus Ilex*, *Quercus Suber*, *Quercus Rotondifolia*);
    - olive-carob forests dominated by *Olea europaea spp. sylvestris*, *Ceratonia siliqua*;
    - palm groves woodlands;
    - holly woods dominated by *Ilex aquifolium*;
    - tamarix woodlands;
    - arborescent matorral with sclerophyllous broad-leaved species;
    - walnut trees and chestnut trees used for wood production included into forest area context;
    - plantations of eucalyptus;
    - carob plantations;
    - short (8-20 years) rotation forestry and coppice areas grown for pulpwood or as energy crop;
- young plantations of broad-leaved trees reaching the 5 m height;
- broad-leaved wooded dunes.

This class includes:
- deciduous and evergreen broad-leaved tree species listed under the "applicable for" section with >75% cover
- palm trees;
- optionally sporadically occurring patches of coniferous trees not exceeding 25 % share of the tree covered area;
- sporadically occurring <25 ha patches of
    - shrubs and dwarf shrubs;
    - herbaceous vegetation (grasses and herbs);
    - mosses and lichens;
    - denuded spots.

This class is not applicable for:
- mixed broad-leaved / coniferous stands where broad-leaved trees cover < 75%, but > 25% of the area (class 313);
- recent or older burnt areas inside forest areas (classes 334 or 32x);
- woodland areas composed of broad-leaved trees smaller than 5 m height (class 322, 323);
- vegetated areas where the crown cover of the broad-leaved trees is < 30 % (class 324, 231, 321), except boreal forest where crown cover threshold is 15%;
- forest nurseries specialised in reproduction situated inside broad-leaved wooded areas (class 324);
- young plantations not yet reaching the 5 m height (class 324);
- clear-cuts (class 324);
- electric line corridors, fire breaks (if wider than 100 m) (class 324);
- forest nurseries outside forests for commercial purpose (class 211);
- wooded parks (in urban setting class 141, outside urban setting class 142).

This class excludes:
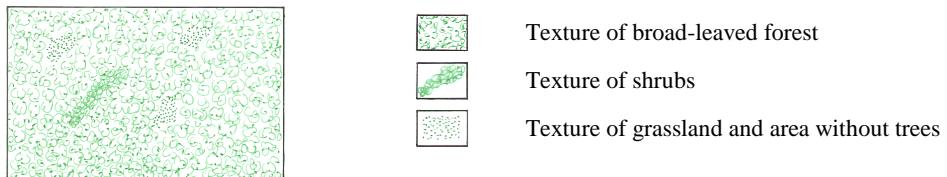- deciduous coniferous trees, dominantly larch (*Larix)* species (class 312).

	Texture of broad-leaved forest
	Texture of shrubs
	Texture of grassland and area without trees

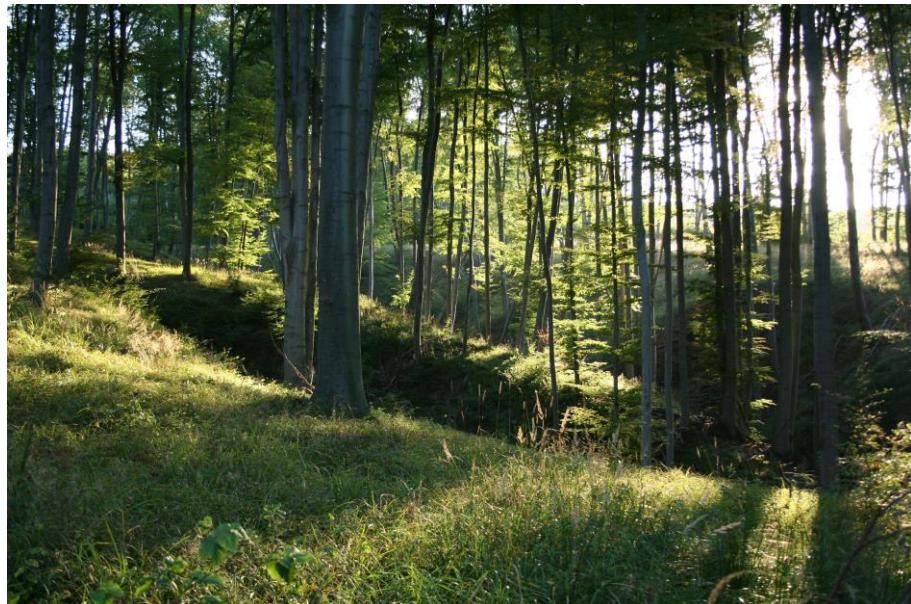Fig. 98   **Generalised pattern of the class 311**

Fig. 99   **Example 311: Broad-leaved (beech) forest (Hungary). B. Kosztra**

Fig. 100   **Floodplain forest along Danube river (Hungary). Photo: Gy. Büttner**

312 Coniferous forest

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

***Clarification*:**
The predominant classifying parameter for this class is a crown cover density of > 30 % or a minimum 500 subjects/ha density, with coniferous trees representing > 75 % of the formation. The minimum tree height is 5 m (with the exception of Christmas tree plantations).

This class is applicable for:
- mature coniferous (needle-leaved) forests of natural or anthropogenic origin like the following:
  o pure or mixed stands of fir (*Abies*), pine (*Pinus*), spruce (*Picea*), cedar (*Cedrus*), cypress (*Cupressus*), juniper (*Juniperus*), yew (*Taxus*), Douglas fir (*Pseudotsuga*) species, among others;
  o deciduous coniferous woodland composed of larch trees (*Larix spp.*);
  o arborescent matorral with dominating *Juniperus oxycedrus/phoenica*;
  o short (8-20 years) rotation forestry and coppice areas grown for pulpwood or as energy crop;
- young plantations of coniferous trees reaching the 5 m height;
- coniferous wooded dunes;
- Christmas tree plantations (also < 5 m height).
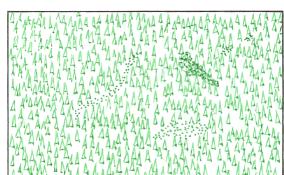
This class includes:
- evergreen and deciduous coniferous trees species listed under the "applicable for" section with > 75% share;
- optionally sporadically occurring patches of broad-leaved trees with < 25 % share of the tree covered area;
- sporadically occurring <25 ha patches of
  o shrubs and dwarf shrubs;
  o herbaceous vegetation (grasses and herbs);
  o mosses and lichens;
  o denuded spots.

This class is not applicable for:
- mixed broad-leaved – coniferous stands where coniferous trees cover between 25 and 75% of the area (class 313);
- vegetated areas where the crown cover of trees is < 30 % (class 324, 231, 321);
- woodland areas composed of grown-up coniferous trees smaller than 5 m height (class 322, 323);
- young plantations not yet reaching the 5 m height (class 324);
- clear-cuts (class 324);
- electric line corridors, fire breaks (if wider than 100 m) (class 324);
- recent or older burnt areas inside forest areas (classes 334 or 32x);
- forest nurseries specialised in reproduction, situated inside coniferous wooded areas (class 324);
- forest nurseries outside forests for commercial purpose (class 211);
- wooded parks (in urban setting class 141, outside urban setting class 142).

This class excludes:
- dwarf coniferous trees as *Pinus mugo spp. mughus* (class 322);
- sclerophyllous trees (class 311);
- evergreen broad-leaved trees (class 311).

Texture of coniferous forest

Texture of grassland and area without trees

Texture of shrubs

Fig. 101   **Generalised pattern of the class 312**

Fig. 102 **Example 312: Semi-natural coniferous forest in the Carpathian Mountains (Romania) Photo: B. Kosztra**

Fig. 103 **Example 312: Plantations of coniferous forest among arable land in Jylland (Denmark). Photo: Gy. Büttner**

Fig. 104   **Example 312: Stand of Norway spruce (Picea abies) near Oslo (Norway).** *Yellow coloured trees are deciduous larches.* **Photo: Gy. Büttner**

313 Mixed forest

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

Extension:
Mixed forests with a crown cover of > 30 % or a 500 subjects/ha density for plantation structure. The share of both coniferous and broad-leaved species exceeds 25 % within the canopy closure. The minimum tree height is 5 m.

This class is applicable for:

- mature forests with at least 30 % crown cover density, where both broad-leaved and coniferous trees occupy at least 25 %, but maximum 75 % of tree-covered area, of natural or anthropogenic origin;
- forests where broad-leaved and coniferous trees are mixed individually or in small groups within the stand (parcel);
- forests consisting of < 25 ha patches of homogeneous broad-leaved and coniferous stands (parcels) none of the types dominating with > 75 %;
- mixed-forest wooded dunes.

This class includes:
- deciduous or evergreen broad-leaved trees with 25-75 % share;
- evergreen or deciduous coniferous (needle-leaved) trees with 25-75 % share;
- sporadically occurring <25 ha patches of
  - shrubs and dwarf shrubs;
  - herbaceous vegetation (grasses and herbs);
  - mosses and lichens;
  - denuded spots.

This class is not applicable for:
- forests where either broad-leaved or coniferous trees cover > 75% of the area (classes 311 and 312, respectively);
- vegetated areas where the crown cover of mixed species trees is < 30 % (classes 324, 231, 321).
- woodlands with mixed species grown-up trees smaller than 5 m high (classes 322, 323);
- young plantations not yet reaching the height of 5 m (class 324);
- clear-cuts (class 324);
- electric line corridors, fire breaks (if wider than 100 m) (class 324);
- recent or older burnt areas inside mixed-forest areas (class 334 or 32x);

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- forest nurseries specialised in reproduction situated inside mixed-forest areas (class 324);
- forest nurseries outside forests for commercial purpose (class 211);
- wooded parks (in urban setting class 141, outside urban setting class 142).

This class excludes:
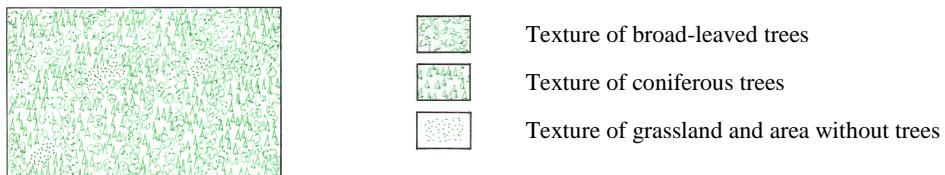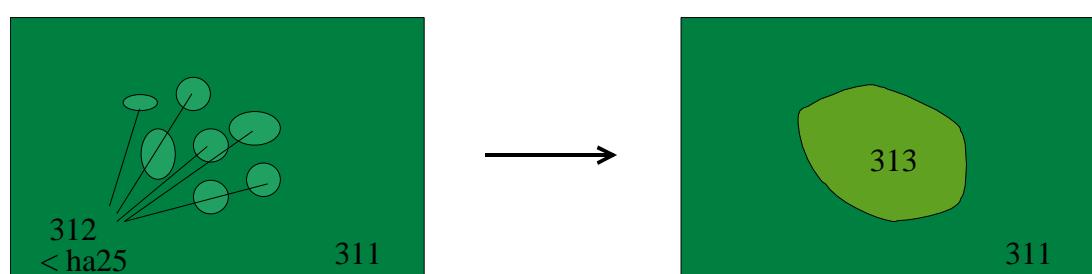- dwarf coniferous trees as *Pinus mugo spp. mughus* (class 322).

	Texture of broad-leaved trees
	Texture of coniferous trees
	Texture of grassland and area without trees

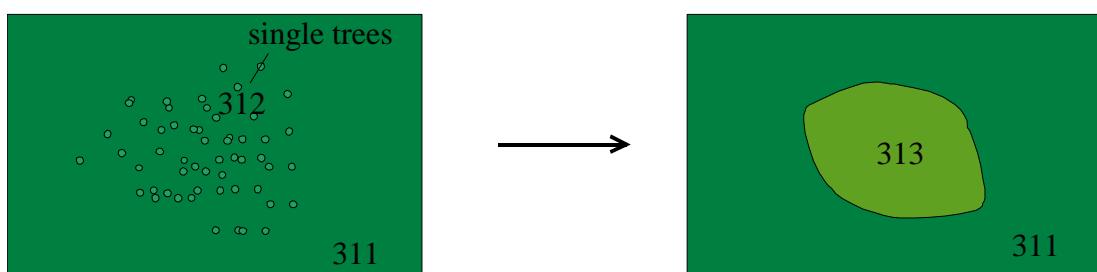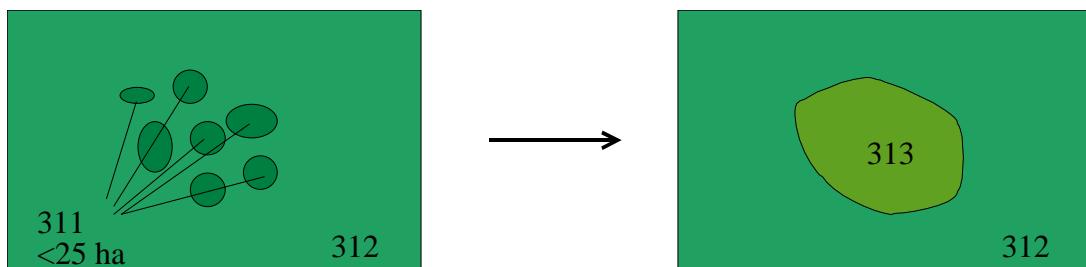Fig. 105   **Generalised pattern of the class 313**
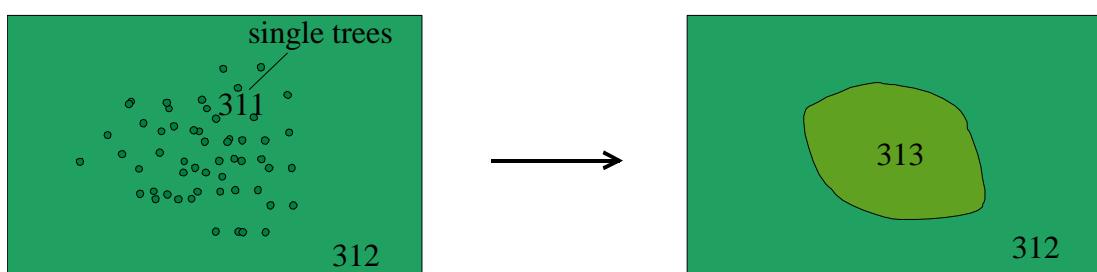
Fig. 106   **Example 313: Mixed forest made up of deciduous forest intermixed with small (<25 ha) stands of coniferous trees (Austria). Photo: Gy. Büttner**

Generalisation:
- Mixed-forest area is formed by alternation of plots or single trees of broad-leaved and coniferous trees.
- For areas with a size around the MMU of 25 ha where it is difficult to measure which leaf type is predominant and broad-leaved trees and coniferous trees stands are mainly not intermixed, class 313 shall not be used as a compromise class. Instead a majority decision in favour of either class 311 or class 312 has to be made.

