Grassland term definitions and classifications adapted to the diversity of European grassland-based systems

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Abstract

Grasslands are represented in an unsatisfactory manner in agricultural statistics. The official definition of grasslands does not include vast areas of grazed shrubby and wooded ecosystems. Temporary grasslands are recorded as 'Leguminous plants' and 'Temporary grass' which induces doubt on the classification of grass-legume mixtures and often leads to the underestimation of temporary grassland areas. Some terms like 'meadows' and 'pastures' are often used in an imprecise and misleading way. The term 'rough grazing' does not include all types of natural and semi-natural grasslands, especially all types of rangelands, forest pastures and traditional hay meadows. It can thus not represent all species-rich grassland types. Improvements of the current situation are proposed. They consist mainly in: (i) better definitions of grassland terms including for pastures and meadows, permanent, agriculturally-improved, semi-natural and natural grasslands; (ii) the classification of temporary grasslands in three categories: pure legume sowings, pure grass sowings and grass-legume mixtures; (iii) the classification of permanent grasslands in three categories: agriculturally-improved, natural and semi-natural, no longer used for production; and (iv) the introduction of a new category for grazed fallow land. The paper presents a comprehensive classification of fodder and grassland types in the agricultural area and a multilingual vocabulary.

Keywords: Grassland term definition, agricultural statistical classification

Introduction

A Working Group on 'Grassland Term Definition' was set up during the 24th General Meeting of the European Grassland Federation (EGF) that took place on 3-7 June 2012 in Lublin (Poland). It gathered together 22 experts from 13 countries (Belgium, Bulgaria, France, Germany, Italy, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, The Netherlands, United Kingdom). The group is thus representative of the diversity of thinking of European grassland researchers.
The purpose of the creation of the Working Group was to support the European Union (EU) Institutions to enable better account to be taken of all the diversity of grasslands into the Common Agricultural Policy (CAP). The EGF adopted a resolution on the reform of the CAP during its Business Meeting. This resolution was sent to a wide group of decision makers of the EU. The participants at the EGF conference decided that a glossary would also be useful in addition to their proposals on grassland in the future CAP. It was thus decided to draft a vocabulary of grassland terms.
After contacts with Eurostat, it appeared that this European Commission organization would also be interested in a better definition and classification of grassland terms. This classification could improve the present system of data collection and could lead to a better consideration of the importance and diversity of grasslands in European agricultural statistics. The system should be simple but at the same time be able to collect some new agri-environmental indicators on grasslands and grassland-based systems. This could be the basis of a better recognition of ecosystem goods and services that grasslands can provide. The present text is a trade-off

between the level of precision that is necessary to reach the objectives described above and the practical aspects related to data collection, in particular from farmers.
The present text is largely inspired by the work of Allen *et al.* (2011) who defined many grassland terms at a global level. In this work, the Working Group adapted these definitions to European specificities. The text is restricted to agricultural grasslands; other types like recreational (e.g. lawns of sport fields) and ornamental grasslands are not considered.

Grassland term definitions

1. **Fodder areas**: Part of the agricultural area that includes permanent grasslands, arable fodder crops and grazed fallow lands.
2. **Arable fodder crops**: Annual, biennial or perennial species sown on arable land for the production of forage and harvested as green material. They include temporary grasslands, green cereals (C3 species such as oats, barley, spelt, triticale, rye and C4 species such as maize and sorghum), green cereal-other crops mixtures, fodder roots, some *Brassicaceae* and *Compositeae* (e.g. sunflower) species.

   Additional remarks:

   Crops that are harvested as grain (cereal grain and pulses) and used for animal feeding are not classified in fodder crops.
   Cereals can represent a resource for mixed farming systems (livestock, grasslands and grain cereal production). This is traditionally the case in Mediterranean areas. Even when sown for grain production, their management can be flexible according to weather conditions prevailing during the growing season. For instance, cereal crops for grain production can be grazed in winter and then harvested for grain production, or grazed only when the predicted grain production will not cover the costs of mechanical harvesting.
   If cereals are harvested green, by grazing or harvested for silage as immature cereals, they should be defined as fodder crops. C3 cereals such as oats, barley and wheat can sometimes be mixed with other crop types like annual legumes (e.g. pea, vetch) and harvested green. These mixtures should also be considered as fodder crops.
3. **Grasslands**: Land devoted to the production of forage for harvest by grazing/browsing, cutting, or both, or used for other agricultural purposes such as renewable energy production. The vegetation can include grasses, grass-like plants, legumes and other forbs. Woody species may also be present. Grasslands can be temporary or permanent.
   Two management categories can be identified:

