PART B4

METHODOLOGY

for assessment and mapping of WOODLAND and FORESTS ecosystems condition and their services in Bulgaria

METHODOLOGICAL FRAMEWORK FOR ASSESSMENT AND MAPPING
OF ECOSYSTEM CONDITION AND ECOSYSTEM SERVICES IN BULGARIA

METHODOLOGY FOR ASSESSMENT AND MAPPING
OF WOODLAND AND FORESTS ECOSYSTEMS CONDITION AND THEIR SERVICES IN BULGARIA

PART B3

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1. Introduction

1.1. What is this methodology about?

The current methodology forms a part of the national methodological framework on mapping and assessment of ecosystem services which aims at streamlining the national ecosystems and ecosystem mapping and biophysical assessment process in Bulgaria. The methodology is not aimed at completing the full cycle of ecosystem service valuation and reporting. It delivers a practical step-by-step guidance to the process of:

- Assessing the condition of the **Woodland and forests ecosystems**;
- Assessing the **Woodland and forests ecosystems' potential to deliver ecosystem services** (biophysical valuation).

The methodology is relevant to Woodland and forests ecosystems on the entire territory of Bulgaria although its implementation will differ between NATURA 2000 zones and areas outside NATURA 2000 due to different data availability, land u se and the spatial distribution of ecosystems. It will form a part of a wider national methodological framework (under development) which details the theoretical background behind the ecosystems approach practiced in Bulgaria, as well as the necessary steps to undertake towards fulfilling Action 5 of Target 2 "Maintain and restore ecosystems and their services" of the EU Biodiversity strategy to 2020.

1.2. Who is this methodology for?

This methodology is to be used by:

- Organizations and scientists who perform ecosystems condition assessment and biophysical valuation of ecosystem services. Such organizations are expected to include the beneficiaries/partners under the programmes that have set aside funding for the national process of ecosystems mapping and assessment – for NATURA 2000, the Operational Programme Environment 2014-2020 and outside NATURA 2000 – programme BG03 Biodiversity and ecosystem services 2009-2014;
- National or local authorities who wish to contribute data they produce to the Bulgarian biodiversity information system;
- Project promoters and partners under other projects, including for example research organizations and NGOs, who wish to perform:
    - contribute to the national assessment results from their past or ongoing projects targeting wholly or in part a more detailed ecosystem biophyslical valuation and ecosystem services assessment on a regional or local scale in smaller scale pilots;
    - plan future projects to complement the national scale assessment and valuation

- Data users wishing to understand the contents and collection method of data, including but not limited to, organizations involved in environmental reporting, regional and local authorities, environmentally responsible companies, NGOs, and other stakeholders.

1.3. How to use this methodology?

The methodological framework provides a combination of information on relevant information sources that may be of interest to a wider circle of stakeholders, while the current methodology is dedicated to specific guidance to assessing ecosystem condition and ecosystem services (including data collection and verification, and mapping guidance).

The wider introductory parts are more likely to be of interest to policymakers and the general public. The more targeted use defined in the current methodology will be mostly needed by professionals involved in the national mapping and assessment exercise.

As the current methodology is a living document, comments are welcome in order to shape it as a national, widely reviewed and adopted guidance document.

2. Typology of ecosystems in Bulgaria

2.1. General typology of woodlands and forests ecosystems

The proposed typology of **woodlands and forest** ecosystems (level 2) corresponds with the ecosystem classification of MAES (2013), combined of CORINE Land Cover (CLC) classes with the European Nature Information System (EUNIS) habitat classification types.

Table 1. Typology of woodland and forests ecosystems in Bulgaria

Level 1	Level 2	Level 3
Terrestrial	Woodland and forest	G.1High deciduous forests
		G1. Coppice forests
		G3. Coniferous
		G4. Mixed deciduous and coniferous woodland

2.2. Detailed ecosystem typology of woodlands and forest ecosystems in Bulgaria

A selection of EUNIS classification on level 2 is proposed for detailed typology as level 3 for target ecosystem type. The proposed forest ecosystems classification correspond to levels “G1”, “G3”, and “G4” from EUNIS group “G”. Descriptions and relations to other classification systems of proposed subtypes of forest ecosystems are presented in Table 2.