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321 Natural grassland

Grasslands under no or moderate human influence. Low productivity grass-lands. Often situated in areas of rough, uneven ground, steep slopes; fre-quently including rocky areas or patches of other (semi-)natural vegetation.

Clarification:
Natural grasslands are areas with herbaceous vegetation (maximum height is 150 cm and gramin-eous species are prevailing) covering at least 50 % of the surface. Besides herbaceous vegetation, areas of shrub formations, of scattered trees and of mineral outcrops also occur. Often under nature conservation.

In this context the term "natural" indicates that vegetation is developed under a minimum human interference,(not mowed, drained, irrigated, sown, fertilized or stimulated by chemicals, which might influence production of biomass). Even though the human interference cannot be completely discarded in quoted areas, it does not suppress the natural development or species composition of the meadows. Maintenance mowing and shrub clearance for prevention of woody overgrowth due to natural succession is tolerated. Sporadic extensive grazing with low livestock unit/ha is possible. Typical visible characteristics: large extent, irregular shape, usually in distant location from larger settlements.

This class is applicable for:
- permanent grasslands of natural origin, under minimum human influence, with close to natural or semi-natural botanical composition, such as:
  - natural grasslands, meadows, steppes on any type of soil (calcareous / acid / neutral, rock / gravel / sand / loess), humid or dry growing conditions, on lowland , riverine, montane, subalpine, alpine, boreal habitats,

- o natural grasslands with sporadically occurring ligneous vegetation (trees and shrubs) if it does not cover > 30 % of the considered surface;
  - o saline grasslands grown on temporary wet areas of saline soils;
  - o humid meadows where sedges, rushes, thistles, nettles cover > 25 % of the parcel;
  - o herbaceous grass covered composed of not palatable gramineous species such as *Molinia spp.* and *Brachypodium spp.*;
  - o grasslands found on calcareous soils with a high proportion of calcicole species of limestone, chalk machair or karst;
- grasslands that can be extensively grazed, but never sown nor otherwise managed by application of fertilizers, pesticides, drainage or reseeding except by burning;
  - high-productive Alpine grasslands far from houses, crops and farming activities;
  - herbaceous military training areas;
  - grasslands with a yearly productivity less than 1.500 units of fodder/ha;
  - grasslands under nature conservation with only maintenance cultivation;
- derelict natural grassland where ligneous vegetation covers < 50 % of the area, trees occupying <30%;
- natural grasslands formed by process of natural succession / colonization on agricultural land abandoned for time long enough for development of a near natural species composition;
- seeding of areas of lupin (Lupinus nootkatesis) and grasses for reclamation and erosion control of large, barren areas in Iceland.
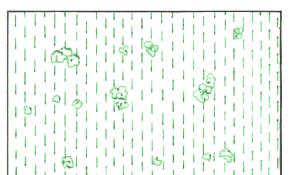
This class includes:
- herbaceous vegetation with > 50% cover, dominated by grasses;
- scattered woody vegetation with < 50% cover, trees occupying <30% of area;
- bare rocks or bare natural surfaces covering < 50 % of the area.

This class is not applicable for:
- permanent grasslands under intensive agricultural use (class 231);
- degraded grass-dominated vegetation of abandoned or ruderal areas, leftover areas around human settlements, under no agricultural use, but with strong human disturbance (class 231);
- derelict grassland where semi-ligneous/ligneous vegetation covers at least 50% of the parcel (class 322, 323, 324);
- grey dunes (class 331);
- natural grasslands where natural bare surfaces (rock, pebble, sand, salt plane) cover 50-90% of area (class 333);
- swampy grassland (class 411);
- humid meadows where hygrophyle plant species cover at least 25 % of the parcel (class 411);
- salt meadows under occasional tidal influence (class 421)
- fallow land (class 211).

This class excludes:
No entry

| | Texture of natural grassland |
| | Texture of scattered trees and shrubs |

Fig. 107 **Generalised pattern of the class 321**

Fig. 108   **Example 321: Species-rich natural grassland in nature conservation area (Hungary) Photo: B. Kosztra**

Fig. 109   **Example 321: Low-productivity grassland on karstic surface with scattered shrubs (Hungary) Photo: B. Kosztra**

Fig. 110   **Examples 321: Dune grassland areas along the coast (the Netherlands). Large areas of 321 with patches of 331, shrubs/trees and 322. Photos: G. Hazeu**
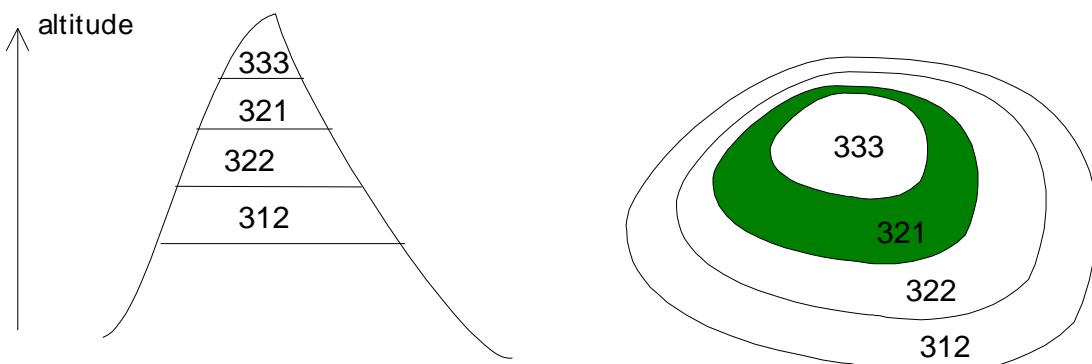
Fig. 111   **Example 321: Extensively used grasslands in floodplains along the Dutch rivers.** *Formerly intensively used but "recently" converted into nature areas.* **Photo: G. Hazeu**

Fig. 112   **Comparison of 321 and 231 in a farm around Akureyri (Iceland***). Around the farm houses the grass has been improved (see vivid green colour). On moderate slopes natural grassland grows (yellow colour).* **Photo: Gy. Büttner**

Generalisation:

- At high altitude, class 321 might be present as altitude formation between heathlands (322) or class 31x and sparsely vegetated areas (333).

Particularity of class 321: Alpine meadows

Grass formations which occur in high mountains above the timberline as natural climax-state herbaceous plant communities, where growing conditions do not allow development and survival of woody vegetation.

This heading is applicable for:
- Alpine grasslands which are either completely unused or only in very extensive use under grazing with low livestock units/ha.

This class includes:
- herbaceous plants (grasses and herbs) covering >50%;
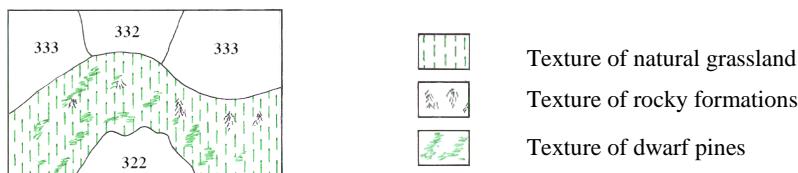- rocky formations <50%;
- dwarf pines <50%.

	Texture of natural grassland	
	Texture of rocky formations	
	Texture of dwarf pines	

Fig. 113 **Generalised pattern of the particularity of class 321**

Fig. 114 **Example particularity of 321: Species-rich alpine meadows in Făgăraș Mountains (Romania). Photos: B. Kosztra**

Particularity of class 321: Grass formations of alluvial and coastal plains with high soil humidity and seasonal inundation, with low human influence.

This class includes:
- natural grassland;
- water bodies;
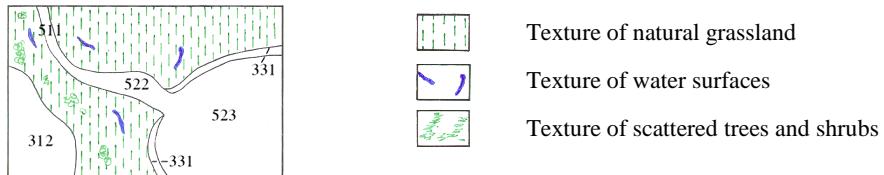- shrub formations and scattered trees.

Fig. 115   **Generalised pattern of the particularity of class 321**

Fig. 116   **Examples particularity of 321: lower coastal grassland and upper coastal grassland (Rumpo and Vaemla, Estonia). Source: Jan Feranec**

322 Moors and heathland

Vegetation with low and closed cover, dominated by bushes, shrubs, dwarf shrubs (heather, briars, broom, gorse, laburnum etc.) and herbaceous plants, forming a climax stage of development.

Extension:
Moors and heathlands are often formed in habitats where natural formation of forests is hindered by or made impossible by growing conditions. However, in some of these habitats afforestation is possible with human intervention.

This class is applicable for:
- Climax stage vegetation dominated by shrubs and dwarf shrubs on temperate, Atlantic, maritime, alpine and arctic habitat, such as:
  o wet heath distributed on humid or semi-peaty soils (peat depth < 30 cm) with *Erica tetralix/ciliaris*, *Sphagnum spp.* and *Molinia spp.*;
  o dwarf pine *(Pinus mugo)* coverage above the upper tree limit in the Alpine zone or in the bottom of large depressions with temperature inversion;
  o maritime, prostrate, wind-swept and cushiony heaths with maritime ecotypes;
  o heath and scrub formation in Atlantic, sub-Atlantic and sub-continental areas with gorse (*Ulex spp.*), vaccinium heaths (*Calluna vulgaris, Vaccinium spp.*), heather (*Erica spp.*), bracken or gorse (*Genista spp.*), bilberry heaths (*Vaccinium myrtillus*), briar patch (*Rubus spp.*);
  o moors in supra-Mediterranean area with box trees and gorse, hedgehog-heaths (*Buxus spp.*, *Astragalus spp.*, *Bupleurum spp.*, etc.);
  o sub Alpine tall herbs with dominating bushy facies (*Calluna spp.*, *Vaccinium spp.*, *Rubus spp.*, *Juniperus nana*, etc.);
  o arctic moors areas with moss, lichen, gramineous coverage and small dwarf or prostrate shrub formations (*Betula nana*, *Salix lapponum*, *Salix glauca*, *Juniperus alpina*, *Dryas spp., Vaccinium myrtillus, Empetrum nigrum*);
  o moss- and lichen-dominated pioneer vegetation of lava fields in areas of active volcanism, typical in Iceland;

- o alpine heaths with dwarf shrubs (*Empetrum, Betula nana, Vaccinium myrtillus, Phyllodoce caerulea, Cassiope tetragona, Dryas*), mosses and lichens
- o thickets and brush woods in temperate climate areas (box, bramble thickets, broom fields, gorse thickets, bracken fields, common juniper-scrubs);
- o brush woods and bush-like forest in Alpine area with dwarf mountain pine scrub or green alder scrub (*Pinus mugo ssp. mughus* and *Alnus spp.*) Alpine willow brush, etc., accompanied by *Rhododendron spp.*;
- o thickets and bush-like forest in arctic area with *Betula nana* and *Salix lapponum/glauca spp.*;
- o dwarf-shrub covered areas with <30 cm peat and without visible sign of morphological features typical of bogs (e.g. pools, peat hags, peatland gullying);
- agricultural crops abandoned for > 3 years, where the above listed ligneous/semi-ligneous vegetation covers > 50 % of the surface;
- coastal dunes (so-called brown dunes) covered and fixed with shrubs (*Hippophae spp.*, *Empetrum spp.*, *Salix spp.*);
- areas covered by the above-listed vegetation types used as ski-pistes during skiing season.

This class includes:
- shrubs and dwarf shrubs, dominating the vegetation;
- trees of dwarf growth form, not higher than 3 m;
- herbaceous vegetation (grasses and herbs);
- mosses and lichens;
- outcrops of natural bare surfaces not reaching 50% cover of the area.

This class is not applicable for:
- Mediterranean drought-tolerant climax stage vegetation (maquis, garrigue, matorral) (class 323);
- heathland in transition, under afforestation process with presence of young forest trees (class 324);
- heathland under natural recolonization process where tree-like species cover > 30 % of the surface (class 31x)
- dwarf-shrub covered areas with >30 cm peat, with visible sign of morphological features typical of bogs (e.g. pools, peat hags, peatland gullying) (class 412).

