

Land Use-Land Cover : LUCAS 2001¹ Primary Results

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Information on land use is particularly important, as it allows environmental concerns to be incorporated into Community policies. To make up for the lack of harmonised information in this field, Eurostat joined forces with the Directorate-General for Agriculture and drew on the technical expertise of the Joint Research Centre to carry out a pilot survey called LUCAS during the course of 2001². The object was to observe land cover and use (i.e. the physical and socio-economic aspects) in a systematic sample of points across Europe, and to monitor various environmental characteristics relating to these points. Initial findings show that woodland is the predominant type of land cover and agriculture the main type of land use.

Primary cover: forested areas

Woodland covers almost 1,1 million km², or 37%, of the total area of 13 of the Union's 15 countries concerned by the survey. This made it the leading type of land cover in 2001. Non-natural areas, by contrast, account for a mere 5% (137 000 km²). Areas under crops account for 27% of the territory, and grassland for 12%.

These average distributions conceal major differences. In Sweden and Finland, forests account for more than 60% of the territory. Indeed, these two countries together account for 44% of all forest in the 13 Member States surveyed.

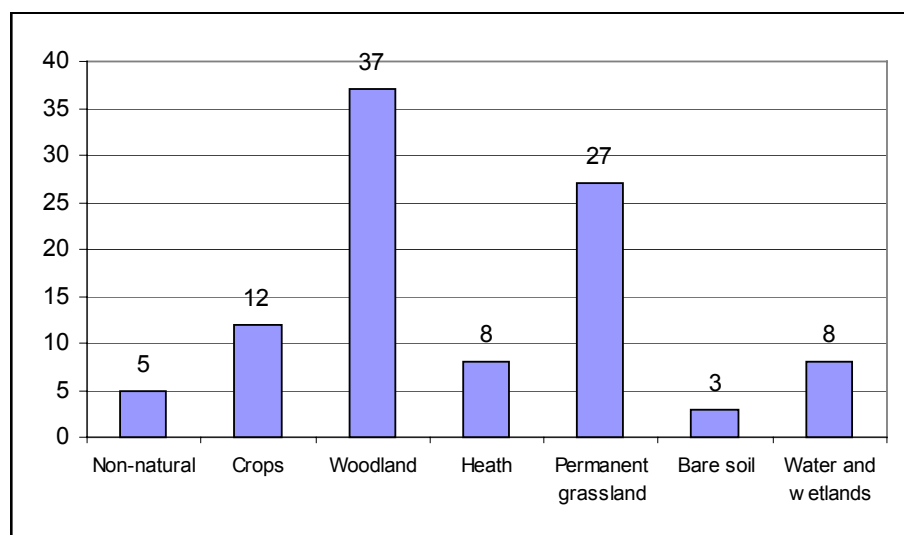


Figure 1: Distribution of land covers in the thirteen countries of the LUCAS 2001 survey

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¹ Land Use/Cover Area Frame Statistical Survey

² Because of the foot-and-mouth epidemic, the survey did not include the United Kingdom and Ireland.

Artificial land areas make up more than 10% of the Benelux countries alone. With the exception of Austria, Sweden and Finland, arable land makes up over 20% of the territory. The Netherlands and Denmark are the only two countries to have more than half of their national territory under this type of cover.

Shrubland (land with more than 20% ligneous vegetation coverage) is a prominent feature of the southern Member States. Coverage rates are 18% or higher in Greece, Portugal and Spain. Indeed, the latter accounts for almost 40% of total shrubland in the 13 Member States surveyed

Types of cover	%
Built-up areas	1.6
Artificial, non built-up areas	3.1
Cereals	13.0
Root Crops	0.9
Non permanent industrial crops	1.9
Dry pulses, vegetables and flowers	0.9
Temporary and artificial pasture	3.3
Fallow land	2.6
Permanent crops and fruit trees and berries	1.3
Other permanent crops	3.0
Woodland	37.4
Shrubland	8.0
Permanent grassland	12.2
Bare land	3.3
Water and wetland	7.7
Total	100.0

Table 2: : Distribution of land covers in the thirteen countries of the LUCAS 2001 survey

. Grassland (all types of use combined) is a particularly prominent feature of the centrally-situated European countries - Germany, France, Belgium, Luxembourg and Austria - accounting for over 20% of the territory. This type of land cover is much less prominent in the southern countries of the Union (10-12% in Italy, Greece and Spain), and is of marginal importance only in Sweden and Finland.