Table 2. Woodlands and forest

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
High decidious	**G1.** Broadleaved deciduous woodland Woodland, forest and plantations dominated by summer-green non-coniferous trees that lose their leaves in winter. Includes woodland with mixed evergreen and deciduous broadleaved trees, provided that the deciduous cover exceeds that of evergreens. Excludes mixed forests (**G4**) where the proportion of conifers exceeds 25%. The differences between same types at high deciduous and coppice are the stand origin and their longevity (forest stand dynamic).	**G1.1 + G1.2 + G1.3:** **G1.1.** Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix. Riparian woods of the boreal, boreo-nemoral, nemoral and submediterranean and steppe zones, with one or few dominant species, typically *Alnus*, *Betula*, *Populus* or *Salix*. Includes woods dominated by narrow-leaved willows *Salix alba*, *Salix elaeagnos*, *Salix purpurea*, *Salix viminalis* in all zones including the mediterranean. Excludes riverine scrub of broad-leaved willows, e.g. *Salix aurita*, *Salix cinerea*, *Salix pentandra* **G1.2.**Mixed riparian floodplain and gallery woodland - Mixed riparian forests, sometimes structurally complex and species-rich, of floodplains and of galleries beside slow- and fast-flowing rivers of the nemoral, boreo-nemoral, steppe and submediterranean zones. Gallery woods with Acer, Fraxinus, Prunus or Ulmus, together with species listed for **G1.1.** Floodplain woodland characterized by mixtures of *Alnus*, *Fraxinus*, *Populus*, *Quercus*, *Ulmus*, *Salix*. **G1.3** Alluvial forests and gallery woods of the mediterranean region. Dominance may be of a single species, of few species or mixed with many species including *Fraxinus*, *Liquidambar*, *Platanus*, *Populus*, *Salix*, *Ulmus*. Excludes mediterranean *Salix* woods (G1.1) and shrubby riparian vegetation (F9.3). **G1.6** - Beech woodland - Forests dominated by beech *Fagus sylvatica* in western and central Europe, and *Fagus orientalis* and other *Fagus* species in southeastern Europe and the Pontic region. Many montane formations are mixed beech-fir or beech-fir-spruce forests, which are listed under **G4.6**	EUNIS classification Bulgarian forest site type classification 2011. **G1.**

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
		G1.7 : Thermophilous deciduous woodland - Forests or woods of submediterranean climate regions and supramediterranean altitudinal levels, and of western Eurasian steppe and substeppes zones, dominated by deciduous or semideciduous thermophilous *Quercus* species or by other southern trees such as *Carpinus orientalis*, *Castanea sativa* or *Ostrya carpinifolia*. Thermophilous deciduous trees may, under local microclimatic or edaphic states, replace the evergreen oak forests in mesomediterranean or mediterranean areas, and occur locally to the north in central and western Europe. **G1.A** : Meso- and eutrophic Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus and related woodland - Woods, typically with mixed canopy composition, on rich and moderately rich soils. Includes woods dominated by *Acer*, *Carpinus*, *Fraxinus*, *Quercus* (especially *Quercus petraea* and *Quercus robur*), *Tilia* and *Ulmus*. Excludes acid Quercus woodland (G1.8) and woodland with a large representation of southern species such as *Fraxinus ornus* or *Quercus pubescens* (G1.7). **G1.C** : Highly artificial broadleaved deciduous forestry plantations - Cultivated deciduous broad-leaved tree formations planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in clearly unnatural stands, often as monocultures. **G1.D** : Fruit and nut tree orchards - Stands of trees cultivated for fruit or flower production, providing permanent tree cover once mature. Extensively cultivated and old orchards are habitats supporting rich flora and fauna.	