This class excludes:
- sclerophyllous shrubs (class 323);
- trees of > 5 m height with >30% cover (classes 31x);
- young forest trees (class 324).

Fig. 117   **Example 322: Alvar with junipers (*Harilaid*, Estonia). Source: Wikipedia**

Fig. 118   **Example 322: Heathland with bracken in Scottish Highlands (United Kingdom).** Photo: Gy. Büttner

Fig. 119   **Example 322: Upland moors in Southern Norway.** Photo: Gy. Büttner

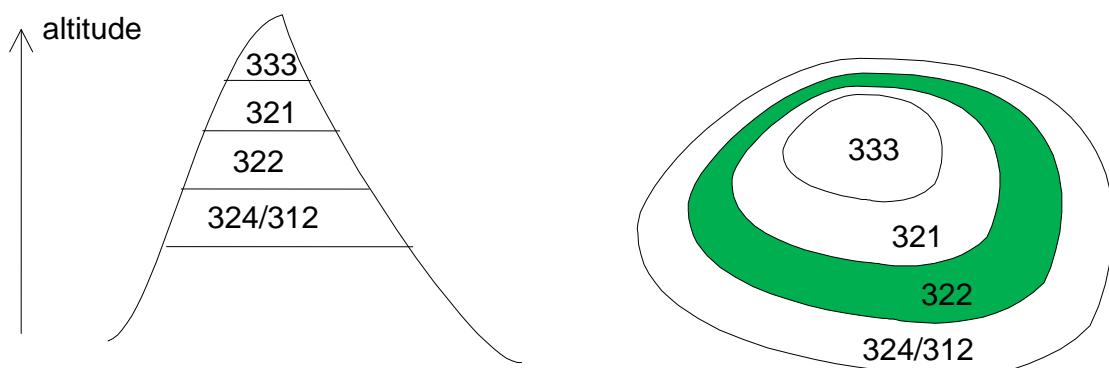Fig. 120   **Example 322: Moors in Hammerfest Northern Norway.** Photo: Per K. Bjørklund

Fig. 121   **Moss and lichen covered basaltic boulders (Iceland). Photo: Gy. Büttner**

Fig. 122   **Example 322: Lowland moors (*Drenthe*, the Netherlands).** *These lowland moors on sandy soils are not climax vegetation, but maintained as moors by (nature) management (grazing, cutting shrubs).* **Photo: G. Hazeu**

Generalisation:
- At high altitude class 322 should be used as altitude range formation according to the vegetation gradient between classes 321 and 324/31x.

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Particularity of class class 322: Dwarf mountain pine scrub

Climax stage dwarf pine stands formations of 2-2.5 m height with a compact canopy occurring in high altitudes, where growing conditions do not allow development higher woody vegetation.

Clarification:
Dwarf pine is usually found from 1,000–2,200 m a.s.l. in Europe, occasionally as low as 200 m in the north of the range in Germany and Poland, and as high as 2,700 m in the south of the range in Bulgaria and the Pyrenees. It is also often artificially planted, for instance in coastal dunes as protection against deflation (e.g.in Lithuania and Denmark), where it can become invasive.

This class is applicable for:
- natural stands of dwarf mountain pine;
- dwarf pine plantations;

This class includes:
- dwarf mountain pine (*Pinus mugo spp. mughus*);
- rocky formations;
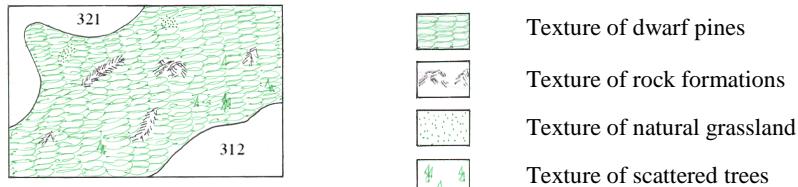- sporadic areas of grassland;
- sporadic tree enclaves.

Texture of dwarf pines

Texture of rock formations

Texture of natural grassland

Texture of scattered trees

Fig. 123   **Generalised pattern of the particularity of class 322**

Fig. 124   **Example particularity of 322: Dwarf mountain pine shrubs (*High Tatras*, Slovakia). *Note the low height of the shrub.* Photo: B. Kosztra**

323 Sclerophyllous vegetation

Bushy sclerophyllous vegetation in a climax stage of development, including maquis, matorral and garrigue.

This class is applicable for:
- Maquis, matorral, garrigue and thermo-Mediterranean brushes, characterized by shrubs of sclerophyllous character, with hard leaves and short internodes, usually evergreen.
  - o   matorral of arid zone with pre-desert brushes and tall *Ziziphus lotus*;
  - o   laurel matorral with *Laurus nobilis*;
  - o   cypress matorral with native or planted cypressus;
  - o   garrigues characterized by *Quercus, Juniperus, Cistus, Lavandula, Rosmarinus, Euphorbia, Genista, Erica, Laurus* etc. species
  - o   tree-spurge formation with dense stands of *Euphorbia dendroides* in thermo-Mediterranean area;
  - o   palmetto brush formations with dominating *Chamaerops humilis*;

85

- o pre-desert scrub with halo-nitrophyllous scrubs and gypsum scrubs: jujube brush (*Ziziphus lotus*), shrubs of African affinities (spiny brush formation of acacia);
- abandoned olive groves
- agricultural crops abandoned for > 3 years, where the above listed ligneous/semi-ligneous vegetation covers > 50 % of the surface;
- abandoned agro-forestry systems (dehesa, montado) where non-permanent crops are replaced by overgrowth of sclerophyllous shrubs.

This class includes:
- sclerophyllous shrubs and low shrubs, dominating the area;
- scattered sclerophyllous trees covering < 30% of area;
- herbaceous vegetation (grasses and herbs);
- outcrops of bare natural surfaces (rocks, scree, sand, soil) covering <50% of area.

This class is not applicable for:
- arborescent matorrals that are pre- or post-broad-leaved evergreen forest formations with more or less dense tree cover. Characterized bya usually thick high evergreen shrub stratum organised around evergreen oaks (*Quercus suber/ilex/rotundifolia*), olive trees or pines with > 30 % crown cover (class 311). If the crown cover is < 30 %, it is assigned to class 324.
- sclerophyllous vegetation under anthropogenic process of afforestation, usually recognizable by rows of plantations following topographic contour lines (class 324);
- sparse sclerophyllous shrubs where bare rocks cover >50% of the area (class 333).

This class excludes:
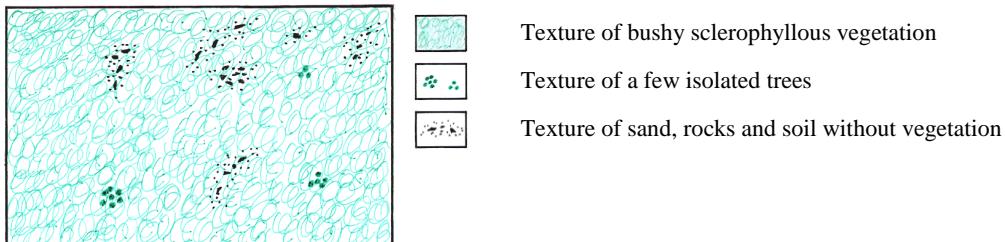- shrub species typical of temperate, Atlantic, alpine, arctic moors and heathlands (class 322).

	Texture of bushy sclerophyllous vegetation
	Texture of a few isolated trees
	Texture of sand, rocks and soil without vegetation

Fig. 125   **Generalised pattern of the class 323**

Fig. 126   **Example 323: Sclerophyllous vegetation on the hills near Athens (Greece). Photo: Gy. Büttner**

127a Albania	127c. Bosnia- Herzegovina
127b Vulcanello (Italy)	127d Masca, Teneriffe (Spain)

Fig. 127 **Examples 323: Sclerophyllous vegetation across Europe. Photos: 127a,b,c: B. Kosztra, 127d: Gy. Büttner**

324 Transitional woodland/shrub

Transitional bushy and herbaceous vegetation with occasional scattered trees. Can represent woodland degradation, forest regeneration / recolonization or natural succession.

Clarification:
Areas representing natural development of forest formations, consisting of young plants of broad–leaved and coniferous species, with herbaceous vegetation and dispersed solitary adult trees. Transitional process can be for instance natural succession on abandoned agricultural land, regeneration of forest after damages of various origin (e.g. storm, avalanche), stages of forest degeneration caused by natural or anthropogenic stress factors (e.g. drought, pollution), reforestation after clearcutting, afforestation on formerly non-forested natural or semi-natural areas etc.

This class is applicable for:
- clear cuts in forest areas;
- selective cut, patch or strip clearcut areas within forest where leftover trees cover <30% of the mapped patch;

- open clear-felled or regeneration areas in the transitional stage of regrowth, which lasts for usually 5-8 years (more than that in boreal forests) or until trees reach the 5 m height;
- young forest plantations;
- forest nurseries inside forests area;
- electric line corridors, fire breaks (if wider than 100 m) (class 324);
- natural grassland areas with small patches of forest < 25 ha and/or with trees intermixed which cover < 30 % of the surface;
- burnt forest or burnt natural shrubland areas that do not show black tones any more in the satellite imagery, but damage is still visible;
- forests heavily damaged by wind, snow-brake, avalanche, insects, acid rain or other pollution with > 50 % of trees severely affected;
- areas of recultivation of mineral extraction sites and dump sites by means of afforestation or natural / semi-natural succession with shrubs;
- agricultural lands (classes 2xx) under recolonization process with occurrence of young forest trees, which cover > 30 % of the surface (scattered trees or small plots of young trees);
- abandoned fruit tree plantations and orchards;
- afforestation on former natural grasslands or natural shrubs (322, 323), even when original vegetation still dominates;
- arborescent matorrals that are pre- or post-formation of broad-leaved evergreen forest with a usually thick evergreen shrub stratum composed of evergreen oaks (*Quercus suber/ilex/ rotundifolia*), olive trees, carob trees or pines, with crown cover density < 30 %;
- marginal zones of bogs with vegetation composed of shrubs and pines, which cover > 50 % of the surface.
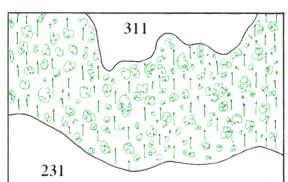
This class includes:
- young broad-leaved and/or coniferous trees;
- damaged or dead trees and shrubs;
- fully grown trees, covering < 30% of area;
- shrubs;
- herbaceous vegetation (grasses and herbs);
- bare soil or natural bare surfaces.

This class is not applicable for:
- young forests where trees reach 5 m height (class 31x);
- abandoned olive groves (class 323);
- agricultural lands (classes 2xx) with patches of forest vegetation with an overgrowth occupation rate < 75 % (class 243);
- stable/climax forest formations with a tree height < 4 m, and *Pinus mugo spp. mughus* forests (class 322);
- coastal dunes (so-called brown dunes) covered and fixed with shrubs (*Hippophae spp.*, *Empetrum spp.*, *Salix spp.*) (class 322);
- moors and heathland in the process of natural regeneration after fire damage (class 322);
- sclerophyllous shrubs in the process of natural regeneration after fire damage (class 323).

This class excludes:
- dwarf mountain pine (*Pinus mugo*).

Texture of forest regeneration or degradation

Texture of herbaceous plants

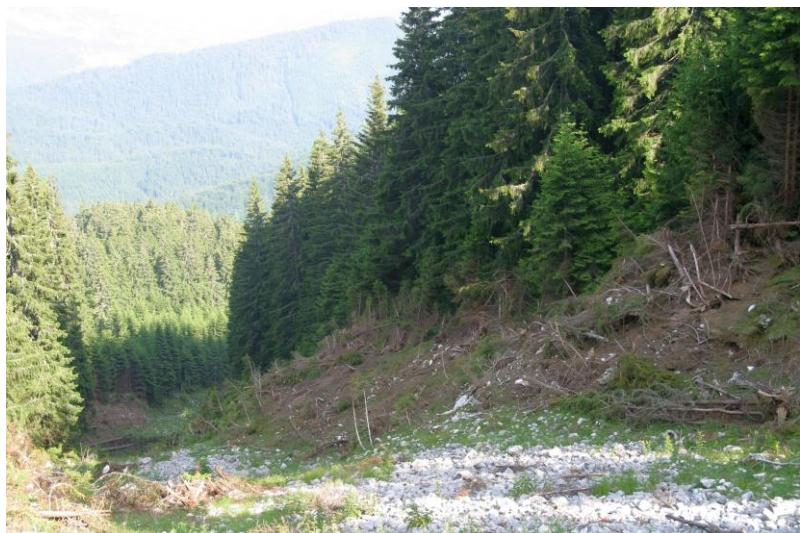Fig. 128   **Generalised pattern of the class 324**

Examples 324: Woodland degradation

129a: Clearcut pine forest (Hungary) Photo: B-. Kosztra

129b. Strip clearcut (Norway). Photo: Gy. Büttner

129c: Avalanche break in spruce forest (Romania). Photo: B. Kosztra

129d: Windbreak in the High-Tatras in 2007 (Slovakia). Photo: B. Kosztra.
Note the waste affected area in the background