More specifically, cereals cover 34% of areas under crops and 13% of the total area (these areas include fodder maize).

Non-natural areas are heavily dominated by linear components (roads, railways, etc.), which account for 44% of this type of area.

Box 1 : The 2001 LUCAS survey:

In 2001, the LUCAS survey was carried out in 13 of the 15 Member States of the European Union. The United Kingdom and the Republic of Ireland were not included, as the foot-and-mouth epidemic would have made it impossible for the surveyors to move around the countryside. During May and June 2001, observations were made for a total of 86 384 points, distributed as follows.

B	DK	D	EL	E	F	I
963	1 347	10 630	3 954	12 657	16 911	9 233
L	NL	A	P	FIN	S	Total
80	1 154	2 527	2 728	10 364	13 736	86 284

Distribution of observations according to the distance from the points (%)

Distance	Close up	3-50 m	50-100 m	Over 100 m	Photo-interpretation
%	54.6 %	16.5 %	6.5 %	10.3 %	11.9%

Land cover (%)	B+L	DK	D	EL	E	F	I	NL	A	P	FIN	SE
Artificial land	10	8	7	4	4	6	7	14	3	4	2	2
Cropland	29	57	34	28	35	33	37	54	17	32	7	6
Woodland	28	14	33	26	24	30	29	10	44	34	61	61
Shrubland	2	2	1	24	18	5	8	2	3	21	1	6
Permanent grassland	30	12	21	10	12	22	10	7	21	4	1	4
Bare land	0	3	1	5	6	2	6	1	10	3	2	2
Water and wetland	2	5	3	2	1	2	3	11	1	2	26	20
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 1: Distribution of land covers per country LUCAS 2001 survey (%)

Primary use: agriculture

Agriculture accounts for almost 40% of the territory, making it the leading type of land use in the 13 countries investigated. This category comprises land used directly for production as well as land used generally for farming purposes (buildings, farmyards, etc.). From lows of under 10% in Sweden and Finland, it rises to a maximum in Denmark, where almost two thirds of the territory is used for agricultural purposes. Portugal and Austria fall between these two extremes, with approximately one third of the territory given over to agriculture. In all the other countries, around half of the territory is used for farming. Forestry comes second, at just over 32%. If this criterion is used, the order of countries is the reverse of farming. In Sweden and Finland, forestry accounts for over half of the territory, whereas the lowest figure is for the Netherlands at just over 3%. The figure for Denmark is less than 12%. In the remaining countries, forestry accounts for over 20% of the territory.

Almost one fifth of the territory of the 13 countries is classified as being without apparent use. The differences are attributable to geographical conditions

(altitude in Austria) or type of predominant cover (heath in Portugal and Greece, inland waters in Finland).

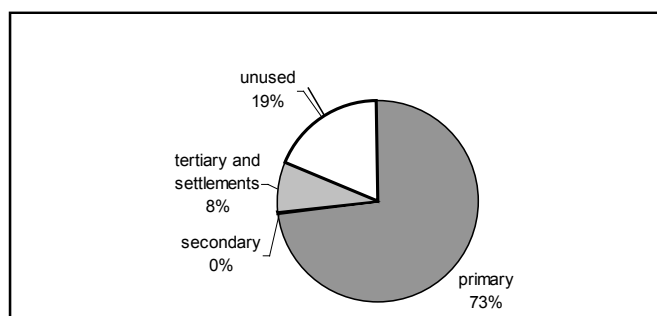


Figure 2: Distribution of land use in the thirteen countries of the LUCAS 2001 survey.

These three headings (agriculture, forestry, unused) account for 90% of the territory of the 13 countries surveyed. Of the remaining types of use, only three exceed 1% - (i) transport and communications, (ii) recreation, leisure and sport, and (iii) residential.

Mixed-use cover

Artificial surfaces show a great diversity of use, two thirds of such areas being accounted for by settlements, transport and communications. At over 10%, agriculture is the third largest user of this type of cover.

80% of areas under grass are used for agricultural purposes, 10% are unused, and settlements and recreation account for the remaining 10%. The use of areas under grass varies greatly. In Spain, France, Greece and Germany, over 80% of this type of land is used for agriculture. "Other uses" increase from north to south, the trend being for grassland to be used for

dwelling (lawns) or recreational purposes (sports grounds). The extreme is Finland, where just 4% of the area under grass is devoted to agriculture and almost 60% to dwellings.

