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Practical Implementation of BioSt-NachV – Sub-project Area-related Requirements (§ 4-7 + 10)

Specifications and recommendations for "grassland" area type

- FINAL DRAFT -

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by

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1 Background and objective

The European Parliament and the European Council passed the EU Directive on the promotion of the use of energy from renewable sources (Directive 2009/28/EG - RES-D) in December 2008, which contains sustainability requirements for bioliquids and demands proof of compliance.

Within the scope of the amendment to the Renewable Energy Directive, the authorisation to receive the Renewable Raw Materials Bonus (NaWaRo) for electricity produced from bioliquids was made subject to compliance with sustainability criteria. These sustainability criteria are essentially based on the criteria specified in the EU Renewable Energy Sources Directive (EU RES-D). A **state accreditation system** for operative certification schemes is needed in order to implement the corresponding German Biomass Electricity Sustainability Ordinance (Biomassestrom-Nachhaltigkeitsverordnung, BioSt-NachV; referred to hereafter as BioSt-NachV and the regulation).

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) commissioned the GTZ (German Society for Technical Cooperation) to provide support in the implementation of the BioSt-NachV. The objective of the project is to develop a state accreditation system which evaluates and approves operative certification schemes. Operative certification schemes for sustainable biomass production are examined and assessed in the context of German and European requirements and are approved where applicable.

Öko-Institut e.V. (Institute for Applied Ecology) was commissioned by the GTZ to carry out the work package on *Area-related requirements (§ 4-7 and 10)* as part of the project on the practical implementation of the BioSt-NachV (see the accepted tender dated 7/5/2009). The tasks to be carried out in this sub-project are divided into the following work packages:

- AP1: Analysing the regulation and operative certification schemes in detail
- AP2: Analysing existing data sources and methods
- AP3: Suggesting solutions and carrying out preliminary work on the introduction of a state accreditation system
- AP4: Providing support for a pilot application
- AP5: Developing transitional solutions
- AP6: Identifying synergies and engaging in information transfer with other sub-projects
- AP7: Establishing agreement, communication, internal workshops and meetings

Analysing the regulation in detail (Document AP1-1) requires an analysis of open questions, room for interpretation, and the need for more precision within the scope of the regulation. More specifically, this refers to:

- the definition of grassland
- analysis of the possible criteria and geographical ranges which could be covered by a definition of “highly biodiverse grassland”.

This report provides specifications and recommendations for the grassland area type, which are intended to function as a basis for deriving criteria, indicators, and, in particular, proof.

2 Detailed analysis of the BioSt-NachV with a focus on grassland

§ 4 Protection of areas of high value with regard to nature conservation

(1) Bioliquids shall not be made from raw material obtained from land with high biodiversity value.

(2) “Land with high biodiversity value” shall include all areas that, as of the reference date or a later date, had one of the following statuses, regardless of whether the areas still have such status:

1. forested areas pursuant to para. 3;
2. areas serving purposes of nature conservation pursuant to para. 4 or
3. grassland with great biodiversity pursuant to para. 5.

…

(5) Highly biodiverse grassland is grassland that, in the absence of human intervention,

1. would remain grassland and which maintains its natural species composition and ecological characteristics and processes (natural grassland) or
2. would cease to be grassland, that is species-rich and not degraded (non-natural grassland), except where harvesting of the raw material is necessary to preserve the land’s grassland status.

“Highly biodiverse grassland” shall especially be considered to include areas that the Commission of the European Communities has defined as such, on the basis of Article 7 para. 3 sub-paragraph 2 of Directive 2009/28/EC. The criteria established by the Commission for determination of natural and non-natural grassland on the basis of Article 17 para. 3 sub-paragraph 2 of Directive 2009/28/EC shall be taken into account in the interpretation of sentence 1.

[The wording of this Box will be adopted when a final English version of the BioSt-NachV is available.]

The distinction between natural and non-natural grassland is made clear in § 4 para. 5 no. 1 and 2. Natural grassland remains as such in the absence of human intervention. In contrast, non-natural grassland would become a different type of vegetation in the absence of human intervention.

However, the term “grassland” itself is not defined in the regulation. As a result, there is an urgent need for more precision in this respect.

Likewise the criteria for natural grassland that is “highly biodiverse” (grassland which maintains its natural species composition, ecological characteristics and processes) are not immediately operational, making more precision necessary here, too.

The criteria for non-natural grassland that is “highly biodiverse” (species-rich and not damaged) are – like the criteria for natural grassland – considered to be not immedi-

ately operational, with the result that more precision is needed in the regulation on this aspect.

Furthermore, based on Article 17 para. 3 sub-paragraph 2 of Directive 2009/28/EG, the European Commission has the capacity to establish criteria and geographical ranges to determine which grassland shall be covered by the term “highly biodiverse”. When these criteria and geographical ranges have been specified, they have to be taken into account in accordance with the regulation (§ 4 para. 5 sentence 2). With regard to the practical implementation of the regulation, a transitional solution is needed to enable the integration of possible developments on an EU level.

3 Definition of grassland

Paragraph 4 of the regulation prescribes that highly biodiverse grassland should not be used for the production of bioliquids. However, the term “grassland” itself is not – as stated above – defined in the regulation. As a consequence, a precise definition is urgently needed.

There are numerous definitions which attempt to elucidate the concept “grassland” in more detail. The following kinds of definitions can be typologically distinguished:

- Ecological / scientific definitions
- Political / normative inclusive definitions related to support mechanisms
- Use- / stakeholder-related definitions

In turn, all of the definitions can also be grouped into different spatial levels (e.g. global, European, national, or even sub-national levels).

The definitions described in the following, which are relevant to this sub-project and have been researched within its scope, are uniformly ecological and scientific in character. In our assessment, these are the most suitable definitions in terms of the project task at hand. Definitions have been elaborated for both global and regional levels of reference.

Definitions of a political and normative character cannot always be satisfactorily substantiated by research findings.

The following definitions of the concept of “grassland” have been identified. They are compiled in Table 1.