   - **Meadows**: grasslands that have been harvested predominantly by mowing over the last 5 years[1] or since the establishment of the sward if it is less than 5 years old.
   - **Pastures**: grasslands that have been harvested predominantly by grazing over the last 5 years[2] or since the establishment of the sward if it is less than 5 years old.
4. **Permanent grasslands:** Grasslands used to grow grasses or other forage (self-seeded or sown and/or reseeded) and that have not been completely renewed after destruction by ploughing or spraying (herbicide) for ten years or longer. They can be agriculturally improved, semi-natural, natural or no longer used for production.
   European permanent grasslands can be dominated by:

   - one or several grass species;
   - one or several grass species and one or several legume species;

[1] Where there has been a recent change in the management strategy (more recently than 5 years), the new management type has to be taken into account.

- grasses, several forb species and possibly legume species;
- grass-like species and possibly forb species;
- shrubby zones (see 'semi-natural grasslands' for more information);
- grazed wooded areas (see 'semi-natural grasslands' for more information).

Additional remarks:

Long-term grasslands provide more ecosystem goods and services than short-term grasslands (e.g. carbon storage, biodiversity levels). In a previously cultivated soil a minimum duration of ten years is necessary in most situations to approach a level of soil organic carbon that is representative of long-term permanent grasslands. A period of ten years is also considered as a minimum for reaching soil biodiversity, and especially higher plant diversity, which is characteristic of long-term permanent grasslands for a given intensification level.

The effects of cultivating and reseeding, however, can vary according to the region and type of grassland, and the acceptable frequency of cultivation also varies. For example, in Mediterranean areas, self-seeded permanent grasslands consisting mainly of annuals can be tilled (light harrowing, not deep ploughing) every few years without destroying floral biodiversity. Harrowing is a quite common practice to control scrub invasion, e.g. in Dehesas/Montados. In these conditions, permanent grasslands can be tilled more frequently than once every ten years.

5. **Natural and semi-natural grasslands**: Low-yielding permanent grasslands, dominated by indigenous, naturally occurring grass communities, other herbaceous species and, in some cases, shrubs and/or trees. These mown and/or grazed ecosystems have not been substantially modified by fertilization, liming, drainage, soil cultivation, herbicide use, introduction of exotic species and (over-)sowing. The occurrence of natural grasslands is not related to human activities, in contrast to the latter.

   Additional remarks:

   Occasional liming on acidic grasslands, or the application of very low amounts of organic fertilizers, if not combined with other 'improvement' techniques, are not considered to modify habitats substantially. If not associated with higher fertilization or stocking rate, drainage can transform wet semi-natural grassland into mesophilous semi-natural grassland. Although most semi-natural communities give low production, some of them, such as purple moor grass (*Molinia caerulea*) or tall sedge (*Carex* spp.) communities, can be quite productive.

   Natural vegetation types are communities where the vegetative cover is in dynamic balance with the abiotic and biotic (human species excluded) forces of its ecosystem. Semi-natural vegetation is not planted/sown by humans but is influenced by human actions such as grazing, cutting or burning. Previously cultivated areas that have been abandoned and where vegetation is regenerating may also evolve to semi-natural vegetation. In contrast with natural vegetation, semi-natural communities thus need regular anthropogenic disturbances to be maintained.

   Semi-natural grasslands are usually biodiverse. They include[2]:

[2] These communities correspond for instance to the 1430, 21A0, 4010-4040, 5130, 52, some 53, 6210-6270, 62A0-62D0, 6310, 6410-6460, 6510-6530, 9070 NATURA 2000 Codes of Annex I of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, the so-called 'Habitats Directive'. They include also non NATURA 2000 habitats such as the *Cynosurion*, *Bromion racemosi* and *Alopecurion*.

- grazed (pastures) or mown (meadows) grasslands in the plain or low mountain areas including wet areas (riparian vegetation, valleys, flood areas) where grazing and mowing are usually combined in time and/or space;
- montane and sub-Alpine meadows and pastures;
- grazed steppes and dry pastures;
- land crossed during transhumance where the animals spend a part of the year (approximately 100 days) without returning to the holding in the evening;
- grazed wooded areas (agroforestry areas, Dehesa and Montado type for example). Forestland that produces, at least periodically, spontaneous native understorey vegetation that is grazed and where shrubs and trees are browsed is also considered as grazed semi-natural vegetation, including fire-break lines;
- grazed/browsed shrubby zones (e.g. heath, maquis, matorral, garrigue).