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
		G1.7D - *Castanea sativa* woodland, G1.7D1 - Helleno-Balkanic *Castanea sativa* forests *Castanea sativa*-dominated forests and naturalised plantations of the *Quercion frainetto* zone of the Balkan peninsula, of northern Greece, including the Chalkidike peninsula, with irradiations in the *Ostryo-Carpinion orientalis aegeicum* zone. They appear to represent the main area of indigenousness of the species. **G1.0: Mixed Broadleaved deciduous woodland.** All other mixed broadleaved, with different species composition	
coppice	**G1.** Broadleaved deciduous woodland Woodland, forest and plantations dominated by summer-green non-coniferous trees that lose their leaves in winter. Includes woodland with mixed evergreen and deciduous broadleaved trees, provided that the deciduous cover exceeds that of evergreens. Excludes mixed forests (G4) where the proportion of conifers exceeds 25%.	**G1.1 + G1.2 + G1.3:** **G1.1.** Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix. Riparian woods of the boreal, boreo-nemoral, nemoral and submediterranean and steppe zones, with one or few dominant species, typically *Alnus*, *Betula*, *Populus* or *Salix*. Includes woods dominated by narrow-leaved willows *Salix alba*, *Salix elaeagnos*, *Salix purpurea*, *Salix viminalis* in all zones including the mediterranean. Excludes riverine scrub of broad-leaved willows, e.g. *Salix aurita*, *Salix cinerea*, *Salix pentandra* **G1.2.**Mixed riparian floodplain and gallery woodland - Mixed riparian forests, sometimes structurally complex and species-rich, of floodplains and of galleries beside slow- and fast-flowing rivers of the nemoral, boreo-nemoral, steppe and submediterranean zones. Gallery woods with Acer, Fraxinus, Prunus or Ulmus, together with species listed for **G1.1.** Floodplain woodland characterized by mixtures of *Alnus*, *Fraxinus*, *Populus*, *Quercus*, *Ulmus*, *Salix*. **G1.3** Alluvial forests and gallery woods of the mediterranean region. Dominance may be of a single species, of few species or mixed with many species including *Fraxinus*, *Liquidambar*, *Platanus*, *Populus*, *Salix*, *Ulmus*. Excludes mediterranean *Salix* woods (G1.1) and shrubby riparian vegetation (F9.3).	**G1.**

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
		G1.6 - Beech woodland - Forests dominated by beech *Fagus sylvatica* in western and central Europe, and *Fagus orientalis* and other *Fagus* species in southeastern Europe and the Pontic region. Many montane formations are mixed beech-fir or beech-fir-spruce forests, which are listed under **G4.6** **G1.7** : Thermophilous deciduous woodland - Forests or woods of submediterranean climate regions and supramediterranean altitudinal levels, and of western Eurasian steppe and substeppe zones, dominated by deciduous or semideciduous thermophilous *Quercus* species or by other southern trees such as *Carpinus orientalis*, *Castanea sativa* or *Ostrya carpinifolia*. Thermophilous deciduous trees may, under local microclimatic or edaphic states, replace the evergreen oak forests in mesomediterranean or thermomediterranean areas, and occur locally to the north in central and western Europe. **G1.A** : Meso- and eutrophic Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus and related woodland - Woods, typically with mixed canopy composition, on rich and moderately rich soils. Includes woods dominated by *Acer*, *Carpinus*, *Fraxinus*, *Quercus* (especially *Quercus petraea* and *Quercus robur*), *Tilia* and *Ulmus*. Excludes acid *Quercus* woodland (**G1.8**) and woodland with a large representation of southern species such as *Fraxinus ornus* or *Quercus pubescens* (G1.7). **G1.C** : Highly artificial broadleaved deciduous forestry plantations - Cultivated deciduous broad-leaved tree formations planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in clearly unnatural stands, often as monocultures. **G1.0: Mixed Broadleaved deciduous woodland.** All other mixed broadleaved, with different species composition	