Examples 324: Forest formation, afforestation

129e: Afforestation near Ankara (Turkey). Photo: Gy. Büttner

129f: Transition from grasslands to forest by natural succession (due to lack of grazing) in the Carpathians (Romania). Photo: Gy. Büttner
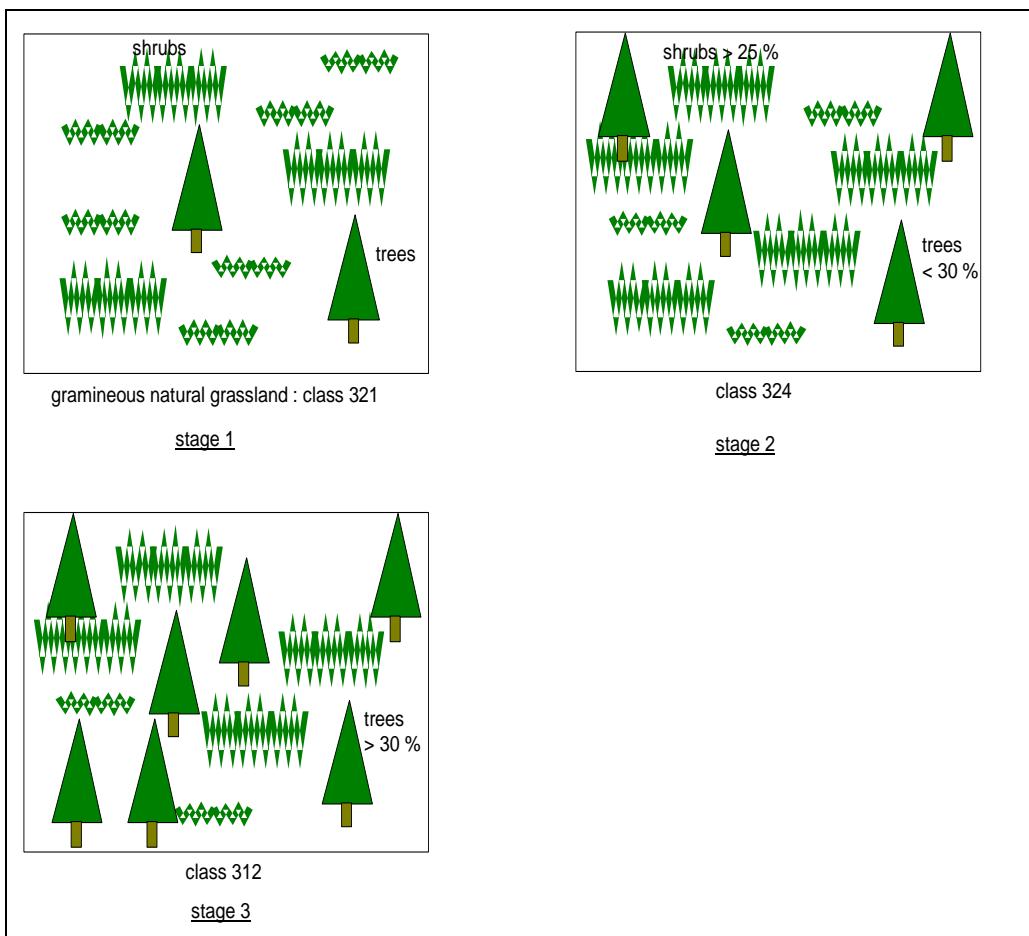
129g: Forest regeneration after fire on Lovcen Mountain (Montenegro). Photo: B. Kosztra

Fig. 129   **Examples 324 from across Europe**

Evolution of 324:

- Class 324 within an evolution stage of natural grasslands.

gramineous natural grassland : class 321

stage 1

class 324

stage 2

class 312

stage 3

Particularity of class 324: Wooded fen, bog and transitional bog

Shrubby-herbaceous vegetation with scattered trees forming marginal zones of peat bogs.

This class is applicable for:
- shrubs and herbaceous vegetation with scattered trees (*Betula pubescens, Alnus glutinosa, Picea abies, Pinus silvestris, Salix spp.*), woody vegetation covering > 50% of area.

Texture of wooded fen, bog or wooded transitional bog

Texture of herbaceous plants
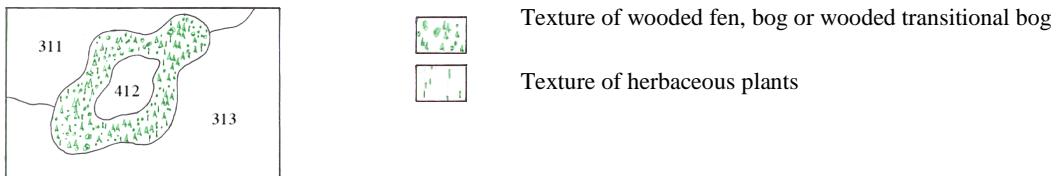
Fig. 130   **Generalised pattern of the particularity of class 324**

Fig. 131   **Example particularity of 324: Wooded fen in Avaste fen, one of the biggest fens in Estonia, Source: Wikipedia**

331 Beaches, dunes, and sand plains

Natural non-vegetated expanses of sand or pebble/gravel, in coastal or continental locations, like beaches, dunes, gravel pads; including beds of stream channels with torrential regime. Vegetation covers maximum 10%.

This class is applicable for:
- supra-littoral beaches and dunes developed at the back of the beach from high water mark towards land;
- river dune formation in the immediate vicinity of great rivers;
- inland and lacustrine dunes;
- shifting dunes with non-vegetated surface or open grasslands (white dune);
- grey dunes fixed, stabilised or colonised by more or less closed perennial grasslands;
- ergs (continental dune fields located in desert);
- accumulation of gravel along lower section of Alpine and glacial rivers;
- ground moraine;
- gravel-covered channels and beds of Mediterranean rivers, having a periodic or episodic water regime without running water for most of the year.

This class includes:
- non-vegetated surfaces of sand, gravel, pebble dominating the area;
- herbaceous vegetation (mostly grasses);
- scattered shrubs.

This class is not applicable for:
- plant formations with >10% vegetation cover;
- inland dune heaths (crowberry and heather brown dunes) (class 322);

- inland dunes thickets occupied by dense formations of shrubs including sea-buckthorn, privet, elder, willow, gorse or broom often festooned with creepers (class 322);
- dune juniper thickets and woods (class 32x);
- dune sclerophyllous scrubs (class 323);
- wooded dunes (class 31x);
- humid dune-slacks (class 411);
- non-vegetated gravel or scree slopes on steep Alpine mountain side (class 332);
- vegetated islands inside stream beds (class 3xx);
- sites and products of recent volcanic activities, volcanic ash and lapilli fields, barren lava fields (class 332);
- temporarily dry parts of riverbeds due to low water level (< 6 months / year) because of seasonal fluctuation of water or low snow melting rate in glacier-fed Nordic rivers (class 511);
- temporarily dry zone of lake beds due to seasonal water level changes (e.g. irrigation water reservoirs, inland saline lakes) (class 512).

This class excludes:
- bare rock and boulders (class 332).

Texture of beach and river banks

Texture of sparse grass
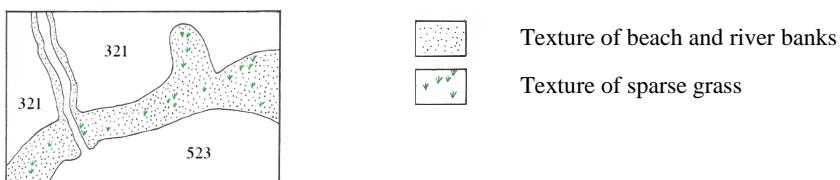
Fig. 132   **Generalised pattern of the class 331**

Fig. 133   **Example 331: Grey dunes (the Netherlands). Photo: G. Hazeu**

Fig. 134   **Example 331: Sand dunes in the Baltic Sea close to Malmö (Sweden). Photo: Gy. Büttner**
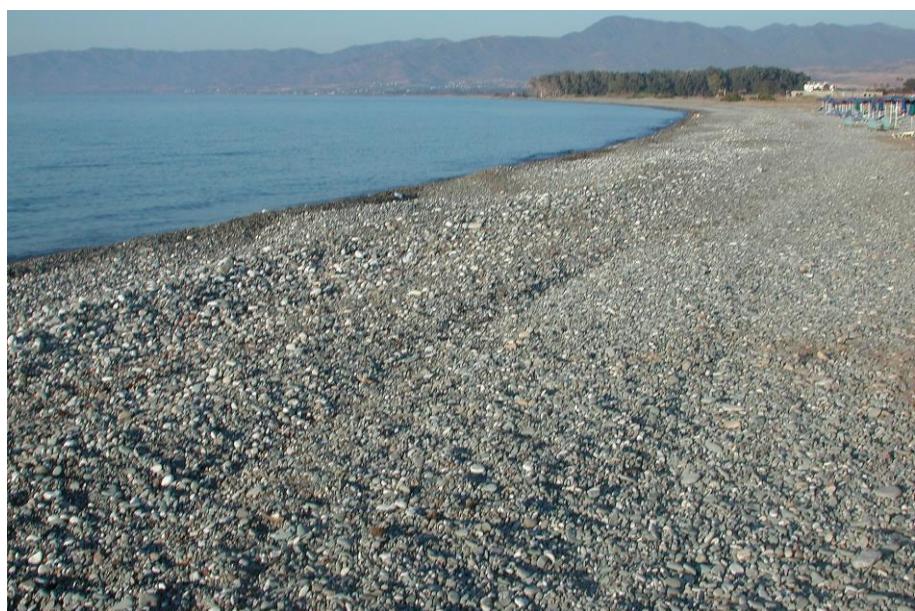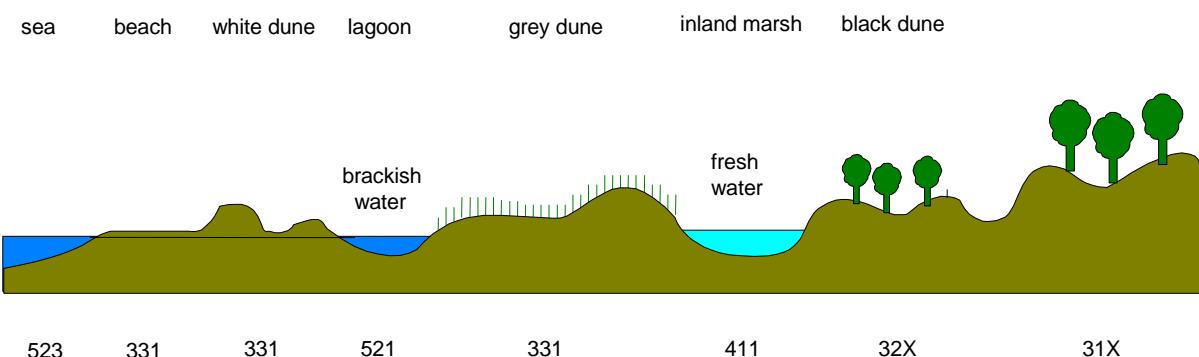

Fig. 135   **Example 331: Gravel beach along the Mediterranean Sea (Cyprus). Photo: Gy. Büttner**

Fig. 136 **Example 331: Inland sand dunes (*province of Noord-Brabant,* the Nether-lands). Photo: G. Hazeu**

Coastal dunes:
- Zoning of dune vegetation from the sea toward supra-littoral landscapes.

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332 Bare rock

Scree, cliffs, rock outcrops, including areas of active erosion, rocks and reef flats situated above the high-water mark, inland salt planes.

This class is applicable for:
- naturally sparsely vegetated or non-vegetated areas where at least 90 % of the land surface is covered by rocks;
- stable rocks with limestone pavements, block litter and mountain-top-debris;
- non-vegetated limestone pavement;
- sites and products of recent volcanic activities, volcanic ash and lapilli fields, barren lava fields;
- non-vegetated supra-littoral rocky zones,
- inland hard salt planes;
- areas with loss of vegetation due to erosion, recent mud flows, landslides, rock avalanches;
- non-vegetated abandoned mineral extraction sites.

This class includes:
- bare rock, large mineral fragments (boulders, scree, lapilli) occupying at least 90% of the area;
- scattered vegetation occupying < 10% of area.

This class is not applicable for:
- mineral extractions sites (class 131);
- mine dumps, deposits of artificial solid waste materials (class 132);
- white dunes (class 331);
- mediolittoral rocky sea beds (class 423);
- bare rocks with 10-30% cover of scattered trees (class 324);
- sparse shrubland on rocky terrain with dominating shrub cover (class 322, 323);
- moraines and gravel beds (class 331);
- sparsely vegetated rocky areas with 10-50% vegetation cover (class 333).

This class excludes:
- sand and gravel (class 331)
- artificial and waste material (class 132).

 Texture of cliff relief forms and talus cones

Texture of grassland
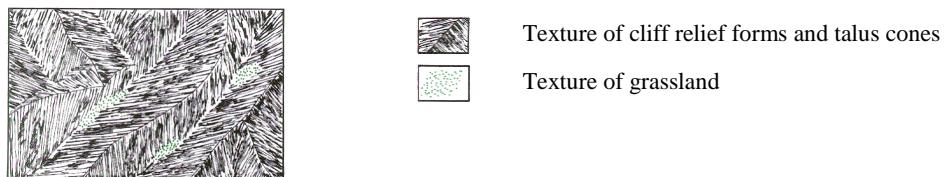
Fig. 137   **Generalised pattern of the class 332**

Fig. 138   **Example 332: Eroded hill side on (*Island Leka*, Norway) Photo: Gy. Büttner**

Fig. 139   **Example 332: Cliffs and scree slopes (*Dolomites*, Italy): Photo: B. Kosztra**

Fig. 140   **Example 332: Crater of a dormant volcano, Volcano Island (Italy). Photo: B. Kosztra**

Fig. 141   **Example 332: Fresh lava flow on slopes of Etna (Italy). Photo: B. Kosztra**

333 Sparsely vegetated areas

Areas with sparse vegetation, covering 10-50% of surface. Includes steppes, tundra, lichen heath, badlands, karstic areas and scattered high-altitude vegetation.