Natural grasslands are also often biodiverse; they cover limited areas in Europe. They include for example[3]:

- Alpine and boreal tundra grasslands (beyond the tree line);
- rupicolous pannonic grasslands for instance of Hungary;
- Macaronesian mesophile grasslands from the Atlantic islands (e.g. Azores);
- steppic grasslands for instance of Romania, Russia and Ukraine;
- Mediterranean xeric grasslands (e.g. main Mediterranean islands and *Stipa* grasslands in SE Spain);
- Grasslands developed on saline soils.

'Agroforestry' is the integration of woody perennials, crops and/or grasslands on an area of land. Trees may be single or in groups, inside parcels (silvoarable agroforestry, silvopastoralism, grazed or intercropped orchards) or on the boundaries (hedges, tree lines). Silvoarable systems are extensively used in Mediterranean areas; they include fodder crop rotation under the trees for feeding animals during shortage periods. Agroforestry systems are obtained by planting trees on agricultural land or by introducing agriculture in existing woodland (e.g. silvopasture).

A silvopastoral system, like the Dehesa/Montado, has the chief aim of providing food for livestock while taking advantage of the presence of trees (for example for shade, shelter, milder microclimate, 'nutrient pump', strategic browsing and acorn grazing), whilst obtaining a secondary profit from trees in the mid/long term (from, for example, cork, wood, firewood).

Silvopastoral systems also include those areas where the understorey of a forest is grazed. It combines grazing with tree production (wood, fruits, fodder) and the maintenance of the forest ecosystem. This system reduces fire risk by controlling inflammable understorey and preserves biodiversity through animal disturbance. In some high forest, the main productive use is wood, but many grazed forests have minimal value for timber or firewood, and grazing is really the most important productive use (e.g. in Mediterranean areas). There are different situations and the official classifications and statistics should recognize this.

[3] Annex I of the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, the so-called 'Habitats Directive' recognizes 9 habitat types of natural grasslands (8 of them can be grazed: 6110, 6120, 6140-6190 NATURA 2000 Codes). The following habitats should also be considered as natural grazed communities: 1330, 1340, 1410-1430, 1630, 2130-2150, 21A0, 2230, 2240, 2330, 2340, 4060, 9050.

6. **Agriculturally improved permanent grasslands**: Permanent grasslands on good or medium quality soils, used with more frequent defoliations, higher fertilization rates, higher stocking rates and producing higher yields than natural and semi-natural grasslands.

   Additional remarks:

   Agriculturally improved permanent grasslands can be dominated by:

   - one or several grass species;
   - one or several grass species and one or several legume species;
   - grasses, one or several forb species and possibly legume species.

   Agriculturally improved permanent grasslands are often classified, in terms of production, on the basis of the proportions of high-, medium- and low-productivity/quality grasses as well as on the proportion of legumes.

7. **Permanent grasslands no longer used for production**: Areas of permanent grasslands, regardless of the grassland type and the previous use, upon which the produced biomass is no longer used for agricultural production purposes, but which are maintained in good agricultural and environmental condition by appropriate measures.

8. **Temporary grasslands**: Grasslands sown with forage species that can be annual, biennial or perennial. They are sown on arable land and can be integrated in crop rotations or sown after another grassland vegetation. They are kept for a short period of time, from a couple of months to (usually) a few years. They can be established with pure sowings of legumes, pure sowings of grasses or grass-legume mixtures.

   Additional remarks:

   This category includes 'Leguminous plants' that are pure stands of leguminous plants or mixtures of predominantly leguminous plants mixed with grasses.

   Temporary grasslands can be grazed or harvested green as hay or silage.

9. **Rangelands**: Extensive, large-scale grazed grasslands. Rangelands can be fenced or not but they are usually not fenced, so a shepherd is often needed.

   Additional remark:

   Rangelands are dominated by grazed semi-natural vegetation. They may include natural and semi-natural grasslands, shrublands, steppes, tundras, alpine communities, marshes and the understorey of forestland.

10. **Grazed fallow lands**: Extensively grazed uncultivated land after a cropping episode. The duration of the fallow is typically between one and four years. The land is then cropped again.

    Additional remark:

    Fallow lands are very commonly grazed in Mediterranean areas for livestock feeding. They are also important for wildlife (e.g. breeding birds) and soil conservation.