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
coniferous	**G3.** Coniferous woodland Woodland, forest and plantations dominated by coniferous trees, mainly evergreen (*Abies*, *Cedrus*, *Picea*, *Pinus*, *Taxus*, Cupressaceae) but also deciduous *Larix*. Excludes mixed forests (**G4**) where the proportion of broadleaved trees exceeds 25%.	**G3.1** Fir and spruce woodland - Woodland dominated by *Abies* or *Picea*. **G3.4** Fir and spruce woodland - Forests of Pinus *sylvestris ssp. sylvestris and Pinus* sylvestris *ssp. hamata* of the Nemoral and Mediterranean zones and of their transitions to the Steppe zone. Included are, in particular, the forests of Scotland, of the Alpine system, of the Mediterranean peninsulas, of the lowlands of Central Europe, of the East European Nemoral zone and its adjacent wooded steppes, formed by *Pinus sylvestris ssp. sylvestris*, as well as those of Anatolia, of the Caucacus and of Crimea, formed by *Pinus sylvestris ssp.* hamata. Excluded are the formations situated within the range of natural lowland occurrence of *Picea abies*. **G3.5** Black pine (*Pinus nigra)* woodland - Forests dominated by pines of the Pinus nigra group. **G3.6 : Subalpine mediterranean Pinus woodland** Woods of *Pinus heldreichii*, *Pinus leucodermis* or *Pinus peuce*. **G3.9 : Coniferous woodland dominated by Cupressaceae or Taxaceae.** Woods dominated by Cupressus sempervirens, Juniperus spp. or Taxus baccata of the nemoral and Mediterranean mountains and hills. **G3.E : Nemoral bog conifer woodland.** Woods of *Pinus* spp. or *Picea* spp., sometimes mixed with *Betula pubescens*, colonizing bogs and fens in the nemoral zone. Conifer-dominated bog woodland occurs mainly in the boreal and boreone-moral zones, but extends into the nemoral, wooded steppe and steppe zones. **G3.F** Highly artificial coniferous plantations - Plantations of exotic conifers or of European conifers out of their natural range, or of native species planted in clearly unnatural stands, typically as monocultures in situations where other species would naturally dominate. **G3.0 – Mixed coniferous forests.** All other mixed coniferous forests, with different species composition	**G3**

Level 3		Level 4 Description by EUNIS	Nomenclature(s)
Mixed deciduous and coniferous woodland	**G.4 Mixed deciduous and coniferous woodland** Forest and woodland of mixed broad-leaved deciduous or evergreen and coniferous trees of the nemoral, boreal, warm-temperate humid and mediterranean zones. They are mostly characteristic of the boreonemoral transition zone between taiga and temperate lowland deciduous forests, and of the montane level of the major mountain ranges to the south. Neither coniferous, nor broadleaved species account for more than 75% of the crown cover. Deciduous forests with an understorey of conifers or with a small admixture of conifers in the dominant layer are included in unit G1. Conifer forests with an understory of deciduous trees or with a small admixture of deciduous trees in the dominant layer are included in unit **G3**.	**G4.5** : Mixed Pinus sylvestris - Fagus woodland - *Pinus sylvestris* woodland south of the taiga (**G3.4**) intimately mixed with Fagus woodland (**G1.6**). **G4.6** : Mixed Abies - Picea - Fagus woodland - Forests in which *Fagus sylvatica* in western and central Europe or other *Fagus* species including *Fagus orientalis* in southeastern Europe and Pontic Asia (**G1.6**), is associated in the main canopy with fir *Abies* spp. and/or spruce *Picea* spp. (**G3.1**), sometimes with an admixture of other conifers, in particular, pines *Pinus* spp. Characteristic of the montane level of the major European mountains south of the boreal zone. **G4.F** : Mixed forestry plantations - Mixed plantations of coniferous and deciduous species where at least one constituent is exotic or outside its natural range, or if composed of native species then planted in clearly unnatural stands. **G4.0. Mixed deciduous and coniferous woodland** All other mixed coniferous and deciduous forests, with different species composition and origin.	**G.4**

* - G 1.0, G 3.0 and G4.0 are introduced stateally to comply with the hierarchical level. These include ecosystem types from the type, which can be found throughout the country but are with relatively small area.

3. Data availability

3.1. Existing data sources

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There is enough aggregated data at the national level form forest inventory. In Bulgaria there isn't National inventory, but there is stand inventory and forest management plan.

- Results of the project – "Mapping and determination of the conservation status of nature habitats and species – Phase I".
- For parameterizing some indicators can be used scientific publications
- There are ways for identification by an indirect characteristics
- ICP Forests (Bulgaria) – over 20 years data set at national level for forest defoliation, forest damage and soil condition - the Pan-European Indicators for Sustainable Forest Management (criterion 2: Maintenance of forest ecosystem health and vitality, indicators: 2.2 Soil condition, 2.3 Defoliation, 2.4 Forest damage). These indicators are part of indicators for assessment of forest ecosystem condition and are included in table 3. Indicators to assess condition and biodiversity of ecosystems of the report of MAES (Indicators for ecosystem assessments under Action 5 of the Biodiversity Strategy to 2020).
- Data source – ExEA by the MoEW;
- EFFIS (European Forest Fire Information System), JRC — indicator 2.4 Forest damage of the Pan-European Indicators for Sustainable Forest Management, included in the list of indicators for assessment of drivers and pressures of the forest ecosystems (table 3. Indicators to assess condition and biodiversity of ecosystems of the MAES report). Data source - EFA (Executive forestry agency).
- ·Project CORINE Land Cover
- Map of restituted property, cadastral maps, forest area layer (Available data in EFA available data and Agrolesproject Ltd