Clarification:
Scattered vegetation is composed of herbaceous and/or ligneous and semi-ligneous species, the rest of area is naturally bare ground. In Mediterranean and extreme dry areas the identification of the class often requires early-in-vegetation-season (spring) imagery, following the phenological cycle of (therophyte) herbs and grasses, which dry out completely during the unfavourable, dry summer period.

This class is applicable for:
- sparsely vegetated and unstable areas of stones, boulders, or rubble on steep slopes where the vegetation layer covers between 10 % and 50 % of the surface;
- sub-desertic steppes with gramineous species (*Artemisia spp.*) mixed with alfa (*Stipa spp.*) covering between 10 % and 50 % of the surface;
- lichen heath;
- sparse vegetation of 'lapie' areas or limestone paving;
- bare soils inside military training areas;
- karstic areas with scattered gramineous, ligneous and semi-ligneous vegetation;
- sparsely vegetated badlands;
- sparse vegetation of abandoned or reclaimed mineral extraction sites or dump sites;
- sparse vegetation of re-greening on unstable surface (e.g. volcanic sand) for reclamation and erosion control;
- burnt areas where sign of recent burn is not visible any more and at least 50% of area is non-vegetated;
- sparsely vegetated areas used as ski-pistes during skiing season.

This class includes:
- bare surfaces (rock, boulders, mineral fragments, bare soil)
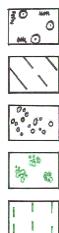- herbaceous and/or woody vegetation altogether covering <50% of surface.

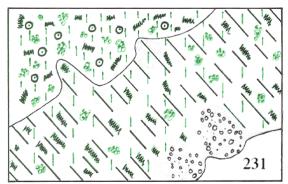### This class is not applicable for:
- windblown part of dune areas (class 331);
- areas where non-vegetated surface covers at least 90 % of the area (class 332);
- areas where the vegetation covers > 50 % of the surface (classes 31x, 32x);
- sparse forests with >30% tree cover (class 31x);
- dense alfa (*Stipa ssp.*) coverage (class 321);

- clear cuts and afforestation areas where most the surface is non-vegetated (class 324)
- mineral extraction sites or dump sites reclaimed by means of afforestation, even if most of the surface is still without vegetation cover (class 324).

This class excludes:
No entry

	Texture of karstic relief
	Texture of rocky slopes of plains and cliffs
	Texture of talus cones
	Texture of shrubs
	Texture of herbaceous plants

Fig. 142 **Generalised pattern of the class 333**

Fig. 143 **Example 333: Karstic Velebit mountains (Croatia) in the background.** *In the foreground, 332 (bare rocks).* **Photo: Gy. Büttner**

Fig. 144 **Example 333: Sparse vegetation colonizing a lava field on Mount Vesuvius. Photo: B. Kosztra**

Fig. 145 **Example 333: Lichen heath near *Roros* (Norway). Photo: Geir-Harald Strand**

Generalisation:

- For class 333, a quantitative scheme should be applied:

Class 321	Class 333	Class 331/332
vegetation > 50 % and bare surface < 50 %	10 % < vegetation < 50 % and 50 % < bare surface < 90 %	vegetation < 10 % and bare surface > 90 %

- 'Lapie' areas:

Sparsely vegetated areas should also be applied for reticulated landscapes as 'lapie' or limestone paving where vegetation is characterised by line/reticular distribution on ground cracking substratum.
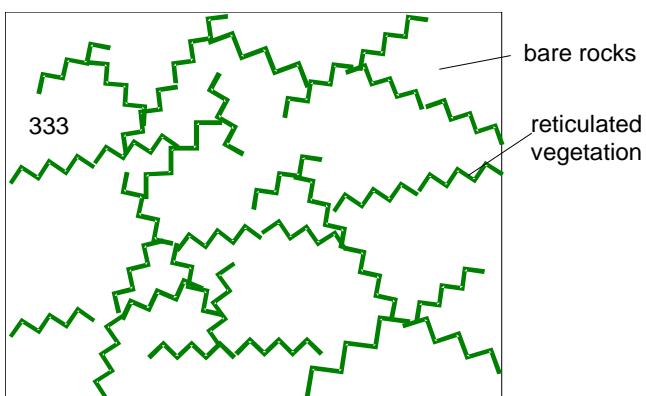
Fig. 146　**Example 333: Stripes of vegetation in limestone pavement (*Lovcen Mountain,* Montenegro). Photo: B. Kosztra**

334 Burnt areas

Natural woody vegetation affected by recent fires.

***Clarification*:**

This class includes recently (within a year of image acquisition) burnt areas of forests, moors and heathlands, sclerophyllous vegetation, transitional forest-shrub formations, areas with sparse vegetation. Recent burn is visible on satellite images, still mainly black, dark green or grey.

This class is applicable for:
- recent burns of forest (classes 31x) still visible in the satellite images;
- recent burns of natural and semi-natural woody vegetated areas represented by classes 322, 323, 324.
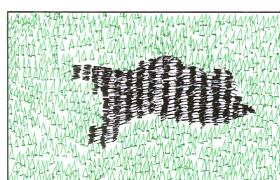
This class includes:
- damaged natural woody plants;
- damaged natural herbaceous plants among burnt woody plants;
- bare soil, rock covered with ash.

This class in not applicable for:
- human farming management by burning arable lands (classes 211 and 231);
- burnt permanent crops (classes 22x);
- burnt natural grassland (class 321);
- burnt areas where regeneration has already started on > 50% of area (classes 32x);
- burnt areas where sign of fresh burn is not visible any more and at least 50% of area is non-vegetated (class 333).

This class excludes:
- damaged agricultural crops (classes 2xx).

Texture of trees	
Texture of burnt trees	

Fig. 147　**Generalised pattern of the class 334**

Fig. 148   **Example 334: Burnt coniferous forest (*Harghita Mountains*, Romania).
Photo: Gy. Büttner**

335 Glaciers and perpetual snow

Land covered by glaciers or permanent snowfields.

Clarification:
Permanent snow and ice can be captured by finding the patches' smallest extent during the year. This can be captured when they shrink to minimum due to summer warmth, but before the first snowfall after summer occurs. Such ideal date is between end July (August in Northern countries) and late September. The general requirement of 100 m delineation accuracy is not sufficient in mapping 335. The tolerable shift in delineation is maximum 50 m.
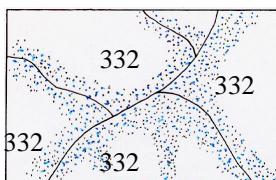
This class is applicable for:
- glaciers and perpetual snow;
- rock glaciers and debris-covered glaciers clearly identifiable by shape.

This class includes:
- permanent ice and snow surfaces;
- bare rocks occupying < 50% of area;
- rock debris covering ice.

This class is not applicable for:
- snow patches pertaining over a part of summer period, but not throughout the whole year (class 3xx).

Texture of glaciers and perpetual snow

Texture of bare rocks
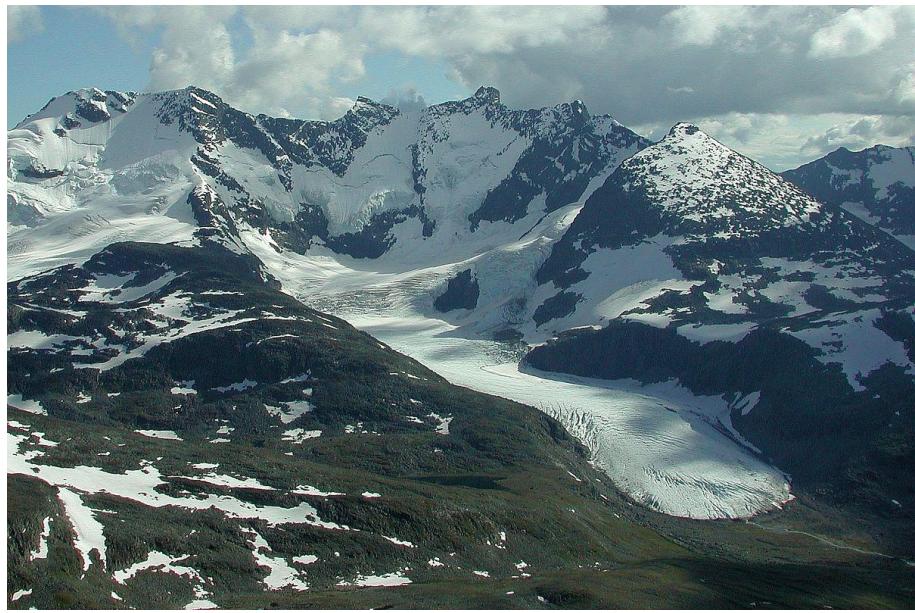
Fig. 149   **Generalised pattern of the class 335**

Fig. 150   **Example 335: Glaciers and permanent snow patches (Norway). Photo: Gy. Büttner**

Generalisation:

glaciers and perpetual snow =50 % and bare rocks =50 % ⇨ 335

- glaciers and perpetual snow >50 % ⇨ 335
- glaciers and perpetual snow <50 % ⇨ 332

Class 4: Wetlands

Class 4.1 Inland wetlands

Areas flooded or liable to flooding during the great part of the year by fresh, brackish or standing water with specific vegetation coverage made of low shrub, semi-ligneous or herbaceous species. Includes water-fringe vegetation of lakes, rivers, and brooks and of fens and eutrophic marshes, vegetation of transition mires and quaking bogs and springs, highly oligotrophic and strongly acidic communities composed mainly of sphagnum growing on peat and deriving moistures of raised bogs and blanket bogs.

Class 4.2 Coastal wetland

Areas which are submerged by high tides at some stage of the annual tidal cycle. Includes salt meadows, facies of saltmarsh grass meadows, transitional or not to other communities, vegetation occupying zones of varying salinity and humidity, sands and muds submerged for part of every tide devoid of vascular plants, active or recently abandoned salt-extraction evaporation basins.

411 Inland marshes

Low-lying land usually flooded in winter, and with ground more or less saturated by fresh water all year round.

This class is applicable for:
- non-forested areas with dominantly herbaceous vegetation that is liable to flooding by fresh running or stagnant water;
- fens and transitional bogs without peat deposition or on peaty ground with less than 30 cm thick peat layer ;
- marsh vegetation located in margin zones of raised bogs;
- water-fringe vegetation of reed beds;
- sedge communities, fen-sedge beds, tall rush swamps;
- riparian cane formations;
- inland saline (alkali) marshes (prevailing archeic) with halophile and gypsophile plant communities;
- humid meadows where hygrophyle plant species cover at least 25 % of the parcel;
- humid meadows around the landward edge of brackish lagoons
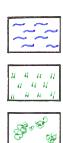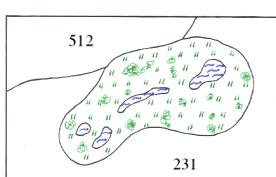
This class includes:
- specific low ligneous, semi-ligneous or herbaceous vegetation;
- reeds, bulrushes, rushes, willows, sedges and tall herbs, sphagnum hummocks and other water plants;
- alder, willows or other tree species (covering < 30%);
- high floating vegetation;
- water surfaces <25 ha within inland marshes.
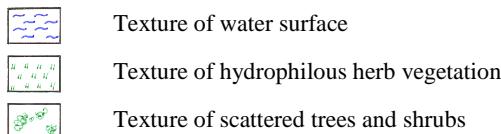
This class is not applicable for:
- humid meadows (water logging of between 10 and 30 cm depth) (class 231 or 321);
- rice fields (class 213);
- salt marshes (class 421);
- salt meadows under tidal influence (class 421);
- polders with reticulated channels bordered by hydrophilic vegetation (class 2xx);
- humid forests with a crown cover > 30 % (class 31x);

This class excludes:
- free water space in wetlands > 25 ha (class 512);
- low floating aquatic vegetation under water (class 512).

	Texture of water surface
	Texture of hydrophilous herb vegetation
	Texture of scattered trees and shrubs

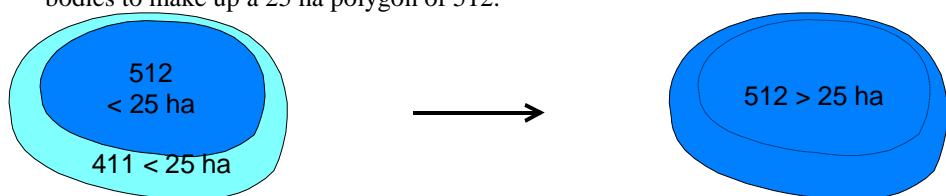Fig. 151 **Generalised pattern of the class 411**

Fig. 152   **Example 411: Inland marsh (*Ócsa*, Hungary). Photo: Gy. Büttner**

Fig. 153   **Example 411: Vast reedbeds of Lake Fertő / Neusiedlersee, the western-most steppe lake in Europe (Hungary/Austria). Photo: B. Kosztra**

Generalisation:

- When a marsh surrounds a small lake < 25 ha, the marsh area should be generalized to water bodies to make up a 25 ha polygon of 512.
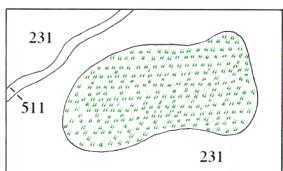
Particularity of class 411: Treeless fens and transitional bogs sometimes with > a 30 cm–thick peat layer

Areas located in inland through-flow basins, in river flood valleys, areas of springs, and margin zones of raised bogs. Surface of peatlands is plain or concave with small microforms - hummocks and tussocks.