11. **Grazed common lands**: Permanent grasslands where two or more persons have the right to let their animals grazing concurrently; in some cases these rights are not permanently vested in the same individuals but are allocated from time to time by a body with legal authority to do so.

Additional remarks:

Common lands are part of the utilized agricultural area. They can be private or public (state, parish, *etc*.). They are generally semi-natural, but not always; some common lands have been 'improved' by reseeding and fertilization.

Rangeland is mostly common land, but not always; it can be in sole use[4]. Most common land is rangeland, but not always; it can consist of grassland, forest, horticultural or other land.

Classification of grassland types into an agricultural statistics system

Preamble

In the classification system described below, three main ideas are introduced:

- Permanent grasslands are described in three main categories:
  - Agriculturally improved permanent grasslands
  - Natural and semi-natural grasslands
  - Permanent grasslands no longer used for production
- The existing Eurostat category 'Fodder crops/Leguminous plants' has been amalgamated with the category 'Fodder crops/Temporary grass' so creating a new category 'Fodder crops/Temporary grasslands'
- A new category is introduced for 'Grazed fallow land'.

Almost no surface data were collected in the past in Europe for the area of 'Natural and semi-natural grasslands'. They differ from 'Agriculturally improved permanent grasslands' since they are usually richer in biodiversity because of a lower intensification rate and less modification of their habitats. Statistical data on these natural and semi-natural grassland types could thus be an important biodiversity indicator. Two main types can be defined: 'Pastures' (including rangelands, rough grazing, forest pastures *etc*.) and 'Traditional hay meadows'. Pastures can be managed in 'Sole use' or have the status of 'Common land'.

The two following arguments justify defining a category 'Temporary grasslands':

- Grassland areas are often underestimated when they correspond to the category 'Permanent grassland and meadow' or even to the sum of the category 'Permanent grassland and meadow' and the category 'Fodder crops/Temporary grass'. 'Fodder crops/Leguminous plants' are usually not included in grasslands since they are supposed to not include grass!
- The current category 'Fodder crops/Leguminous plants' is unclear. According to the understanding of farmers and national statistical services, they can include pure forage legumes or legume-grass mixtures. There is indeed no clear difference between the following covers: 100% lucerne, 90% lucerne with 10% grass, 80% lucerne with 20% grass, *etc*. Moreover, a pure sowing of lucerne can include after some time a variable proportion of spontaneously grown grasses.

Regarding (red) clover-grass mixtures, the situation is even less clear since red clover is almost never sown in pure stand; it is almost always mixed with grass. Do they have to be classified in the category 'Fodder crops/Leguminous plants' or in 'Fodder crops/Temporary grass'? For farmers, pure lucerne, lucerne-grass mixtures and red clover-grass mixtures are all fodder crops. They use one or the other according to soil characteristics, their experience and other factors. If red clover-grass mixtures are classified in 'Fodder crops/Leguminous plants' the problem is that after 2-3 years, they can include much more grass than clover!

[4] The term 'sole use' is used for land that is not common.

According to countries, legume-grass mixtures can thus be included in the category 'Fodder crops/Leguminous plants' or in the category 'Fodder crops/Temporary grass'.
All these problems are removed if the two categories 'Fodder crops/Leguminous plants' and 'Fodder crops/Temporary grass' are replaced by 'Fodder crops/ Temporary grasslands'.
In order to take into account the variable proportion of legumes in temporary grassland swards, a simple 3-level system is proposed: pure legume sowing; legume-grass mixtures; pure grass sowing. This system could be replaced in the future by a new one with more precise assessment of the proportion of legumes in the sward. That could be done in a later document for temporary and permanent grasslands.

Classification based on all land use types of the Utilized Agricultural Area

1. Arable land
   - 1.1. Fodder crops
     - 1.1.1. Temporary grasslands
       - 1.1.1.1. Pure legume sowing
       - 1.1.1.2. Grass-legume mixtures
       - 1.1.1.3. Pure grass sowing
     - 1.1.2. Green cereals
       - 1.1.2.1. Green oats, barley, spelt, triticale, rye and other C3 cereals
       - 1.1.2.2. Green oats, barley, wheat and other C3 cereals mixed with other crop types like annual legumes (e.g. pea, vetch)
       - 1.1.2.3. Green maize and sorghum
     - 1.1.3. Fodder roots (including fodder beet)
     - 1.1.4. Fodder brassicas
     - 1.1.5. Fodder *Compositeae*: sunflower
   - 1.2. Fallow lands
     - 1.2.1. Grazed fallow lands
     - 1.2.2. Non-grazed fallow lands
   - 1.3. Other crop types
2. Permanent grasslands
   - 2.1. Agriculturally improved permanent grasslands[5]
   - 2.2. Natural and semi-natural grasslands
     - 2.2.1. Pastures, including rangelands, rough grazing, forest pastures, *etc*.
       - 2.2.1.1. Sole use
       - 2.2.1.2. Common land
     - 2.2.2. Traditional hay meadows
   - 2.3. Permanent grasslands no longer used for production
3. Permanent crops
4. Other agricultural land such as kitchen gardens