Shrubland is not generally used (70%). Agriculture accounts for 14% of such this type of area, and is the second largest user. Generally speaking, this type of land has a greater utilisation rate in the countries of the south (between 20 and 30%). Spain is a special case, as use for forestry exceeds agricultural use.

	Artificial land	Cropland	Woodland	Shrubland	Permanent grassland	Bare land	Water and wetland
Agriculture	0.5	26.5	0.7	1.1	9.8	0.0	0.1
Forestry	0.1	0.0	32.4	0.8	0.0	0.0	0.0
Transport, communication, storage, protective works	1.8	0.0	0.0	0.0	0.1	0.0	0.2
Recreation, leisure, sport	0.2	0.1	0.7	0.4	0.5	0.1	1.1
Residential	1.3	0.0	0.1	0.0	0.5	0.0	0.0
Other uses	0.6	0.0	0.1	0.0	0.1	0.1	0.5
No apparent use	0.1	0.0	4.1	5.4	1.2	2.7	5.8
Total	4.7	26.6	38.1	7.6	12.3	3.0	7.7

Table 3: Cross distribution of uses and covers in the thirteen countries of LUCAS 2001 survey (%).

Over 20% of the territory deemed to be noise-free

Noise is one of the variables used to assess the environmental quality of daily life. During their observations of half of the survey points, surveyors noted the existence or absence of noise, and classified it according to intensity and origin. It transpired that over 20% of the territory of the 13 countries is considered noise-free, two-thirds has an acceptable level of noise and 10% is classed as having a level of noise that is considered a nuisance. Noise perception depends on human activity. In countries with a high concentration of human activity (such as the Netherlands and Belgium), the portion of the territory deemed noise-free is virtually non-existent. By contrast, almost three-quarters of Finland is deemed noise-free...

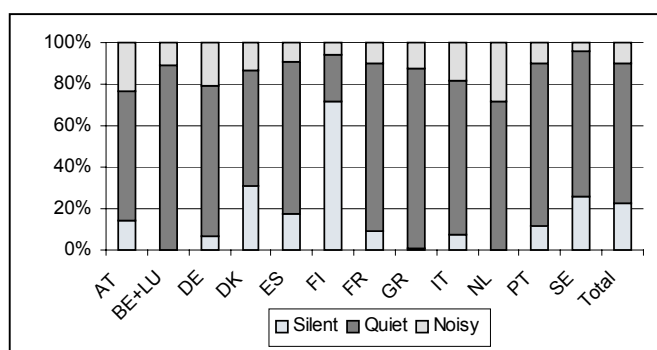


Figure 1: Distribution of the territory according to observed noise level (%)

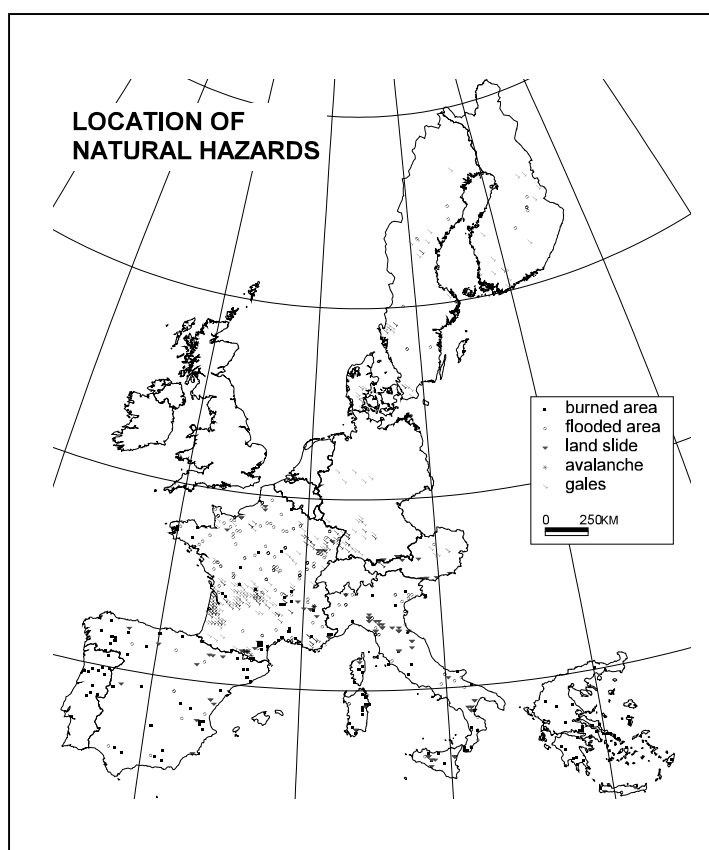
Natural hazards : 2.5% of the territory at risk