This class is applicable for:

- areas of hydrophilous herb vegetation (*Cares spp., Comarum palustres, Menyanthes trifoliata, Phragmites australis, Trychophorum alpinum, Oxycoccus spp.*).

Texture of hydrophilous herb vegetation

Fig. 154   **Generalised pattern of the particularity of class 411**

Fig. 155   **Example particularity of 411: treeless fen (Tuhu NR, Estonia) Source: : https://loodusegakoos.ee/where-to-go/nature-reserves/protected-areas-in-estonia/tuhu-hiking-trail-1-dot-1-km**

412 Peatbogs

Wetlands with accumulation of considerable amount of decomposed moss (mostly Sphagnum) and vegetation matter. Both natural and exploited peat bogs.

Clarification:

Peat bogs are types of mire where peat, a deposit of dead plant material—often mosses, and in a majority of cases, sphagnum moss, - is accumulated. Bogs occur where the water at the ground surface is acidic and low in nutrients. In general the low fertility and cool, moist climate results in relatively slow plant growth. The decay of biomass is even slower owing to the water-saturated soil which results in accumulation of peat.

This class is applicable for:

- specific plant communities of valley bogs, raised bogs, blanket bogs and quacking (floating) bogs usually with > 30 cm peat layer underneath, such as:
  - minerotrophic peat bogs fed by ground water or streams with mosses (*Drepanocladus spp.*) and *Carex spp.* or schoenus in alcaline bogs with occurrence of *Calix spp.*, *Betula spp.* and *Alnus spp.*;
  - ombrotrophic peat bogs fed only by direct precipitation with sphagnum species which are abundant and dominant with other acidophilous plants such as *Eriophorum vaginatum*, *Scirpus spp.*, *Carex spp.*, *Vaccinium oxicoccos*, *Andromeda spp.*, *Drosera spp.* and lichens;
  - blanket bogs with sphagnum species and *Narthecium spp.*, *Molinia spp.*, *Scirpus spp.*, *Shoenus spp.*, *Erophiorum spp.*;

- boreal peat bogs with reticulated structure (aapa) with *Sphagnum spp.*, *Empetrum spp.*, *Vaccinium spp.*, *Betula nana*, *Salix nana*, *Carex spp.*, *Eriophorium spp.*, *Utriculara spp.*, *Drosera spp.*;
- fossil arctic peat bogs (palsa) with *Vaccinium spp.*, *Betula nana*, *Salix lapponum* and *Salix glauca*, lichens and *Carex spp*
- tilting bogs;
- peat extraction areas.

This class includes:
- mosses (mostly *Sphagnum spp.*);
- acidophillous herbaceous plants (grasses and herbs), such as *Carex, Molinia , Drosera* species, carnivorous plants;
- woody plants: dwarf shrubs, such as Vaccinium, Erica species, shrubs and dwarf-growth trees, such as *Betula nana, Salix nana*;
- scattered trees;
- non-vegetated peat surfaces under exploitation;
- piled up heaps of extracted peat;
- water surfaces: bog eyes (open water surface occurring near the centre of raised bogs), canals and pools of peat extraction.

This class is not applicable for:
- wooded peat bogs (class 31x);
- upland areas of blanket peat bogs where peat does not accumulate and are dominated by *Nardus* or other unpalatable grasses (class 321);
- dwarf-shrub covered areas with <30 cm peat and without visible sign of morphological features typical of bogs (eg. pools, peat hags, peatland gullying) (class 322);
- transitional bogs on peaty soils (< 30 cm thick peat) (class 324);
- drained peat bogs (class 411).

This class excludes:
- bog eye > 25 ha : large pool or lake occurring near the centre of raised bogs (class 512).
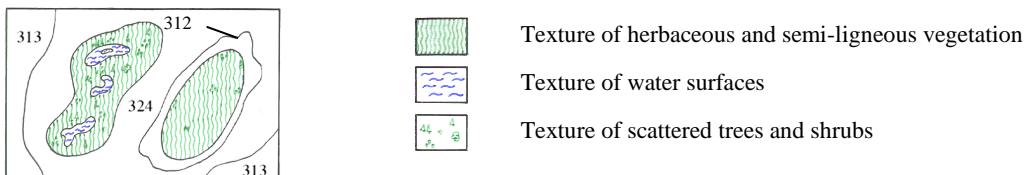

	Texture of herbaceous and semi-ligneous vegetation
	Texture of water surfaces
	Texture of scattered trees and shrubs

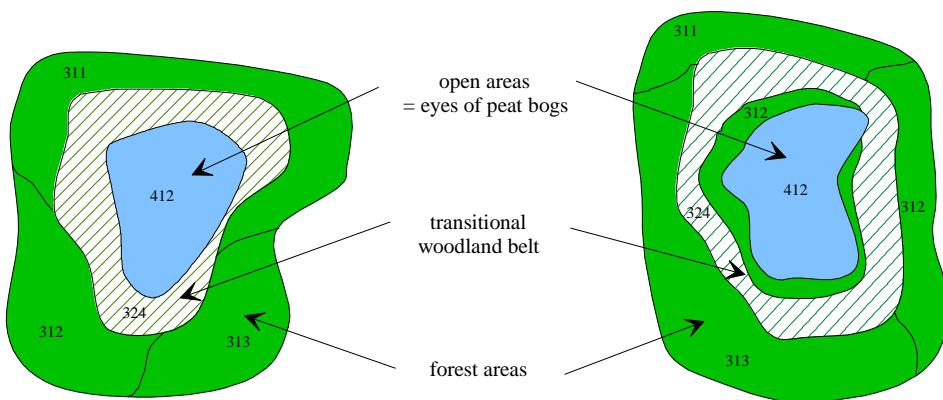Fig. 156   **Generalised pattern of the class 412**

Fig. 157   **Example 412: Natural open bog with pools in Viru bog (Estonia). Source: Wikipedia**

Fig. 158   **Example 412: The bog's eye in the Viru bog (Estonia). Source: Wikipedia**

Generalisation:

- The figures below illustrate the two possible schemes to be applied for mapping peat bogs according to their geographic context.

Particularity of class 412: Exploited peat bogs

This class is applicable for:

- areas of peat accumulation where peat extraction is in progress;
- abandoned peat extraction sites where successive vegetation cover is not yet developed.

This class includes:

- uncovered peat surfaces;
- piled up heaps of extracted peat;
- canals and pools for peat extraction;
- remnants of natural vegetation among peat extraction plots.

This class is not applicable for:

- abandoned peat extraction areas overgrown by natural vegetation (classes 321, 322, 324);
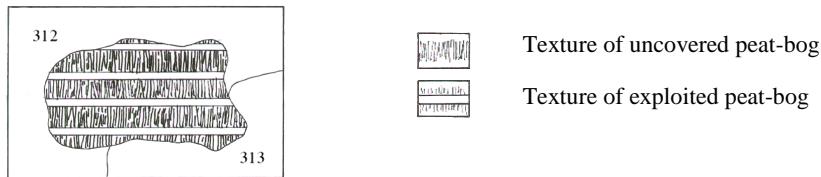
Fig. 159   **Generalised pattern of the particularity of class 412**

Fig. 160   **Example particularity of 412: Exploited peat bog in Ireland. Source: Wikipedia**

421 Coastal salt marshes

Vegetated low-lying areas in the coastal zone, above the high-tide line, susceptible to flooding by seawater. Often in the process of being filled in by coastal mud and sand sediments, gradually being colonized by halophilic plants.

Clarification:
Salt marshes are in most cases directly connected to intertidal areas and may successively develop from them in the long-term.

This class is applicable for:
- intertidal sand, silt or mud-based habitats colonized by halophytic herbaceous plants;
- all flowering plant communities t are submerged by high tides at some stage of the annual cycle;
- coastal salt pastures and meadows;
- salt meadows in the intertidal zone.

This class includes:
- halophytic grasses such as: *Puccinelia spp.*, *Spartina spp.*, rushes such as *Juncus spp.* and *Blismus rufus* and herbs such as *Limonium spp.*, *Aster tripolium*, *Salicornia spp.*
- tidal creeks in between and cutting through salt marsh where sea water flows in and out (coming from intertidal flats).

This class is not applicable for:
- humid meadows of low herbaceous vegetation dominated by Juncus gerardis, Carex divisa, Hordeum marinum or Trifolium spp. and Lotus spp.;
- inland salt marshes with halophile and gypsophile communities (classes 333 or 411);
- humid meadows around the landward edge of brackish lagoons (class 411).
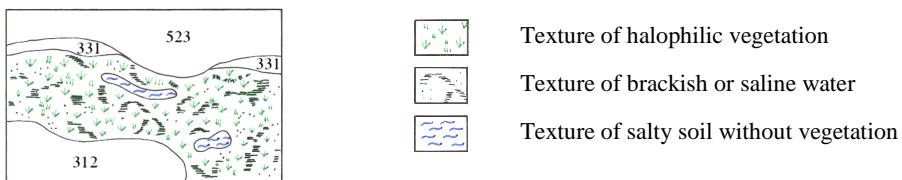
This class excludes:

No entry

	Texture of halophilic vegetation
	Texture of brackish or saline water
	Texture of salty soil without vegetation

Fig. 161   **Generalised pattern of the class 421**

Fig. 162   **Example 421: Salt marshes on a low-lying island (Saltholm, *Öresund*, Denmark). Photo: Gy. Büttner**

Fig. 163   **Example 421: Communities of annual halophytes in coastal salt marshes (*Black Sea,* Bulgaria) http://e-codb.bas.bg/rdb/en/vol3/04a2.html Photo: Rosen Tzonev**

422 Salines

Salt-pans for extraction of salt from salt water by evaporation, active or in process of abandonment. Sections of salt marsh exploited for the production of salt, clearly distinguishable from the rest of the marsh by their parcellation and embankment systems.

This class is applicable for:
- coastal or inland salt pans (saltern) in use or recently abandoned;
- salines organised for breeding shellfish, fishes.

This class includes:
- salt water in the evaporation ponds;
- piled up heaps of extracted salt;
- vegetated or non-vegetated embankments separating ponds;
- sealed or unsealed storage areas;
- associated buildings and installations.

This class is not applicable for:
- salt pans abandoned for considerable time, natural vegetation occupies the area (class 421).
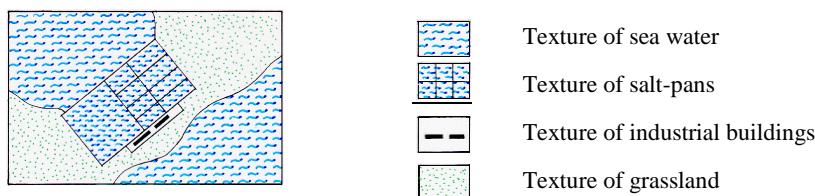
This class excludes:

No entry

	Texture of sea water
	Texture of salt-pans
	Texture of industrial buildings
	Texture of grassland

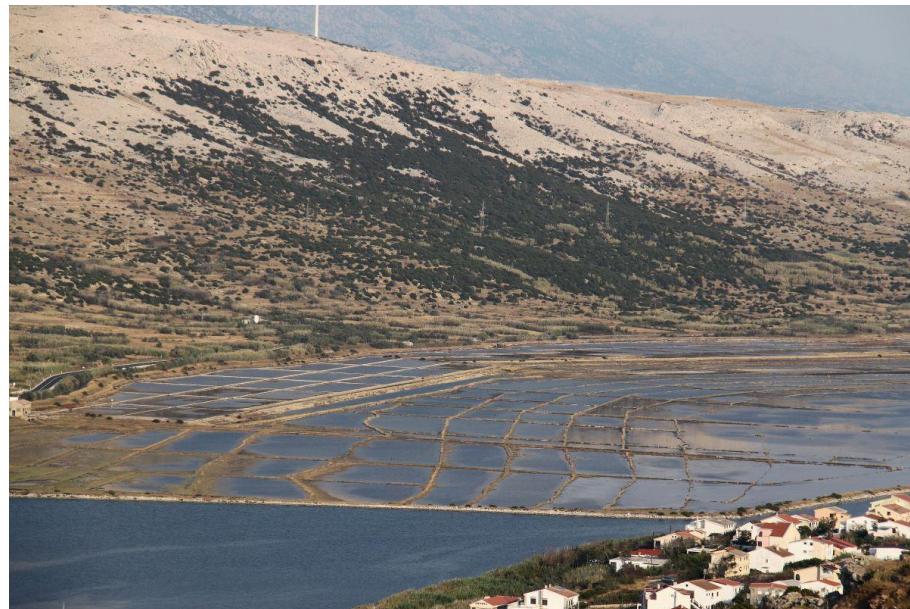Fig. 164   **Generalised pattern of the class 422**

Fig. 165   **Example 422: Salines (*Island Pag*, Croatia). Photo: Gy. Büttner**

423 Intertidal flats

Coastal zone under tidal influence between open sea and land, which is flooded by sea water regularly twice a day in a ca. 12 hours cycle.
Area between the average lowest und highest sea water level at low tide and high tide. Generally non-vegetated expanses of mud, sand or rock lying between high and low water marks.