Table1: Comparison of grassland definitions

Source	Definition	Spatial reference	Definitional criteria	Measurability
Allaby (1998)	Grassland occurs where there is sufficient moisture for grass growth, but where environmental conditions, both climatic and anthropogenic, prevent tree growth. Its occurrence, therefore, correlates with a precipitation intensity between that of desert and forest and is extended by grazing and/or fire to form a plagioclimax in many areas that were previously forested.	Global	Definition is based on **climate parameters combined with further environmental conditions**. To use this definition, a more precise determination of precipitation intensity, within which grassland should be found, is required. Further environmental conditions which prevent the occurrence of wooded areas also have to be defined more precisely.	/
IPCC (2003)	This category includes rangelands and pasture land that is not considered as cropland. It also includes systems with vegetation that fall below the threshold used in the forest land category and is not expected to exceed, without human intervention, the thresholds used in the forest land category. This category also includes all grassland from wild lands to recreational areas as well as agricultural and silvo-pastural systems, subdivided into managed and unmanaged, consistent with national definitions.	Global	Definition is based on **degree of canopy cover** to which further undefined criteria are added.	The degree of canopy cover can be mapped using remote sensing data. The definition allows a lot of room for interpretation, particularly because of the phrase “in accordance with national definitions”.

Source	Definition	Spatial reference	Definitional criteria	Measurability
Olson *et al.* (2001)	No explicit definition given.	Global	Definition of ecosystems is based on biogeographic regions, biome systems, the consultation of global maps of floral and zoogeographic provinces, global and regional maps of units based on the distribution of selected groups of plants and animals, maps of the biotic provinces in the world, as well as global mappings of vegetation types. The boundaries of the ecosystems roughly reflect the original expanse of natural communities of species before comprehensive changes in land use began.	Dataset is available for downloading, see http://www.worldwildlife.org/science/data/item6373.html (Note: The original expanse of grassland is shown, rather than the current one.)
Scholes and Hall (1997)	Grasslands (savannas and woodlands) are part of a continuum of vegetation types on moisture and temperature gradients.	Global	**Climate parameters**, also see Figure 1.	
Suttie *et al.* (2005)	UNESCO defines grassland as "land covered with herbaceous plants with less than 10 percent tree and shrub cover."	Global	Definition is based **on the degree of canopy cover** corresponding to the IGBP-DIS land cover classification and is also used in greenhouse gas reporting under the UNFCCC.	Degree of canopy cover can be measured using remote sensing data.
White *et al.* (2000)	Terrestrial ecosystems dominated by herbaceous and shrub vegetation and maintained by fire, grazing, drought and/or freezing temperatures.	Global	**Vegetative morphology**. Definition refers to the dominance of herbaceous and shrub vegetation cover, but does not specify how this dominance is defined. Rather, it is comprehended in a broader manner. According to Gibson (2009) it draws upon the most widely accepted description of grassland.	Dataset is available for downloading; see: http://www.wri.org/publication/content/8576
Widgley and Schimel (2000)	Grasslands occur where the seasonal drought prevents the development of extensive tree cover as well as where our predecessors or contemporaries have cleared away forest to create grazing	Global	Low tree cover, **degree of canopy cover** is specified as a possible parameter for the definition; other definitions of savannas as part of grassland use the percentage of cover provided	

Source	Definition	Spatial reference	Definitional criteria	Measurability
	land. Grassland may be defined as those areas with less than 10% tree cover; savannas have 10-50% woody plant cover and a well-developed grass layer in their undeveloped state.		by woody vegetation.	
Woodward *et al.* (2004)	If the definition put forward by Allaby is made more concrete by incorporating the spread of annual rainfall and mean annual temperature levels which, if they are found together, foster the growth of grassland.	Global	Definition is based on **climate parameters combined with further environmental conditions.** The definition derives from the origins of grassland and the resulting quick expansion of these so-called "super-biomes". See Figure 2.	Can be measured by using climate parameters. However, other environmental conditions exacerbate the measurability. No dataset available.
Yangambi classification (as found in Descoings 1957)	Tropical grassland is characterised by carpet-like cover with herbaceous vegetation exceeding 80 cm in height. Steppe is characterised by carpet-like cover with herbaceous vegetation under 80 cm in height. Prairie and meadowland is not defined.	Africa	**Vegetative morphology (height of growth) and floral composition**	Dataset can be downloaded here: http://gcmd.nasa.gov/records/GCMD_GNVd0031_104.html (Note: Data is limited to Africa)
Rieder (1983)	Permanent sod made up of numerous plant species occurring together.	Central Europe	Defined by use (permanent grassland)	No significant natural grassland in Central Europe

Some of the definitions comprehend grassland in a broader sense; other definitions are narrower to varying degrees (given their different criteria) in terms of the natural areas and the use types they cover (see Appendix 1). Moreover, the multitude of definitions is limited to natural grassland (for a more detailed discussion of this, see Gibson 2009 or IPCC 2003).

In conclusion, none of the above definitions are in fact suited to an understanding of grassland which is globally consistent and comprehensive in terms of the regulation. This is also true for "highly biodiverse" grassland.

In the following, the most recognised global definition of grassland – found in White et al. (2000) – is selected as a starting point. It is then expanded for the purpose of the regulation and subdivided into the two sub-units of "non-natural grassland" and "natural grassland" using criteria requiring proof.

3.1 Expanded definition of grassland within the framework of the BioSt-NachV with regard to non-natural grassland

For the implementation of the BioSt-NachV, it is proposed that an expanded version of the definition provided by White et al. (2000) is used. The definition given by White et al. (2000) is as follows:

> Grassland comprises "*terrestrial ecosystems dominated by herbaceous and shrub vegetation and maintained by fire, grazing, drought and/or freezing temperatures*."

This means that above all, natural grassland and pastured grassland are covered by the definition. Large shares of non-natural managed grassland (in particular mown grassland) are not covered by the definition. White et al. (2000) complement their definition with a global GIS grassland dataset (1 km² resolution, raw data of 1992/93). Examination of the dataset of White et al. (2000) confirms that large shares of managed grassland (including semi-natural grassland) are lacking. The following expansion of the definition is proposed, partly for this reason:

> Grassland comprises "*terrestrial ecosystems dominated by herbaceous and shrub vegetation and maintained by fire, grazing, drought and/or freezing temperatures* ***or maintained in this state for at least 5 years[1] as a result of human intervention****."*

In spite of an expansion of the definition being necessary, arguments can be found in favour of using the definition and dataset of White el al. (2000). They are as follows:

- According to Gibson et al. (2009), it constitutes the most broadly recognised definition of grassland.
- Since the definition does not refer to a sharp distinction based on canopy cover of around 10%, transition is allowed, thereby reflecting the natural conditions of

1 Based on EU law (2000/115/EG).

the continuum of grassland types (see Figure 1 below). In this way, it is ensured that as many grassland types as possible are covered.