Indicators and relevant parameters for forest ecosystems conditions - see *Annex 6 of Methodology.*

Table 3. Sources of spatial and quantitative/qualitative database.

Subtype	DATABASE Sources – main stakeholders	
	Spatial	Quantitative/Qualitative
High deciduous forests	Forest management plans, MOEW – ExEA – ICP Forests, National Database for Biodiversity, National Soil Monitoring Network. Cadastre www.icadastre.bg National Concept for Spatial Development 2013-2025 EEA – CORINE – Land Cover	Executive forest agency - forest information system – forest inventory data Maps of restituted property, Action Plans for Programmes of Environmental protection, National Concept for Spatial Development 2013-2025, National Statistical Institute, , JRC, Publications, Project Reports, Environmental NGO FRA 2015/FAO/UN Forest Europe – Quantitative assessment
Coppice forests		
Coniferous		
Mixed deciduous and coniferous forests		

3.2. Gaps of data and areas with uncertainty of data

Most of the data needed for mapping and analyzing the condition of forest ecosystems is available but in different format. It is necessary to prepare the database to be useful for current aim.

4. Mapping ecosystem types

The following section describes the procedure of mapping the ecosystem types, specifications of the final products for the maps and databases, and gives references to the Annexes to this document where database shema is provided in accordance to the specifications given hereafter.

4.1. Description of the mapping procedure

The workflow for mapping of ecosystem types comprises the following main steps:

- Generation of vector dataset with representation of polygon, polyline, or point features each of them containing information on level 3 ecosystem type;
- The source data needed to generate the vector datasets or the mapping approach should allow the specifications for the output scale, MMU and MMW to be kept as described in section 4.4.;
- Assembling the product in the geodatabase schema provided in the Annex 9 (Annex 9.00_EcosystemDatabase_Schema);
- Validation of the product accuracy, described in point 4.6. of this methodology;
- Preparation of digital maps of ecosystem types;
- Generation of metadata.

The specifications of the final product should follow the requirements provided in the following sections. As the outcome of each mapping project will be used for preparation of national dataset for ecosystem types at level 3, it is mandatory to follow each requirement described below.

4.2. Data format

Output data have to be delivered in GIS compatible vector format, in accordance with geospatial standards of OGC and INSPIRE.

The vector format should be with the following topology:

- In case all the ecosystems are presented as one geometry type - complete coverage in a single layer –;
- In case the different ecosystem types are represented with different geometry types, up to 3 layers could be delivered – one for polygon, one for polyline and one for point features.
- The vector layer has to be delivered in topologically correct geometries: see rules in http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#/An_overview_of_topology_in_ArcGIS/006200000001000000/.

4.3. Geographic projection / Reference system

Vector layer should be delivered in ETRS89-LAEA. The description and definition of ETRS89 is based on the convention of ISO19111, the 'Spatial referencing by coordinates' standard. For further documentation on ETRS89, see:

http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_RS_v3.2.pdf, and;

http://www.eionet.eu.int/gis

4.4. Geometric resolution – scale and minimum mapping units

The source data which will be used for the ecosystem type mapping vary in geometric resolution, as well as in the level of detail of the different ecosystem types. Hence, the output vector dataset containing the graphical representation of the ecosystem types should be delivered in scale between 1:10 000 and 1:25 000, depending on:

the used source data;

the ecosystem type on level 3.

The minimum mapping area should be between 0.1 and 0.25 ha also depending on the source data used and the mapped ecosystem type. The same apply for minimum mapping width of representing linear features: minimum 10 and up to 30m.

4.5. Data structure/schema

The structure of the database should follow the one provided in the Annex 9.00 – both on number of vectors and tables delivered the structure of each feature class and tables, and nomenclatures provided in the same Annex. The database schema in Annex 9.00 is provided in XML and Personal DataBase format – OCG and INSPIRE compatible.