Natural disasters affect 2.5 % of the territory of the countries surveyed. The southern countries are affected most, the main cause being fires (accounting for over a third of all disasters). Most of the disasters

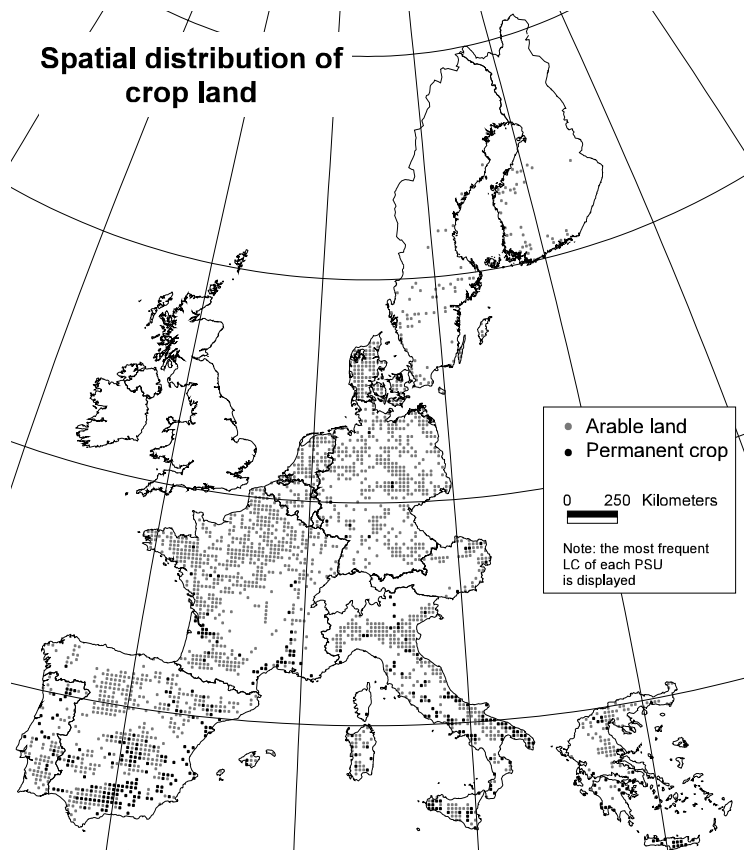
affect shrubland, forests and bare land. Most forest damage is the result of storms, accounting for 70%, compared with 20% fire damage. Conversely, 80% of natural disasters on shrubland are caused by fire.



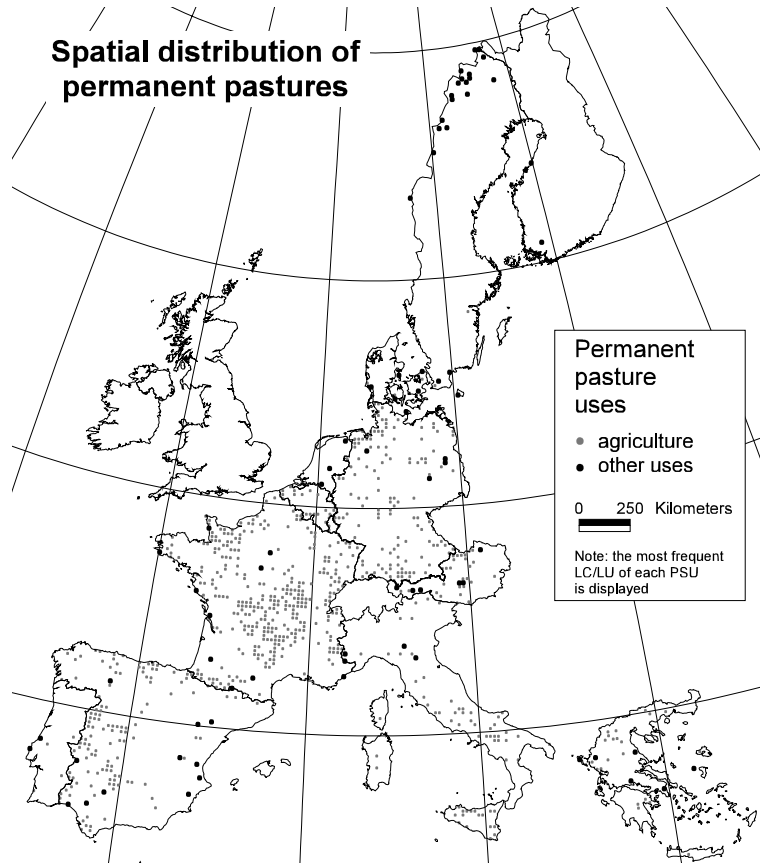
Figure 3: Distribution of natural hazards causes for two specific land covers (%)