- Any overlap with forest definitions is regarded as unproblematic since the BioSt-NachV also allows for the cumulation of several criteria for identical areas in other cases, e.g. when the criteria for primary forest and protected areas regionally converge.
- The dataset is highly suited to the incorporation of semi-open and closed savannas as a special case.

3.2 Necessary specifications of the expanded definition of grassland

The BioSt-NachV distinguishes between natural and non-natural grassland. However, the definition for grassland taken from White et al. (2000) and the corresponding dataset above all refer – as mentioned earlier – to natural vegetation cover with a large number of non-ligneous plants. This means that savannas, ligneous crops, shrublands and tundra, young succession stages and, to a certain extent, also grassland under a somewhat conventional agricultural definition are brought together.

For a better understanding of the necessity of the following specifications, the remote sensing data sources from White et al. (2000) are listed:

1. The “Advanced Very High Resolution Radiometer” (AVHRR) Land Cover Characteristics (GLCCD 1998) of the International Geosphere-Biosphere Project (IGBP) which has a 1 km resolution: open and closed shrublands, woody savannas, savannas and non-wooded grassland are considered as grassland;
2. The global ecosystem classification according to Olson et al. (1983): for distinguishing tundra;
3. The “Nighttime Lights of the World” database of the „Defense Meteorological Satellite Program” which has a 1 km resolution, Operational Linescan System of the United States (NOAA-NGDC 1998): for excluding urban areas.

In particular the grassland definition of the first dataset listed above only has an accuracy level of 64 % (Loveland et al. 2000; for discussion, see Wood et al. 2000). Precise criteria which led to the definition of grassland are not specified by White el al. (2000) and can only partly be derived from the above-mentioned data sources.

However, the obligations to furnish proof laid down in the BioSt-NachV require indicators to be as precise as possible. The following specifications are therefore proposed which retain reference to White et al. (2000) as a data source:

1. In the literature, a maximum woody plant coverage of 10-15 % is usually stipulated for grassland (e.g. IPCC 2003, Suttie et al. 2005). However, at the same time savannas with a 10-50 % coverage are invariably taken into account (Widgley & Schimel 2000). In the database of White et al. (2000), grassland with over 60% of woody plant coverage is also added to the category on the basis of DeFries et al. (2000) and GLCCD (1998).

In the proposed approach, the woody plant coverage is limited to 60% in order to incorporate all grassland types. However, it should be borne in mind that the majority of grassland types have a maximum woody plant coverage of 30%.

Exceptions understood to be necessary are as follows:

a. To determine the degree of coverage, woody plants and those plant types which can be used agriculturally as part of an agroforestry system are not taken into account (e.g. berry and fruit orchards with greenery, olive groves or orchard meadows);

b. Should individual trees that have naturally taken root in grassland areas cast shadows over 60 % or less of the grassland without fundamentally changing the natural composition of vegetation cover, then the area is classified as grassland (this holds above all for savannas).

2. Plant cover should amount to a minimum of approx. 5 % and precipitation levels should exceed 250 mm/a.

   This specification serves to distinguish grassland from deserts and areas generally low in vegetation. Deserts are especially characterised by low precipitation levels of below 250 mm/a (see, for example, Peverill Meills 1935, Walker 1998). In terms of remote sensing, the Normalized Differenced Vegetation Index (NDVI) is < 0.14 – a level reached by deserts with a vegetation cover of less than 15% (Cherlet et al. 2000).

   This vegetation cover remains persistent for a minimum of 5 years.

It is generally the case that risk assessment for the identification of grassland using remote sensing data is 60-80 % accurate (Loveland et al. 2000). Even with multispectral QuickBird data, the accuracy is determined with R^2 = 0.52-0.76 (Kuemmerle et al. 2006).

4 Distinguishing between natural and non-natural grassland in practice

In accordance with the BioSt-NachV, grassland that is natural needs to be distinguished from grassland that is non-natural. The definitions of the two terms put forward in §4 para. 5 are as follows:

- **Natural grassland** is grassland which would remain grassland "in the absence of human intervention"…
- **Non-natural grassland** is grassland which would cease to be grassland "in the absence of human intervention"…

In Box 1 the terms "natural grassland" and "non-natural grassland" are discussed in more detail.

Box 1: "Natural grassland" and "non-natural grassland"

The focus of general and global grassland definitions is placed on natural grassland, which basically has site-specific characteristics (to a large extent determined by precipitation and temperature levels) and contains, in terms of typology, life-forms (precedence of hemicryptophytes followed by nanophanerophytes). Figures 1 and 2 should provide a good systematic overview:

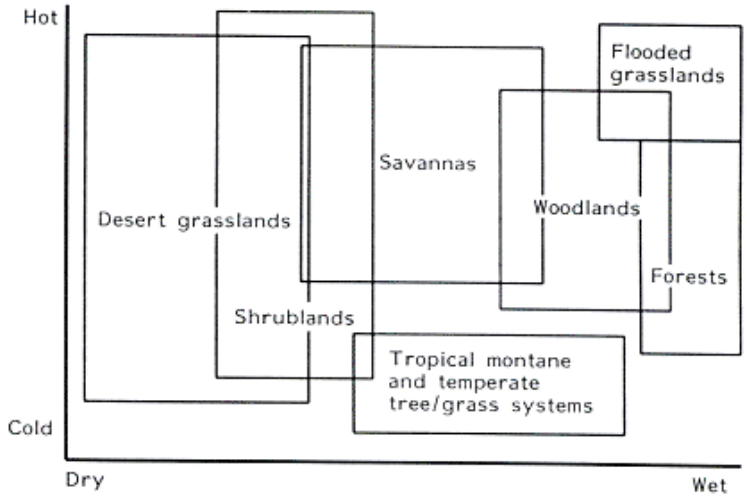

Figure 1: Representation of grassland as part of a continuum of vegetation types plotted along moisture and temperature gradients, taken from Scholes and Hall (1997).