The schema of the database for the ecosystem types is presented in Figure 1.

The detailed technical description of the classes and tables of the ecosystem types database is provided in Annex 9.01_Schema_Report_ES_Database in the file

9.01_1_Schema_Report_ES_Database.htm.

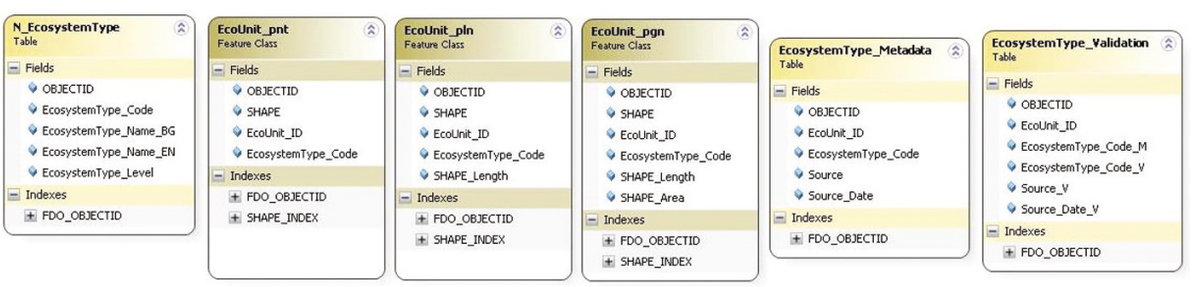


Figure 1: Ecosystem Types Database Schema

The following steps were undertaken for the creation of the geodatabase:

- Feature Class **"EcoUnit"** -this is the vector feature class which contains the information on ecosystem types at level 3. The attribute fields of the feature class which have to be filled are as follows:
- EcoUnit_ID: each object should have unique ID;EcosystemType_Code: this field should contain 3 digit value of the ecosystem type at level
- The value for the ecosystem code should be taken from the nomenclature table N_EcosystemType/EcosystemType_Code provided in Annex 9.02_NOMENCLATURES_XLS. This field is used for relating all the tables and feature classes in the database.

Since, the object geometry of the different ecosystem types could be point, polyline, or polygon, up to 3 feature classes **"EcoUnit"** could be generated and named as follows:

- **EcoUnit_pnt**: for objects with point geometry;

- **EcoUnit_pln**: for objects with polyline geometry;

- **EcoUnit_pgn**: for objects with polygon geometry.

- Table **"N_EcosystemType"**: Nomenclature table for ecosystem type levels at level 2 and 3. This table should not be changed. It has the following fields:

- EcosystemType_Code: integer codes for ecosystem types at level 2 and 3;

- EcosystemType_Name_BG: names in Bulgarian of ecosystem types at level 2 and 3;

- EcosystemType_Name_BG: names in English of ecosystem types at level 2 and 3;

- EcosystemType_Level: check field defining the level of each ecosystem type with values 2, for level 2 and 3 for level 3;

- Table **"EcosystemType_Metadata"**: Table providing information on datasources used when defining the ecosystem type for each feature from the Feature Class **"EcoUnit"**:

- EcoUnit_ID: field to relate with the feature class;

- EcosystemType_Code: integer codes for ecosystem types at level 3;

- Source: free description of the source used to map the specific ecosystem type for each feature;

- Source_Date: date of the source used to map the specific ecosystem type for each feature;

- Table **"EcosystemType_Validation"**: Table providing information on work performed to validate the thematic accuracy for the final product:

- EcoUnit_ID: field to relate with the feature class;

- EcosystemType_Code_M: integer codes for ecosystem types at level 3 of the final product;

- EcosystemType_Code_V: integer codes for ecosystem types at level 3 derived in the validation process;

- Source_V: free description of the source used to validate the ecosystem type;

- Source_Date_V: date of the source used in the validation.

4.6. Thematic accuracy and validation

The overall thematic accuracy for all ecosystem types should be >=85%.

The validation should be based on scientifically sound approach used for validation of the product thematic accuracy.

Apart from providing information in Table **"EcosystemType_Validation"**, the validation should be accompanied by Quality Control/Quality Check Reports for each ecosystem type.