Clarification:
The seaward boundary of intertidal flats may underlay constant change in geographical extent due to littoral morphodynamics. Range of water level between low tide and high tide may vary between decimeters and several meters in height. Due to constant change of water level, topographic maps or multi-temporal imagery should be used for delineation of this class.

This class is applicable for:
- non-vegetated shores under periodic tidal flooding.

This class includes:
- mud and sand plains,
- intertidal shattered rocks or boulders, eventually seaweed-covered,
- cliffs and outcropping base-rocks,
- tidal creeks in between and cutting through mud and sand plains where sea water flows in and out,
- scattered halophytic plants on the transition zone between intertidal flats and salt marshes.

This class is not applicable for:
- salt marshes (class 421);
- broadening of rivers entering the sea (class 522);
- part of lagoon area directly connected to the sea which is artificially separated (class 521).

This class excludes:
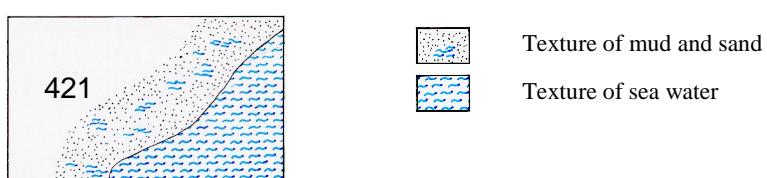- part of land that is occasionally covered with sea water at storm high tide events

Fig. 166   **Generalised pattern of the class 423**

Fig. 167   **Example 423: Intertidal flat of Pilsumer Watt (Germany). Source: Wikipedia**

Class 5: Water bodies

Class 5.1 Inland waters
Lakes, ponds and pools of natural origin containing fresh (i.e non-saline) water and running waters made of all rivers and streams. Man-made fresh water bodies including reservoirs and canals.

Class 5.2 Marine waters
Oceanic and continental shelf waters, bays and narrow channels including sea lochs or loughs, fiords or fjords, rya straits and estuaries. Saline or brackish coastal waters often formed from sea inlets by sitting and cut-off from the sea by sand or mud banks.

511 Water courses

Natural or artificial water-courses serving as water drainage channels. Includes canals. Minimum width for inclusion: 100 m.

Clarification:
In case of rivers with oscillating water level (when the width of the stream is less than 100 m in certain seasons of the year), the whole river bed must be added to the narrow water surface and then classified as 511. However, if there is no water in the river during a substantial part of the year (> 6 months), then the gravel and sand parts of the river bed (along with the narrow river bed, if appropriate) must be classified under class 331.

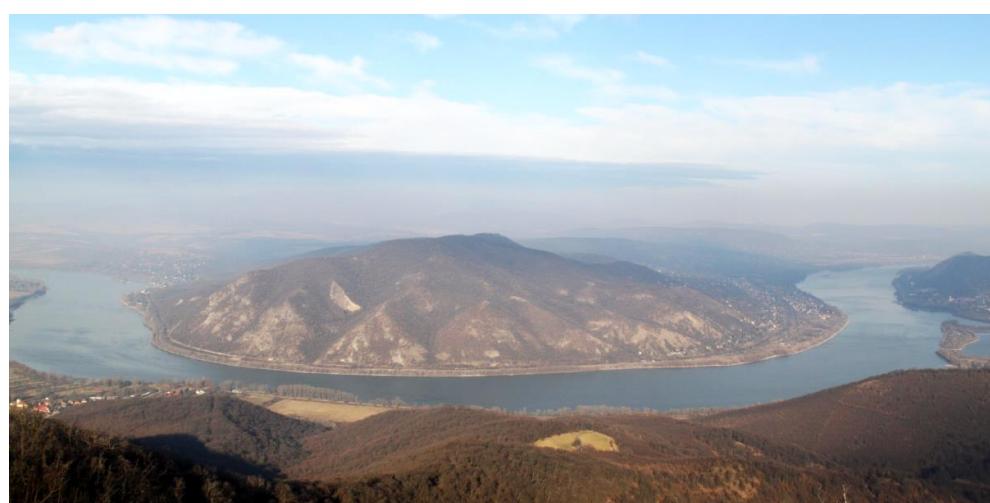### This class is applicable for:
- natural water streams;
- rivers that are canalised;
- artificial canals;
- branching glacial rivers with dynamically changing courses and interspersed gravel islands, where water surface in yearly average occupies >50% of the area.

This class includes:
- flowing water;
- sand or gravel accumulations along / among streams < 25 ha;.

This class is not applicable for:
- water bodies connected to watercourses (class 512);
- hydroelectric plant located on watercourses > 25 ha (class 121);
- sections of river mouth affected by tide (class 522);
- branching glacial rivers with dynamically changing courses and interspersed gravel islands where water surface occupies <50% of area most of the year (class 331);
- temporarily flooded areas along rivers (to be mapped according to the land cover dominant over the year).

Fig. 168   **Example 511: Bend of the Danube river, 50 km upstream from Budapest (Hungary). Photo: Gy. Büttner**

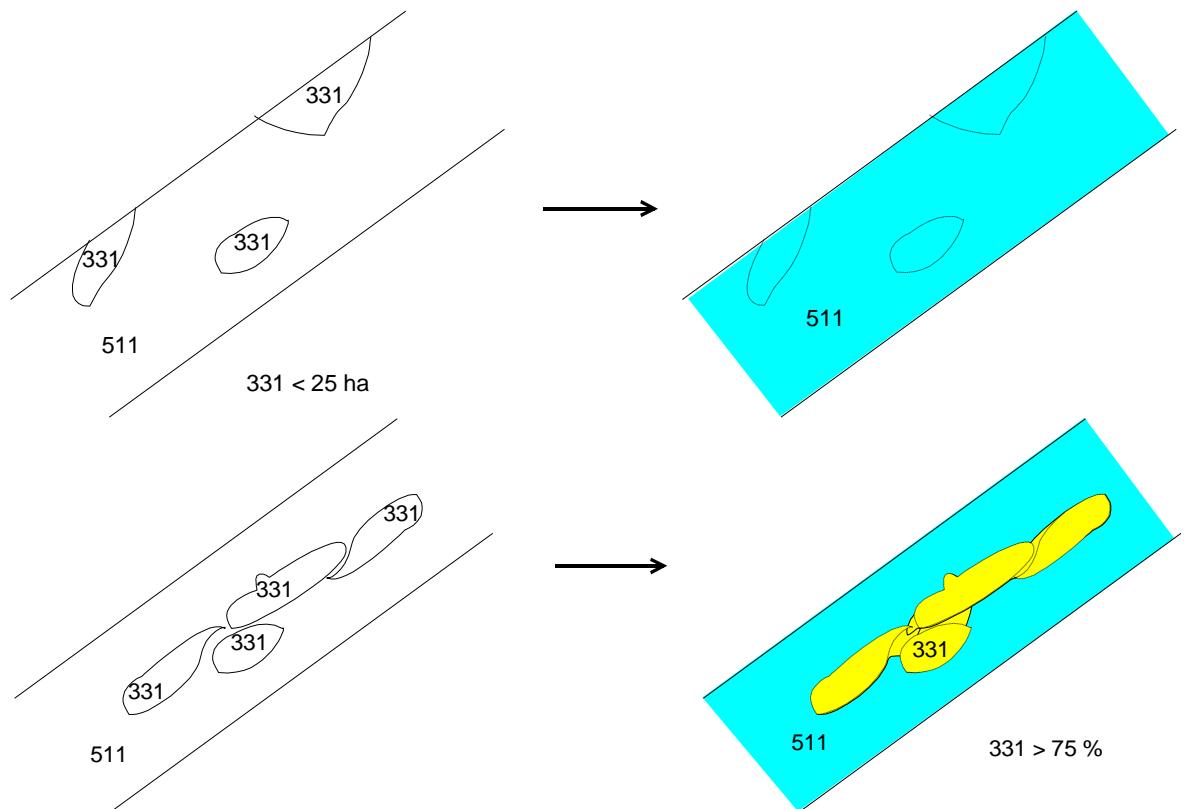Fig. 169   **Example 511: Danube river (Hungary). Photo: B. Kosztra**

Fig. 170   **Example 511: Branching glacial river (Iceland) Photo: Gy. Büttner**
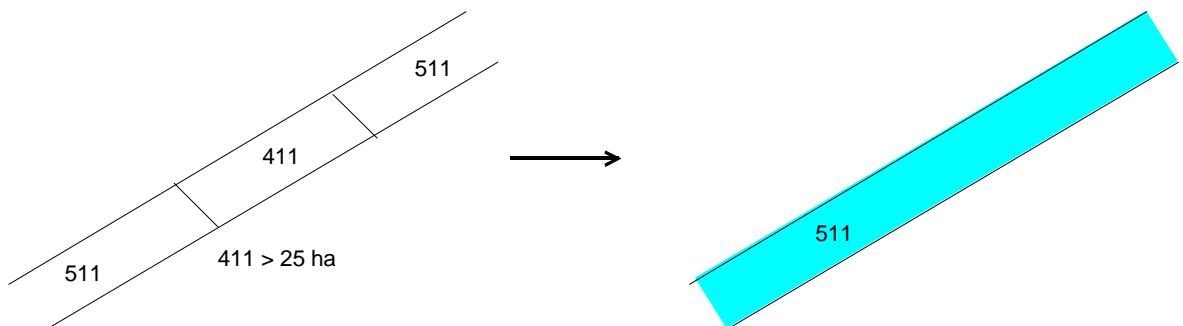
Generalisation:

- Water body areas along streams are artificially separated from class 511 and assigned class 512 even if they are connected to them.

- Sand and gravel accumulations inside a streambed are generalized into 511, unless they can be connected to a >25 ha patch and exist most of the year (class 331).

Keeping continuity of rivers is preferred in mapping watercourses with significant presence of *reeds* (class 411) within the watercourse

- Hydroelectric plant located on water-course is an exception of the continuity rule normally applied for class 511.

512 Water bodies

Natural or artificial water bodies with presence of standing water surface during most of the year.

This class is applicable for:
- natural freshwater and inland salt water lakes;
- water reservoirs, areas of water retention;
- archipelago of lakes inland;
- fish ponds, water surfaces used for freshwater fish-breeding activities;
- disused mineral extraction pits filled with water;
- fish ponds and water reservoirs temporarily without water (seasonal lack of water, maintenance, etc.), given that the area is most of the year covered by water.

This class includes:
- water surface;

- low floating aquatic vegetation with species such as *Nuphar spp.*, *Nymphaea spp.*, *Potamageton spp.* and *Lemna spp.*;
- embankments separating pools of fishponds;
- temporarily dry sand, gravel or rock surfaces around lakes with changing water level;
- floating aquaculture installations (cages, buoy lines).

This class is not applicable for:
- land temporarily inundated for flood prevention purpose or as result of natural flood event (classes 2xx, 3xx);
- temporal lakes, most of the year used as agricultural land, such as *polje* of the Dinaric Alps (classes 2xx);
- open water surfaces of rice fields (class 213) ;
- salt or brackish water surfaces separated from the sea by narrow stretches of land and having connection to sea water (class 521).

This class excludes:
- surface plant species characteristic for standing water (e.g. *Typha latifolia*, *Carex riparia*, *Glyceria maxima*, *Sparganium erectum* and *Phragmites communis* (class 411);
- liquid waste (class 132);
- flowing water (class 511).

Fig. 171   **Example 512: Lake Skadar, largest lake of the Balkan Peninsula (Montenegro). Photo: B. Kosztra**

Fig. 172   **Example 512: Natural lake (*Malaren,* Sweden). Photo: Gy. Büttner**
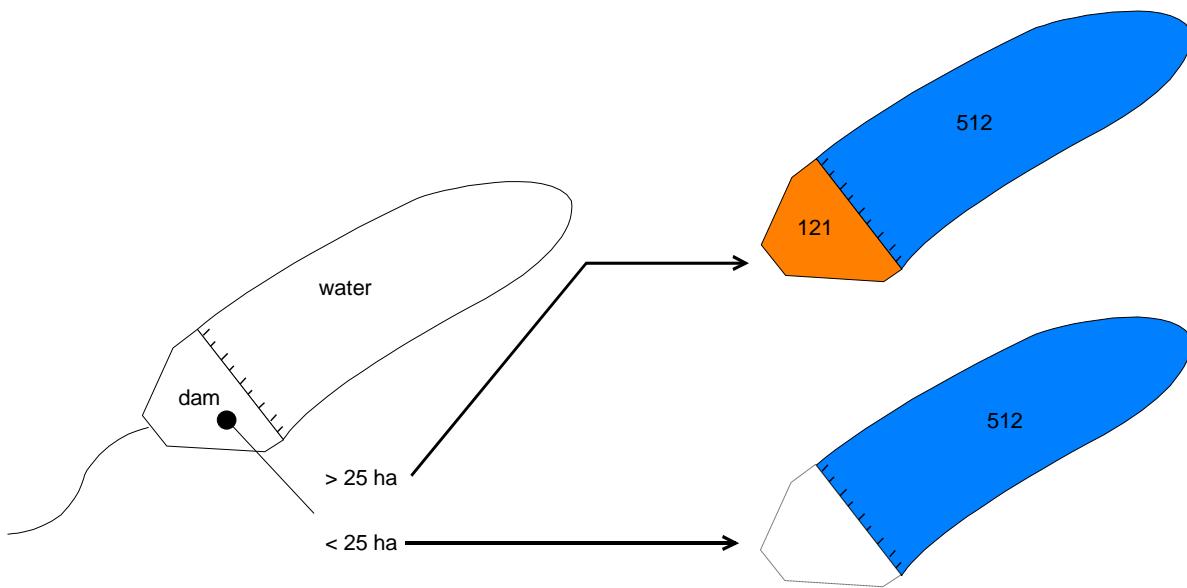
Fig. 173   **Example 512: Artificial reservoir with dam infrastructure (Troodos moun-
tains, Cyprus),** *Low water level is visible due to high water use in summer – im-
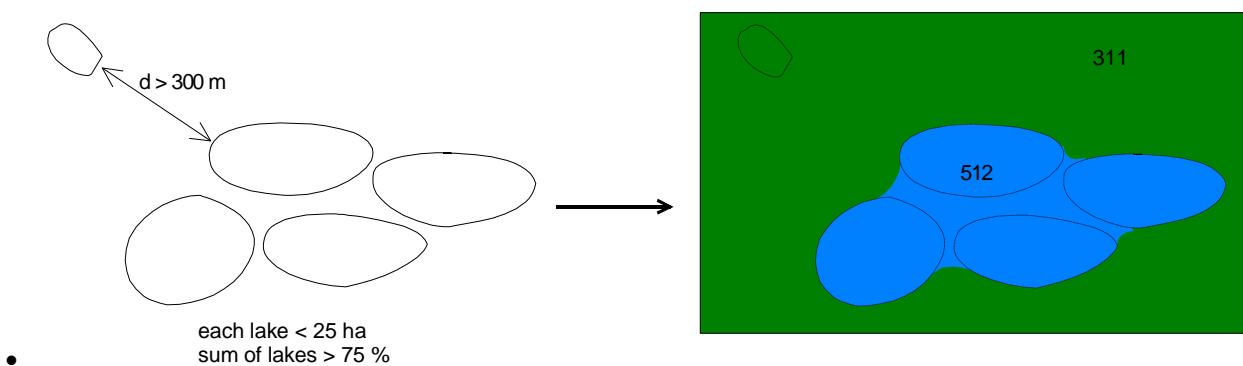age was taken in December.* **Photo: Gy. Büttner**