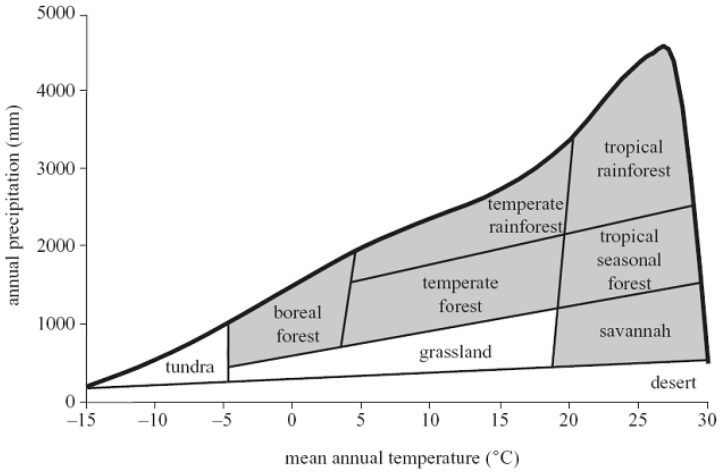

Figure 2: Distinction of grassland from other biomes using precise data of annual precipitation and annual average temperature, taken from Woodward et al.(2004).

Suttie et al. (2005) state that no grassland is in fact natural. Rather, it is fundamentally subject to different sorts of human influence. As such, it is held in ecological equilibrium and cannot reach a state of climax. Woodward et al. (2004) likewise explain that disturbances are a key factor in the development of grassland. However, there is palynological proof that, for example, the grassland type "savanna" in West Africa existed prior to any notable human occupation of the land (Salzmann 2000, Salzmann et al. 2002). Generally, grassland is classified as natural when it is not the result of ploughing or sowing where the current plant composition on meadowland sowed a long time ago is rarely in keeping with the seed mix at the time of sowing (Suttie et al. 2005).

In Germany "non-natural grassland" has not been comprehensively defined to date, either in the scope of research or in the vernacular. In a narrow sense the term "seeded grassland" (*Saatgrünland*) comes into question. However, it is not a case of permanent grassland (EU: less than five years); rather it is better agriculturally classified under the definition of arable land provided here and, more precisely, as fodder production ("*Ackergras*" and "*Kleegras*"). If, however, the the areas of arable grass are no longer integrated in crop rotation after 5 years, it no longer falls under the category of "grassland" according to EU law (2000/115/EG). The corresponding term in Chinese is used for sowed grazing land or grazing land that has been "improved" by hybrid seed varieties (DIIR 2007, Suttie et al. 2005).

In the absence of human intervention, non-natural grassland can satisfy the criteria for grassland for significantly longer than 50 years and cannot always be distinguished from natural grassland during this period (Kunde 2004). This is often the case with so-called semi-natural grassland. Above all in European literature on the subject, the distinction of natural grassland from anthropogenic grassland ("non-natural grassland") is often supplemented by the term "semi-natural grassland". Veen et al. (2001) interpret "semi-natural grassland" (synonyms: partially natural, near-natural grassland) as

"grassland ecosystems managed by mowing and/or grazing in such a way that characteristic populations of plants and animals endure in these ecosystems". Additionally, Hopkins (2009) defines semi-natural grassland using productivity. On average, this share amounts to 50 % of the achievable agricultural yields for each site (with a span of 20-80 %). The retention of management measures is seen as the basis for maintaining biodiversity on semi-natural grassland; many semi-natural grassland areas are regarded as very species-rich (Gibson 2009). Anthropogenic intervention generally takes place (very extensively) more infrequently than every 2 years; the species composition is predominantly natural and the ecological processes are broadly speaking maintained. Often extreme site conditions prevail (e.g. very dry, very wet, very cold, very hot, very N-rich, very low N), which prevent intensive use of the land or make such use more difficult.

Based on the proposed definition, semi-natural grassland is likewise to be understood as non-natural, anthropogenic grassland, whereby a clear distinction between semi-natural and other non-natural grassland is not possible. In some countries (above all in Europe), semi-natural grassland is differentiated by plant habitats, each of which have their own definition. "Managed grassland" is likewise classified under "non-natural grassland".

Grassland can change dramatically within a few years when subject to anthropogenic influence. In this context, Oppermann et al. (2009) concluded that mulched areas can have significantly fewer species of character plants even within a year. According to Scharf (2008), more intensive land use through a shift from hay to silage management leads within five years to more than 40 % of meadowland no longer having the status of a species-rich natural habitat as defined by the FFH Directive (general loss and species loss).

For the implementation of the BioSt-NachV, it is necessary to describe conditions and define criteria which determine whether grassland remains as such in the absence of human intervention. Both Figure 1 (Scholes and Hall 1997) and Figure 2 (Woodward 2004) use a specific combination of mean annual temperature and mean precipitation levels. On the one hand this combination of factors permits the growth of grasses, herbaceous and shrub vegetation; on the other hand it prevents the growth of trees. In these cases, grassland is the climax of vegetation development. Particularly in the case of savannas, fires originating either naturally or anthropogenically at certain intervals also contribute to grassland remaining as such. The same holds for other factors such as natural or anthropogenic grazing (e.g. Jeltsch et al. 2000).

Archibold (1995) identifies the climate parameters for temperate and tropical grassland regions globally which contribute to the occurrence of grassland (see Figure 3). Scholes and Hall (1997) define the following possible "reasons" for the occurrence of tropical, completely treeless grassland: the soil is periodically saturated with water; intensive fires occur regularly (once or twice a year), usually on fertile soil; the soil contains elements which are toxic for trees (typically metals); areas are regularly subject to frost (e.g. in high altitudes); areas with a very low precipitation (< 100 mm/a).

However, reasons of this kind can vary regionally, making it extremely difficult to decisively specify parameters that are generally applicable. As a result, the following approach is recommended with regard to obligations to provide proof:

When implementing the regulation, grassland areas which fulfil the definition of grassland provided in White et al. (2000) or lie within the boundaries of a regionally accepted definition or regional mapping of natural grassland should be treated for the time being as natural grassland – unless their status as non-natural grassland can be soundly proven by experts by the specified date.