4.7. Digital Maps for Ecosystem Types

Maps in scale 1:125 000 for the ecosystem types should be in PDF at size A2. In addition the maps could also be prepared in paper format in the same scale and size.

Each data frame should represent one cell from the EEA 50 km reference grid; hence up to 77 maps could be produced for all the cells of the 50 km EEA gird for Bulgaria. In case that no objects from Feature Class **"EcoUnit"** fall in certain cell, map for this cell should not be delivered. Therefore, the actual number of maps to be delivered will depend on the number of cells that contain at least one object from Feature "**Class EcoUnit**". The EEA reference grid is available at:

http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids/

Color codes for visualization of the ecosystem types at level 3 should be in accordance to these used in the European Map of Ecosystem types:

http://biodiversity.europa.eu/maes/mapping-ecosystems/map-of-european-ecosystem-types

The technical details for the map, as well as color codes are accessible at:

http://projects.eionet.europa.eu/eea-ecosystem-assessments/library/draft-ecosystem-map_europe/

The ecosystem types in the European Map of Ecosystem types are defined based on EUNIS classification. Hence, not all of the level 3 types determined for Bulgaria will correspond to the European ones. In this case, similar color codes should be used, which are closer to these of EUNIS classes. When generating these color codes the guideline of EEA should be used, available here:

http://www.eionet.europa.eu/gis/docs/EEA%20Corporate%20identity%20manual%20Map%20colour%20guide.pdf

The layout of the maps of the ecosystem types should follow the guidelines of EEA:

http://www.eionet.europa.eu/gis/docs/GISguide_v4_EEA_Layout_for_map_production.pdf

4.8. Metadata

Each dataset should be accompanied by INSPIRE conformal metadata. The minimum requirement is the metadata to be generated using the INSPIRE MetadataEditor:

http://inspire-geoportal.ec.europa.eu/editor/

5. Assessment of forest ecosystem condition (woodland and forests)

5.1. Steps for assessment of Ecosystem condition

Step 1: Identify the indicators of ecosystem condition for the given ecosystem type –level 3/4

- Indicators are a subset of the many possible attributes that could be used to quantify the condition of a particular landscape, catchment or ecosystem (Walker 1998). According to MAES (2013) choice of indicators should be seen not only by the need to be mapped, but it is essential subsequently to be used for further assessment of ecosystems and the services they provide. In this regard the indicators have to be able to:
    - provide information to policy makers and the wider public on the current condition and changes in the states of the environment in *Woodland and forest* ecosystems;
    - assist policy makers to better understand the linkages between the causes and effects of the impact of *Woodland and forest* ecosystems and agricultural policy on the environment, and help to guide their responses to changes in environmental states;
    - contribute to monitoring and evaluation of the effectiveness of policies in promoting sustainable management.
- There are potentially a large number of indicators that could be developed to help quantify the various components of environment. To assist in the choice of an operational set of indicators within this framework each indicator has to be examined against four general criteria:
    - policy relevance - the criterion of policy relevance relates to those identified environmental characteristics as being of importance to policy makers. While the list of indicators is evolving and must be flexible so as to incorporate new indicators or abandon old ones.
    - analytical soundness - the criterion of analytical soundness concerns, in particular, the extent to which the indicator can establish environmental characteristics, and thus refers more specifically to the attributes which provide the basis to measure the indicator. It should also be possible for the indicator to explain an environmental characteristics which is easy to interpret and applicable to a wide set of *Woodland and forest* ecosystems. The indicator should also be able to show trends and ranges of values over time, which might be complemented by nationally defined targets and thresholds where these exist;
    - primary data contribution and measurability - the criterion of measurability, relates to the appropriate data available to measure the indicator. The indicator should be developed from established national or sub-national data, scientific data and publications, data from other data sets available in third parties preferably using an expert based and long time series where this is available given the lengthy time period for many environmental effects to become apparent. Present work has revealed that while a considerable national and state database exists from which to calculate indicators, problems of data gathering, data providing, definitions, quality, the regularity of data collection and methods of indicator measurement remain obstacles to progressing the work on certain indicators. In an effort to overcome some of these difficulties, a discussion on development of approaches and methods for data exchange and providing between state authorities has begun;