Multilingual vocabulary of grassland terms

Fodder areas: Futterflächen (DE); Superficies forrajeras (ES); Surfaces fourragères (FR); Superfici foraggere (IT); Voederareaal (NL); Plochy krmovín (SK); Foderarealer (SE)

Fodder crops: Futterpflanzen (DE); Cultivos forrajeros (ES); Cultures fourragères (FR); Colture foraggere (IT); Voedergewassen (NL); Krmoviny (SK); Fodergrödor (SE)

Grasslands: Grünland (DE); Pastos (ES); Prairies (FR); Prati e pascoli (IT); Grasland (NL); Trávne porasty (SK); Gräsmarker (SE)

[5] Almost always in sole use but occasionally common land

Meadows: Wiesen (DE); Pastos de siega (ES); Prairies de fauche (FR); Prati da sfalcio (IT); Maailand (NL); Lúky (SK); Slåtterängar (SE)

Pastures: Weiden (DE); Pastos de pastoreo (ES); Pâtures, prairies pâturées (FR); Pascoli (IT); Weilanden (NL); Pasienky (SK); Betesmarker (SE)

Permanent grasslands: Dauergrünland (DE); Pastos permanentes (ES); Prairies permanents, Surfaces toujours en herbe (FR); Prati e pascoli permanenti (IT); Blijvend grasland (NL); Trvalé trávne porasty (SK); Permanenta gräsmarker (SE)

Agriculturally improved permanent grasslands: Landwirtschaftlich entwickeltes Dauergrünland (DE); Pastos mejorados (ES); Prairies permanentes améliorées (FR); Prati e pascoli permanenti migliorati (IT); Landbouwkundig verbeterd blijvend grasland (NL); Intenzifikované trvalé trávne porasty (SK); Förbättrade permanenta gräsmarker (SE)

Natural and semi-natural grasslands: Natürliches und naturnahes Dauergrünland (DE); Pastos naturales y seminaturales (ES); Prairies naturelles et semi-naturelles (FR); Prati e pascoli naturali e semi-naturali (IT); Natuurlijk en half natuurlijk grasland (NL); Prírodné a poloprírodné trávne porasty (SK); Naturbetesmarker och hagmarksbeten (SE)

Permanent grasslands no longer used for production: Aus der Produktion genommenes Dauergrünland (DE); Pastos permanentes no utilizados para la producción (ES); Prairies permanentes plus utilisées pour la production (FR); Prati e pascoli permanenti non più utilizzati per la produzione (IT); Blijvend grasland dat uit productie is genomen (NL); Neprodukčné trvalé trávne porasty (SK); Permanenta gräsmarker tagna ur produktion (SE)

Rangelands: Rangelands, Hutungen (DE); Rangelands, Pastos de uso extensivo (ES); Parcours (FR); Rangelands, Spazi vasti a pascolo (IT); Rangelands, woeste gronden (NL); Rangelands, Extenzívne pasienky (SK); Rangelands, Extensiva betesmarker, Fjällbeten (SE)

Temporary grasslands: Wechselgrünland (DE); Pastos sembrados temporales (ES); Prairies temporaires (FR); Prati e pascoli temporanei (IT); Tijdelijk grasland (NL); Dočasné trávne porasty (SK); Vall på åker (SE)

Grazed fallow lands: Beweidete Brachen (DE); Barbechos y posíos (ES); Jachères pâturées (FR); Riposo pascolativo (IT); Braakliggende gronden die beweid worden (NL); Spásaný úhor (SK); Betad träda (SE)

Grazed common lands: Gemeinschaftsweiden (DE); Pastos comunales (ES); Terrains communaux pâturés (FR); Terreni a pascolamento collettivo (IT); Gemeenschappelijke weidegronden (NL); Obecné pasienky (SK); Betad allmänning (SE)

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