Temperate **Tropical**

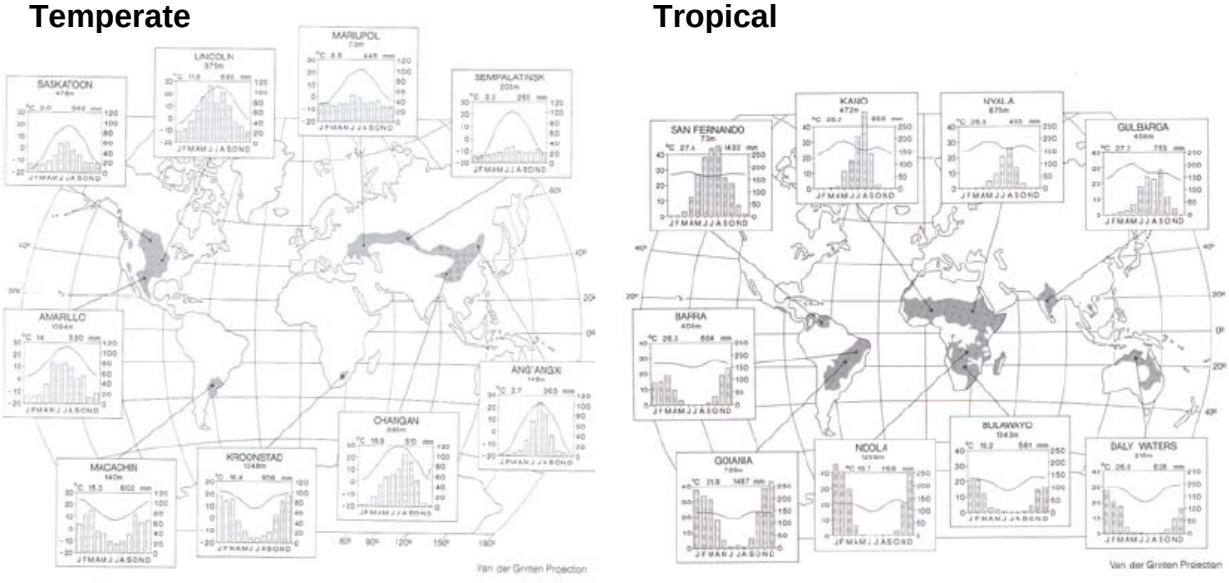

Figure 3: Climate maps of temperate and tropical grassland regions (Archibold 1995, p.60 and p.204).

5 Highly biodiverse grassland

In the BioSt-NachV, natural and non-natural highly biodiverse grassland is defined by the following alternative criteria according to §4 para. 5:

- **Natural grassland** is grassland which would remain as such in the absence of human intervention and whose **natural species composition** as well as **ecological characteristics and processes** are **intact**.
- **Non-natural grassland** is grassland which would not continue to be grassland without human intervention and which is **species-rich** and **not degraded** - unless the harvesting of biomass is required so that its status of grassland can be retained.

This definition draws on different criteria for high levels of biodiversity. The specifications for natural grassland are “natural species composition” and “intact ecological characteristics and processes”; for non-natural grassland “species richness” and “the absence of signs of degradation” are specified. In addition, biomass is allowed to originate from non-natural grassland areas if the harvesting of biomass is required for it to retain its grassland status. Box 2 provides a short overview of grassland and biodiversity.

Box 2: Grassland and biodiversity

The potential biodiversity of grassland is often underestimated since many species are inconspicuous and many more live under the surface of the soil in the so-called edaphon (Coupland 1979). The plant diversity of grassland, the species composition, the relative abundance of species as well as the vegetative structure of the grass are predominantly determined by the following according to Hopkins and Holz (2006):

(1) the fertility of the soil and the change in its fertility through the use of inorganic and organic fertilizer, including the manure and urine of grazing animals, and liming; and

(2) defoliation and other disruptions, mainly due to the intensity and frequency of grazing or the frequency of mowing and when it takes place as well as due to other naturally occurring environmental stressors (e.g. flooding, drought, fire) or agricultural activities (e.g. cultivation, re-seeding, drainage work, harrowing, the use of pesticides).

According to the definition agreed upon at the Convention on Biodiversity (CBD)[2], the term “biodiversity” is understood as having three different organisational levels: the genomes, species, and ecosystems. The examination of biodiversity on the genomic level is very time-consuming and measurement on a global scale is not feasible. The determination of species diversity on grassland areas is also problematic on a global level.

2 Biological diversity (= biodiversity) means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD, Article 2). http://www.cbd.int/convention/articles.shtml?a=cbd-02

However, the definitions of grassland found in the BioSt-NachV refer only marginally to the CBD definition. For natural highly biodiverse grassland, the three criteria of the CBD definition are not provided. For non-natural grassland, species richness is listed, which can be seen as a short excerpt from the CBD definition of biodiversity.

For natural grassland as determined by the specified criteria, it is highly probable that ecological characteristics and processes are intact and that there is a natural species composition. Thus, when implementing the regulation it is important to demand very clear expert reporting in order to be able to provide proof if the opposite should be the case.

However, in terms of non-natural grassland, only a share of the corresponding grassland areas shall satisfactorily fulfil the “species-rich” criterion. Regionally adapted criteria and methods also have to be defined in order to enable classification.

If national lists of semi-natural grassland exist, such areas are treated in the same way as species-rich grassland (analogous to the approach specified within the EU definition of High Nature Value farmland, Beaufoy et al. 2009).