Spatial distribution of crop land



Spatial distribution of permanent pastures



➤ ESSENTIAL INFORMATION – METHODOLOGICAL NOTES

LUCAS: two-stage area sampling

Systematic area sampling was chosen as the sampling method, since LUCAS is a **multiple objective** information system that must cover the territory of the EU Member States as a whole rather than just farmland.

The sampling base provides area estimates for categories of land cover and land use at **European level**. However, results may be obtained at a more detailed level if they are correctly aggregated and if the basic characteristics of the survey plan are taken into account during the interpretation of results.

The LUCAS universe consists of the entire territory of the European Union (15 Member States), i.e. 3 240 190 km².

Sampling is done at **two levels** - primary sampling units (PSU), consisting of **cells in a regular grid** measuring 18 km square, and secondary sampling units (SSU) comprising 10 **points** spread over a rectangle (1 500 m long by 600 m wide) around the centre of each PSU. The sample contains around 10 000 PSUs spread over the territory of the EU. This number of PSUs was chosen to optimise cost structure and accuracy at European level.

The observation unit

1 - The point

The **point (SSU)** is the basic observation unit used in LUCAS. The ten SSUs are spread evenly around the centre of the PSUs from west to east. The data collected at these points relate to land cover and a number of environmental features.

Observations are made **within a radius of 3 m**.

However, as land cover and use varies so much, **observations sometimes extend to a radius of 20 m around a point (extended window)**. This is done systematically in the following cases:

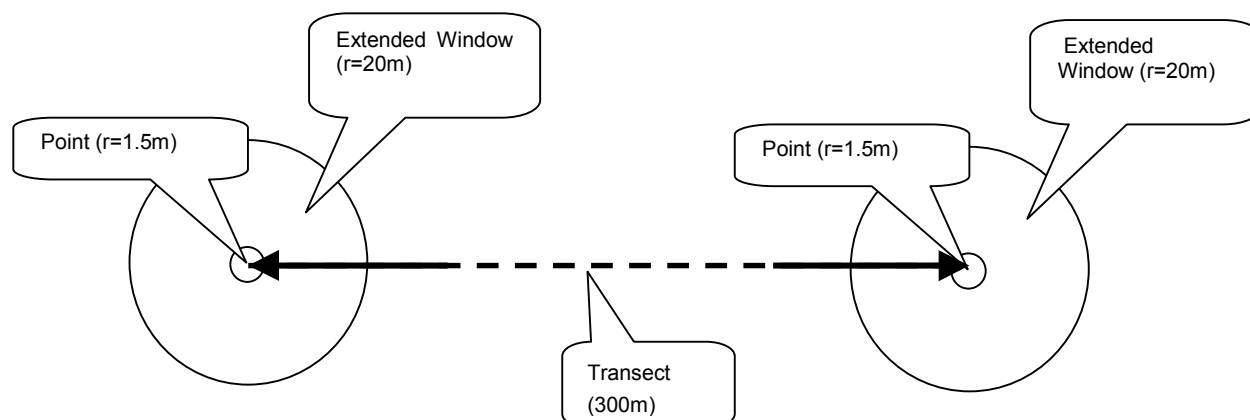
- Mixed areas* in which the land characteristics change every 20-25 m or so;
- Permanent crops* (cultivated areas alternating with bare soil and/or grassland, or other types of crop);
- Crops under cover* (covered by other types of vegetation or trees);
- Wooded areas and semi-natural areas*.

Certain other types of feature (such as isolated trees and soil erosion) are also included in this extended window.