Fig. 174   **Example 512: Shallow salt lake of Tüz Gölü (Anatolia, Turkey).** *Extent of
salt lakes can vary significantly with seasons.* **Photo: Gy. Büttner**

Generalisation:
Dam infrastructure should be isolated and assigned class 121 if its surface area is > 25 ha.

512

121

512

water

dam

> 25 ha

< 25 ha

512

- In case of a group of small lakes (each water surface < 25 ha), linking principle may be applied if :

1) the resulting water polygon is > 25 ha,

2) the new zone created is composed of 75 % of free water.

d > 300 m

311

512

each lake < 25 ha
sum of lakes > 75 %

-

521 Coastal lagoons

Stretches of salt or brackish water in coastal areas which are separated from the sea by a tongue of land or other similar topography. These water bodies can be connected to the sea at limited points, either permanently or for parts of the year only.

Clarification:
The connection between a lagoon under tidal influence and open sea does not have to be necessarily permanent and can also be present only during high tides.

This class is applicable for:
- estuarine lagoon;
- salt or brackish water surface remaining at low tide;
- lagoons organised for breeding shellfish.
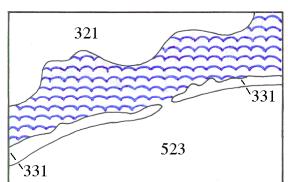
This class includes:
- only water surface.

This class is not applicable for:
- salt marshes (class 421);
- water courses (class 511);
- beaches (class 331);
- fresh water bodies along shoreline (class 512);
- artificially enclosed parts of coastal lagoons that formerly used to have direct natural connection to the sea, but are not connected any more (class 512).

This class excludes:
- vegetation fringe along water surfaces should be captured separately.

Texture of salt or brackish water
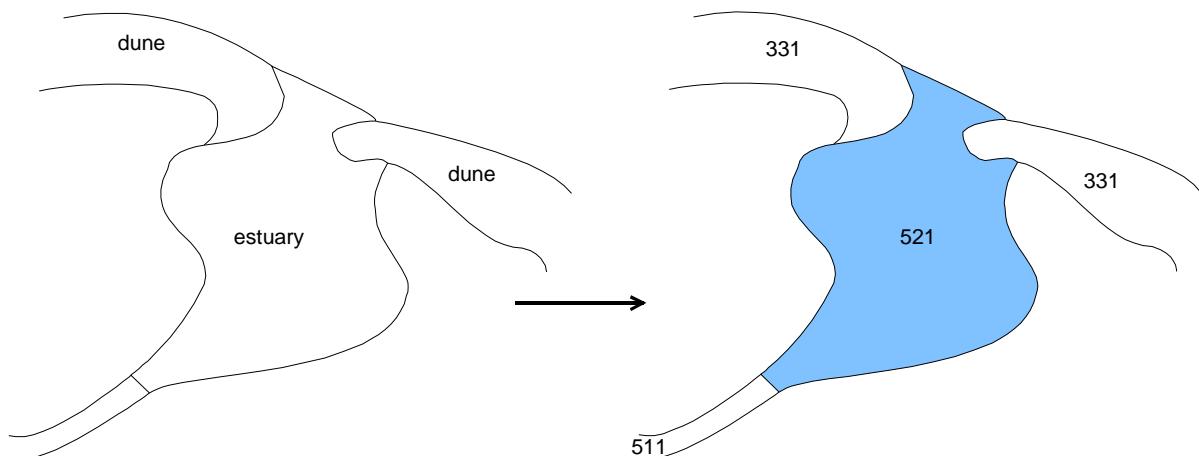
Fig. 175   **Generalised pattern of the class 521**

Fig. 176   **Example 521: Karavasta lagoon (Albania).** *Note the land area separating the brackish water from the sea.* **Photo: Gy. Büttner**
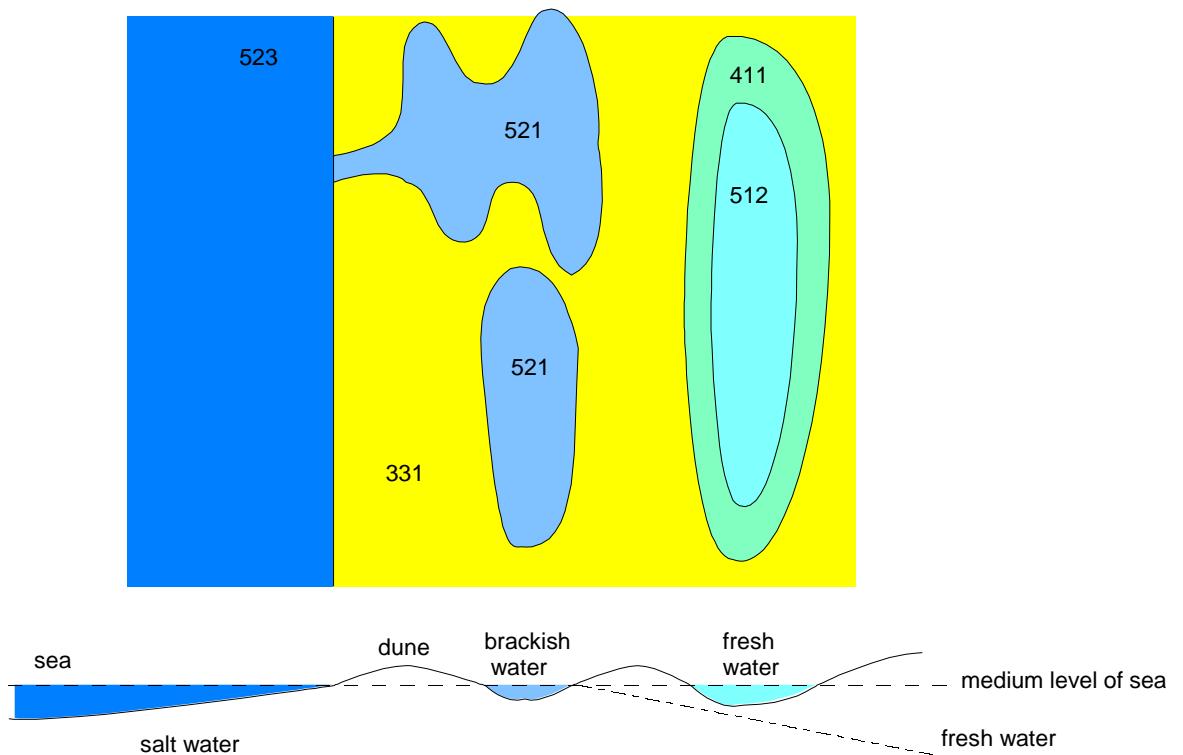
Fig. 177   **Example 521: Glacial lagoon of Fjallsárlón (Iceland). The meltwater of glaciers is flowing into the Atlantic Ocean via a short river, which penetrates the barrier made of the former end moraine of the glacier. Photo: Gy. Büttner**

Mapping rules:
- In case of estuarine lagoon shape as described below, priority should be given to lagoon class.

- In case of water bodies along the shoreline, its geomorphologic position regarding to the water table must be taken into account. Normally:

522 Estuaries

The mouth of a river under tidal influence within which the tide ebbs and flows.

Clarification:
In practice, upstream maritime influence is stopped by the first floodgate; downstream, the estuary limit is arbitrary.

This class is applicable for
- river mouths under tidal influence.

This class includes:
- the water and the channel bed with the fringing vegetation zone < 25 ha.

This class is not applicable for:
- bays (class 523);
- fjords or fjards, ryas and straits (class 523);

This class excludes:
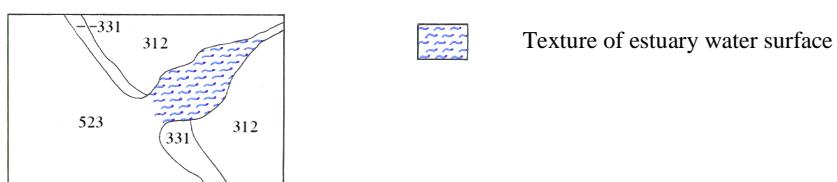- fringing vegetation along the estuary channel bed > 25 ha (class 421).

Texture of estuary water surface

Fig. 178   **Generalised pattern of the class 522**

Fig. 179 **Example 522: Estuary of river Exe (United Kingdom). Source: Wikipedia**

Fig. 180 **Example 522: Estuary of Tagus River (Portugal).** *Note the large intertidal area and the salt marshes connected to the estuary.* **Photo: B. Kosztra**

Generalisation:

- In practice, upstream maritime influence is stopped by the first floodgate; downstream, the estuary limit is arbitrary.

523 Sea and ocean

Zone seaward of the lowest tide limit.

This classis applicable for:
- sea surface below lowest tide limit;
- fjords, fjards and sea lochs;
- off-shore floating aquaculture facilities for fish, shellfish or macroalgae production.

This class includes:
- sea water;
- floating marine vegetation (macroalgae);
- floating aquaculture installations, such as cages, tanks, buoy lines;
- narrow (<100 m wide) coast defence structures (breakwaters, seawalls, sea dikes, groins, jetties) stretching into the sea.

This class is not applicable for:

- archipelago of lands located inside sea/ocean areas;
- sea water areas as part of port areas that include sea water to reach a zone > 25 ha (class 123);
- on-shore aquaculture installations, such as tanks, basins, buildings (class 121).

Fig. 181   **Example 523: Skagen, where the Skagerrak and Kattegat straits meet (Denmark). Photo: Gy. Büttner**

Fig. 182   **Example 523: Lyse fjord near Stavanger (Norway). Photo: Gy. Büttner**
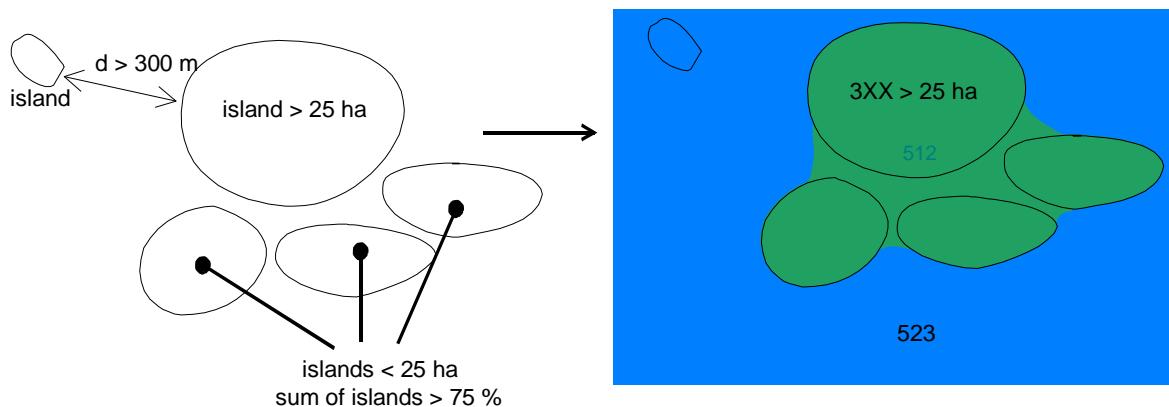

Fig. 183   **Example 523: The Atlantic Ocean at Vík (Iceand).** *The coast is black because of the basaltic rocks.* **Photo: Gy. Büttner**

Fig. 184 **Example 523: Floating cages of off-shore aquaculture (Feroe Islands). Photo: B. Kosztra**

Generalisation:

- The same generalisation rule as for archipelago of lakes (class 512) should be applied on two conditions:

1) resulting island polygon > 25 ha,

2) the new zone created is composed of 75% of land.

3   References

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