To enable greater definitional precision, existing diversity maps can be used as a help for certain countries and regions. Such maps are generally based on a mixture of historical and current data and therefore do not necessarily reflect the situation at the present time (or rather the situation in 2008, see for example Kier et al. 2009). Additionally, several global biodiversity programs can be drawn upon in carrying out the provision of proof (summary based on White et al. 2000):

- Almost half of the 234 current Centers of Plant Diversity contain areas of grassland; the centres can be found in almost all regions of the world. They represent highly biodiverse areas for which nature protection measures can preserve a high number of characteristic types of grassland. Corresponding GIS datasets are not publicly available; a map of the Centers of Plant Diversity and Endemic Bird Areas can be found at: http://earthtrends.wri.org/pdf_library/maps/9-7_m_EBAandCPDGrass.pdf.
- For around 23 of the 217 Endemic Bird Areas (EBAs), grassland is the key habitat type. 3 of these 23 grassland EBAs are particularly relevant from the perspective of biodiversity: the Peruvian Andes, Central Chile and Southern Patagonia. The GIS dataset is not publicly available; a map with the corresponding Endemic Bird Areas and Centers of Plant Diversity can be found at: http://earthtrends.wri.org/pdf_library/maps/9-7_m_EBAandCPDGrass.pdf
- Of the 136 terrestrial ecoregions identified as excellent examples of particularly diverse ecoregions of the world, 35 are grassland ecoregions which comprise a considerable share of most significant grassland biodiversity in the world. The ranking was carried out based on the criteria of species richness, endemism, unique higher taxa and unusual or evolutionary significant phenomena. The GIS dataset can be requested from WWF, see http://www.worldwildlife.org/science/data/item1878.html.

- A specific search for grassland habitats can be undertaken in the database of Important Plant Areas. The convention under which the areas are classified as such is also specified (e.g. Habitats Directive, Bern Convention), see http://www.plantlife-ipa.org/Reports.asp?v=vRepHom.
- A specific search for grassland regions is not possible in the context of Prime Butterfly Areas (PBAs) in Europe. However, the majority of Prime Butterfly Areas are to be found in grassland areas (van Swaay and Warren 2001 and 2006). Butterfly species are used as proxy indicators for the conservation status of grassland areas, wherefore the incorporation of PBAs is of particular importance (van Swaay and Van Strien 2008).
- The IUCN Red List of Threatened Species can be searched specifically for those species which populate grassland habitats. Taking into account the years for which an assessment of red list categories took place and excluding the categories “data deficient”, “not threatened”, “extinct in the wild“ and „extinct“, the number of species in the list totals 20,729 (including all taxa). Region- and location-specific data on the catalogued species was not available.

To determine highly biodiverse grassland, a combination of top-down and bottom-up approaches is proposed: Global biodiversity programs can be used for basic information whilst a more precise definition of highly biodiverse grassland areas is needed nationally. In this respect, national and/or sub-national lists of plant-habitat types for highly biodiverse grassland and/or lists of characteristic species (see for example Appendix 2), showing highly biodiverse grassland should be drawn up.

Information from the biodiversity programmes should be taken into account as much as possible in the compiling of corresponding national lists and used to identify the location of relevant areas. The same applies to existing national mappings of grassland. Moreover, available data should be used and expanded by further research in order to guarantee that intensive cultivation of cultures suited to biomass does not occur on highly biodiverse grassland areas. The incorporation of all relevant sources has to be confirmed in writing.

For a number of countries and regions, highly biodiverse grassland areas have already been identified, the results of which can be found in the following sources:

- Germany: Lists of natural and semi-natural plant-habitat types according to High Nature Value (HNV) farmland definition: mapping of plant-habitat types, “species-rich grassland” projects undertaken in four federal German states, areas in nature conservation schemes, grassland habitat types listed in the FFH Directive (see Box 3).
- Europe: European grassland with a high nature value (High Nature Value Farmland) (Veen et al. in press).
- Argentina, Uruguay and southern Brazil: Substantial grassland areas (Bilenca and Miñarro 2004)

- Argentina, Uruguay, Paraguay and Brazil: Important bird areas in grassland regions (IBAs) (Di Giacomo and Krapovickas 2005).
- North America: Nature conservation assessment of the Northern Great Plains (priority sites defined in Annex) (Forrest et al. 2004).
- New Zealand: Study on the nature conservation status of “indigenous” grassland areas (Mark and MacLennan 2005).
- Significant temperate grassland areas of numerous countries worldwide were shown in the workshop report of the World Temperate Grassland Conservation Initiative of 2008 (Temperate Grasslands Conservation Initiative 2008).
- Grassland inventory of the Royal Dutch Society for Nature Conservation (KNNV) in close cooperation with colleagues from Central and Eastern Europe (Veen Ecology; http://www.veenecology.nl/):
    - Estonia: Estonian Fund for Nature and Estonian Seminatural Community Conservation Association (1998-2001) http://www.veenecology.nl/data/Estonia.PDF
    - Latvia: Latvian Fund for Nature (1999-2003) http://www.veenecology.nl/data/Latvia.PDF
    - Lithuania: Lithuanian Fund for Nature and Institute of Botany (2002-2005) http://www.veenecology.nl/data/Lithuania.PDF
    - Slovakia: Daphne, Institute of applied ecology (1998-2002) http://www.veenecology.nl/data/Slovakia.PDF
    - Hungary: Ministry of Environment, National Authority for Nature Conservation, Institute of Botany (1997-2001) http://www.veenecology.nl/data/Hungary.PDF
    - Romania: University of Bucharest, Association of Botanical Gardens, Danube Delta Institute (2000-2004) http://www.veenecology.nl/data/Romania.PDF
    - Bulgaria: Institute of Botany, Wilderness Fund, Bulgarian Society for the Protection of Birds (2001-2004) http://www.veenecology.nl/data/BG_grasslands_text.pdf
    - Slovenia: Slovenian Natural History Society, Institute of Botany, University of Maribor and of Ljubljana (1998-2003) http://www.veenecology.nl/data/Slovenia.PDF

Existing methods of identifying significant grassland areas should be incorporated in the compilation of national lists. Additionally, it is possible that groups of experts who focus specifically on grassland, such as the Grassland Task Force of the World Commission on Protected Areas, the European Dry Grassland Group (EDGG), the Temperate Grasslands Conservation Initiative or the Grasslands Foundation, have more information available.

As an example, the current approach for identifying highly biodiverse grassland that is used in Germany is presented in Box 3. This approach can be applied to other countries and regions.

Box 3: Natural grassland and highly biodiverse grassland – Assessment approaches n Germany

For the assessment of these categories, a methodology developed within the scope of implementation of the High Nature Value farmland indicator can be used (Oppermann, Fuchs and Krismann 2009)

The HNV farmland indicator is an instrument which is supposed to show changes in the number and size of ecologically valuable areas of cropland as well as changes in its quality during land use. After the EU Rural Development Regulation (1698/2005) and the associated implementation regulation (1974/2006) came into force, a methodology, that is adapted to the relatively intensive and subdivided use structures, was developed for Germany in order to determine the indicator. This was adopted by the federal states and was first implemented in 2009 within the scope of monitoring representative tests sites.