2 - The segment

As regards spatial variations in linear features and in land cover (landscape structure), data are collected along a **straight line** segment connecting two observation points. Four segments are observed in PSUs. These are situated on the first sample line between SSU.

Figure 1: Points and transects



LUCAS observations are extrapolated with respect to the sampling plan characteristics. Each point has the same probability of being observed. For a given characteristic (such as land cover and use), **areas** are evaluated by multiplying the estimated frequency of the heading by the total area of the zone under investigation.

The area of a given category of land use or cover within a given country is estimated as follows:

$$\hat{a} = \frac{A}{m} \cdot \sum_{i=1}^m \sum_{j=1}^n \frac{y_{ij}}{n_i}$$

where \hat{a} = estimated area of land use/cover within the geographical region in question;

A = area of the geographical region in question;

m = number of PSUs in the geographical region in question;

y_{ij} = 0 if the point *does not* display the characteristic in question;

1 if the point *does* display the characteristic in question;

0.5 if the point displays a dual land use/cover characteristic.

n_i = number of SSUs in PSU i .

LUCAS nomenclature

Nomenclature of land cover

ARTIFICIAL LAND	BUILT-UP AREAS	Buildings with 1 to 3 floors	
		Buildings with more than 3 floors	
		Greenhouses	
	ARTIFICIAL NON BUILT-UP AREAS	Non built-up area features	
		Non built-up linear features	
CROPLAND	CEREALS	Common wheat	
		Durum Wheat	
		Barley	
		Rye	
		Oats	
		Maize	
		Rice	
		Other cereals	
	ROOT CROPS	Potatoes	
		Sugar beet	
		Other root crops	
		NON PERMANENT INDUSTRIAL CROPS	Sunflower
			Rape seeds
			Soya
Cotton			
Other fibre and oleaginous crops			
Tobacco			
Other non permanent industrial crops			
	DRY PULSES, VEGETABLES	Dry pulses	
		Tomatoes	
		Other fresh vegetables	
		Floriculture and ornamental plants	
	TEMPORARY, ARTIFICIAL PASTURES	Temporary, artificial pastures	
	FALLOW LAND	Fallow land	
	PERMANENT CROPS FRUIT TREES, BERRIES:	Apple fruit	
		Pear fruit	
		Cherry fruit	
		Nuts trees	
		Other fruit trees and berries	
		Oranges	
		Other citrus fruit	
		OTHER PERMANENT CROPS	Olive groves
			Vineyards
Nurseries			
Permanent industrial crops			
WOODLAND	FOREST AREA	Broadleaved forest	
		Coniferous forest	
		Mixed forest	
	OTHER WOODED AREA	Other broadleaved wooded area	
		Other coniferous wooded area	

		Other mixed wooded area
	POPLARS, EUCALYPTUS	Poplars, eucalyptus
SHRUBLAND		Shrubland with sparse tree cover
		Shrubland without tree cover
PERMANENT GRASSLAND		Permanent grassland with sparse tree/shrub cover
		Permanent grassland without tree/shrub cover
BARE LAND		Bare land
WATER AND WETLAND		Inland water bodies
		Inland running water
		Coastal water bodies
		Wetland
		Glaciers, permanent snow

Nomenclature of land use

U1	U11	AGRICULTURE
	U12	FORESTRY
	U13	FISHING
	U14	MINING, QUARRYING
	U2	ENERGY PRODUCTION
U2	U22	INDUSTRY, MANUFACTURING
	U3	TRANSPORT, COMMUNICATION, STORAGE,
	U32	WATER, WASTE TREATMENT
	U33	CONSTRUCTION
	U34	COMMERCE, FINANCE, BUSINESS
	U35	COMMUNITY SERVICES
	U36	RECREATION, LEISURE, SPORT
U37	RESIDENTIAL	
U4	U40	UNUSED

Noise nomenclature

ROAD TRAFFIC
AIR TRAFFIC
RAIL TRAFFIC
INDUSTRIAL ACTIVITY
FARMING, FORESTRY
NATURAL NOISE (WIND, LIVESTOCK, BIRDS, RUNNING WATER)
HUMAN VOICES
OTHER SOURCES

Nomenclature of Natural hazards

NO VISIBLE TRACE
BURNED AREA
FLOODED AREA
AREA AFFECTED BY LANDSLIDE
AREA AFFECTED AVALANCHES
AREA AFFECTED BY GALES (WIND FALL)

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