According to Andersen et al. (2003 citing EEA 2005a), the EU distinguishes between three types of HNV farmland areas:

Type 1: Farmland with a high proportion of semi-natural vegetation.

Type 2: Farmland dominated by low intensity agriculture or a mosaic of semi-natural and cultivated land and small-scale features.

And optionally:

Type 3: Farmland supporting rare species or a high proportion of European or world populations.

Lists of plant-habitat types and FFH lists of habitat types

Type 1 covers semi-natural grassland which can be combined with species-rich grassland (see below). The plant-habitat types and FFH grassland habitats which fall under this type can be found in a list encompassing all federal states (see Appendix 1). Assessments of whether the criteria of natural species composition and grassland are fulfilled, as well as whether the ecological characteristics and processes are intact, need to be undertaken by experts (plant-habitat types: “typical rating”, FFH habitat types: conservation status has to be at least “B”).

The most comprehensive category in Germany in terms of land is “species-rich grassland”. Such grassland is determined using a so-called “rapid approach”:

Short transect surveys based on regional lists of characteristic species:

Generally, a first superficial assessment of land quality takes place from the margins of the land outwards: If a maximum of 2 species (see Table 3) are identified in the area, i.e. at least 3 m from the lot margin (to exclude the side effect), the area can be classified as low in species. If at least 3 species are found, a transect survey spanning

approx. 30 m in length takes place. All species are counted which are found in a rectangle stretching 1m left and right of the surveyor. The area is regarded as “species-rich” if 4 or more species are found.

Fallow land in terms of HNV farmland can also be understood as “species-rich grassland”. For this purpose, there is also an accompanying of lists of characteristic species for farmland flora. In this case, proof of 4 species found in the combined farmland and grassland lists is sufficient.

Generally similar methods for determining species-rich grassland are being put to use within the agri-environmental programmes in the German federal states of Baden-Wuerttemberg, Brandenburg, Lower Saxony and Rhineland-Palatinate. If an area has been recognised as “species-rich” within this programme, the assessment outlined above is no longer necessary.

In some of the cantons of Switzerland (Peter and Jörg 1997, BLW 1997, part of the eco-quality regulation - Öko-Qualitätsregulation, ÖQV - since 2001), the method has already been used for many years. In France, lists of characteristic species have now been developed for at least three natural parks in order to identify species-rich grassland and to financially support it.

6 Conclusions and recommendations

Use of the expanded grassland definition of White et al. (2000) is recommended:

> Grassland is comprised of "*terrestrial ecosystems dominated by herbaceous and shrub vegetation and maintained by fire, grazing, drought and/or freezing temperatures or maintained in this state for at least 5 years as a result of human intervention."*

1. a-1) For retrospective proof of the non-existence of grassland for the reference year of 2008, submission of a state-recognised document or proof by an independent third party certifying that the area had a different land use type (usually farmland) in at least one of the years from 2004 to 2008 is sufficient. This is because the chosen grassland definition demands that grassland has to have persisted for at least 5 years[3]. Proof has to be provided for each individual area (polygon precision of 20 m).

   a-2) As is the case with 1. a-1, proof must be provided that an area has not developed into grassland since 31/12/2007.

   b) As is the case with 1. a with regard to farmland, such proof can be provided for areas which have a woody plant coverage exceeding 60%.

2. The following approach is recommended to determine natural grassland:

   a-1) In regions which are likely to have natural grassland for climate reasons, it is assumed that the existing grassland would remain as such without human intervention, thereby fulfilling the criteria for natural grassland laid down in the BioSt-NachV.

   a-2) Further, regions nationally proven to contain natural grassland, as well as local mapping or remote sensing data of high quality (> 80 %) based on lists of plant-habitat types for natural grassland, should also be added as proof for grassland if they are recognised by the competent authorities.

   b) Even if an area of grassland is to be found in the regions / areas identified under 2. a-1) and 2. a-2), the grassland can still be non-natural. However, proof still needs to be provided by experts that such areas would not remain grassland without human intervention.

   c) For natural grassland it is automatically to be expected that the natural species composition and ecological characteristics and processes are maintained and that

[3] Based on EU law (2000/115/EG)

there are high levels of biodiversity. If an area of natural grassland does not have these characteristics at the time of reference, proof of such needs to be provided by experts.

3. Non-natural grassland

a) It is recommended that areas of grassland that are not recognised as natural grassland under criterion no. 2 should be regarded as non-natural grassland.

b) Grassland areas located in protected areas for the conservation of grassland habitat types and/or species are to be automatically classified as highly biodiverse grassland.

c) On a national and/or sub-national level, lists of characteristic species and/or plant-habitat types should be compiled, and, by means of these lists, highly biodiverse grassland can be determined in the field.

d) Existing methodological approaches (e.g. rapid assessment of HNV farmland in Germany) are to be used and, if necessary, first adapted to national conditions.

e) Optimally, comprehensive mapping of highly biodiverse grassland areas or an equivalent classification (e.g. as species-rich grassland) of areas has already been drawn up by 2008.

f) If an area has been examined by experts shortly before it is used rather than in 2008, it is necessary to recognize that, in case of land-use change (e.g. because of a more intensive use of fertilizers or a more radical change), a previous status of high biodiversity can disappear within 2-3 years, and cannot be identified in the field any more. This problem can be solved – if at all – if there is proof that no change in land use has taken place since 2008. As a result, it is necessary that the grassland status of an area has to be evaluated by 2010/2011, including an expert assessment of its status in 2008. When collecting data after 2010/2011, proof is also necessary that no change in land use has taken place in the area since 2008; this proof should be provided in the form of state-recognised documents and/or documentation of independent third parties.

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Appendix 1: Semi-natural and natural grassland types in Germany based on protected plant-habitat types and FFH habitat types

Biotoptyp (nach Riecken et al. 2003)	**BB**	**BE**	**BW**	**BY**	**HB**	**HH**	**MV**	**NI**	**NW**	**RP**	**SH**	**SL**	**SN**	**ST**	**TH**
07.01, 07.02 Salzgrünländer Nordsee								X			X				
07.03 Strandwiesenkomplex Nordsee								X							
07.06 von Brackwasser beeinflusstes Grünland Nordsee					X			X							
08.02 Salzgrünländer Ostsee							X								
34.01 Trockenrasen (basisch und sauer)			X					X		X			X	X	
34.02 Halbtrockenrasen	X	X	X	X			X	X	X	X		X	X	X	X
34.03 Steppenrasen	X							X						X	
34.04 Sandtrockenrasen	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
34.05 Schwermetallrasen								X	X					X	
34.06 Borstgrasrasen	X		X	X			X	X	X	X		X	X	X	X
34.07 Artenreiches Grünland frisch	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
35.01 Oligo-mesotrophe Niedermoore	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
35.02.01 Pfeifengrasstreuwiesen	X	X	X	X	X	X	X	X	X			X	X	X	X
35.02.02 Brenndolden-Auenwiesen						X	X	X						X	
35.02.03 und 35.02.04 sonstiges Grünland nass bis feucht	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
35.02.05 Flutrasen			X		X	X	X		X			X		X	X
35.03 Salzgrünländer des Binnenlandes	X				X		X	X	X		X			X	X
40 Zwergstrauchheiden (ohne 40.02)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
41.06 Streuobstbestand	X		X	X		X	X	X	X	X		X	X	X	X
66 Gebirgsrasen				X											
68 Zwergstrauchheiden				X											

Fortsetzung Anhang 1	
Lebensraumtypen nach FFH-Richtlinie	**FFH-Code**
Atlantische Salzwiesen	1330
Salzwiesen im Binnenland	1340
Trockene Sandheiden mit Genista	2310
Trockene Sandheiden mit Empetrum	2320
Trockene Sandheiden mit Corynephorus	2330
Feuchte Heiden des nordatlantischen Raums	4010
Trockene europäische Heiden	4030
Alpine und boreale Heiden	4060
Wacholder-Formationen auf Kalkheiden und -rasen	5130
Lückige basophile oder Kalk-Pionierrasen	6110
Trockene, kalkreiche Sandrasen	6120
Boreo-alpines Grasland auf Silikatsubstraten	6150
Alpine und subalpine Kalkrasen	6170
Naturnahe Kalk-Trockenrasen und deren Verbuschungsstadien	6210
Artenreiche montane Borstgrasrasen auf Silikatböden	6230
Subpannonische Steppen-Trockenrasen	6240
Pfeifengraswiesen	6410
Feuchte Hochstaudenfluren der planaren und montanen-alpinen Stufe	6430
Brenndolden-Auenwiesen	6440
Magere Flachland-Mähwiesen	6510
Berg-Mähwiesen	6520
Übergangs- und Schwingrasenmoore (nur < 2.000 m²)	7140
Kalkreiche Sümpfe mit Schneide u. Davallsegge	7210
Kalkreiche Niedermoore	7230
Silikatfelsen mit Pioniervegetation	8230

Appendix 2: Species list for the determination of "species-rich grassland" in Germany (as an example, the list for north-east Germany is given; there are six regional lists overall)

Achillea millefolium
Achillea ptarmica
Agrimonia eupatoria
Ajuga reptans
Alchemilla spec.
Anthoxanthum odoratum
Apiaceae spec.
Armeria spec.
Caltha palustris
Campanula glomerata
Campanula spec. (übrige Arten)
Cardamine pratensis
Carex spec. (Großseggen)
Carex spec. (Klein- und Mittelseggen, ohne Carex hirta)
Scirpus spec., Bolboschoenus spec. (Simsen, Strandsimsen)
Carlina vulgaris, Carlina acaulis
Centaurea spec. (alle Arten)
Chamaespartium sagittale
Chrysanthemum leucanthemum
Cirsium oleraceum
Cirsium heterophyllum, C. rivulare u. C. palustris
Cnidium dubium
Crepis spec.
Daucus carota
Dianthus spec.
Euphorbia cyparissias, Eu. esula
Euphrasia spec.
Galium mollugo agg.
Galium spec. (übrige Arten) außer Galium aparine agg.
Galium verum agg.
Genista spec. (kleine Arten)
Geranium pratense, G. sylvaticum

Geranium spec. (übrige Arten)
Geum rivale
Hieracium pilosella
Hieracium spec. (übrige Arten)
Hypericum spec. (alle Arten)
Hypochaeris radicata
Inula britannica
Knautia arvensis
Lathyrus pratensis
Lathyrus palustris
Leontodon spec.
Lotus spec.
Luzula spec.
Lychnis flos-cuculi
Lysimachia vulgaris
Lythrum salicaria
Meum athamanticum
Myosotis scorpioides
Nardus stricta
Orchidaceae spec.
Phyteuma spec. (alle Arten)
Plantago lanceolata
Polygala spec.
Polygonum bistorta
Potentilla erecta
Primula spec. (Pr. veris + elatior)
Prunella vulgaris
Ranunculus acris
Ranunculus flammula
Ranunculus spec. (übrige Arten)
Rhinanthus angustifolius, Rh. minor
Rhinanthus spec. (übrige Arten)
Rumex acetosa
Rumex thyrsiflorus

Salvia pratensis
Sanguisorba minor
Sanguisorba officinalis
Saxifraga granulata
Scabiosa spec.
Silene dioica
Stachys officinalis
Stellaria graminea, St. palustris
Cerastium arvense, Stellaria spec. (übrige Arten)
Succisa pratensis
Symphytum spec.
Thymus serpyllum
Thymus spec. (übrige Arten)
Tragopogon pratensis agg.
Trifolium spec. - nur kleine gelbe Klee
Trifolium pratense
Trollius europaeus
Valeriana officinalis agg.; Val. dioica
Veronica chamaedrys
Vicia cracca
Vicia sepium
Ranunculua auricomus

* the following characteristic species (-groups) are considered as only one species:
Campanula spec. - all species; Galium spec. - all species; Lathyrus palustris and
L. pratensis

Green fields: characteristic species of north-eastern Germany;
Other species: at least mentioned in an other regional list