- level of aggregation - the criterion of the level of aggregation seeks to determine at which level (i.e. sectoral, regional, national), the indicator can be meaningfully applied for policy purposes and not to conceal more than it reveals. This criterion highlights the issue of encapsulating the spatial and temporal diversity of the environment and the geographical scale of different environmental characteristics ranging from the single region to the global scale. In many cases national data are often collected on the basis of political and/or administrative units, such as sub-national regions (regions, districts, municipalities). There is no unique way to address the aggregation issue for each indicator and it is most effectively tackled pragmatically, on a issue-by-issue and indicator-by-indicator basis. Nevertheless, methods to provide national level indicators that take into account spatial diversity have to be assessed and developed based on spatial databases available at national and European level (CORINE, GMES) and for the purposes of facilitating international comparison.
- The proposed condition indicators assess the environmental condition (climatic, chemical, physical condition of ecosystems or land cover types) in *Woodland and forest* ecosystems.

We propose the following table with Indicators and their Rationales to be used for assessment of the Ecosystem condition. Condition indicators assess environmental condition (climatic, chemical, physical condition of habitat or land cover) in forest ecosystems. We have defined and quantified 23 indicators that are relevant for the forest ecosystem conditions. The indicators represent the ecosystems structure and ecosystem processes of forest types of ecosystems. For some of the parameters there is not available data or there is some information from publications, but only for single forest types.

Table 4. Rationales of ecosystem condition's indicators

Ecosystem condition Indicator group	Indicators/Rationales
Biotic heterogeneity	**Spatial or temporal variability of resources. Biotic heterogeneity is caused by organisms**. **It may occur even in absence of abiotic heterogeneity**. **To determine biotic factors and forest habitat diversity the following indicators are proposed**: *"Plant diversity",* *"Animal diversity",* *"Habitat diversity",* *"Invasive plant species",* *"Other biotic heterogeneity indicators (naturalness etc.)"* The ecosystem service projects using other indicators, must define them consistently to the current methodology.

Ecosystem condition Indicator group	Indicators/Rationales
Abiotic heterogeneity	**Spatial or temporal variability of abiotic resources and factors. Abiotic heterogeneity has abiotic origin.** To determine abiotic factors and abiotic heterogeneity the following indicators are proposed: *"Soil heterogeneity",* *"Hydrological heterogeneity",* *"Air heterogeneity",* *"Geomorphological heterogeneity",* *"Disturbance regime",* *"Other abiotic heterogeneity indicators"* The ecosystem service projects using other indicators, must define them consistently to the current methodology.
Energy budget	Ecological energy budget describes the ways in which energy is transformed from one state to another within different forest ecosystems. Includes analysis of inputs, outputs, and changes in the quantities stored. Ecological energy budget focuses on the use and transformations of energy in the components of forest systems. To account energy budget in forest ecosystems the following indicators are proposed: *"Energy balance (capture, storage)",* *"Entropy production",* *"Metabolic efficiency",* *"Other energy budget indicators"* The ecosystem service projects using other indicators, must define them consistently to the current methodology.
Matter budget	Matter budget describes the cycle in which matter is transformed from one state to another within the components of forest ecosystems. To account matter budget in forest ecosystems the following indicators are proposed: *"Matter balance (input, output)"* *"Matter storage" - biomass* *"Element concentrations (other state variables)"* *"Efficiency measures"* The ecosystem service projects using other indicators, must define them consistently to the current methodology.
Water budget	The cyclical movement of water between the atmosphere and the ground surface in forest areas, considering precipitation, stemflow, throughfall, evaporation, and runoff. The following indicators are proposed: *"Water balance (input, output)",* *"Water storage",* *"Other state indicators",* *"Efficiency measures"* The ecosystem service projects using other indicators, must define them consistently to the current methodology.

***Precised information is given in the xls file /Annex 6 to this Methodology/ where indicators applicable to forest ecosystems are checked. Those indicators which are not relevant to Woodland and forest ecosystems are marked N/A.**

Step 1-2

The assessment of "Biotic heterogenity" for all subtypes of Forests includes indicators and parameters as follows:

- Indicator "plant diversity" is proposed to be evaluated by parameters "Species compisition", "Stand dynamic phase" and percentage of "Grass cover".
- Idindicator "Animal diversity" should be accounted only by parameter "Red list species (animals)" – The information is available in each FMP.
- For "Invasive plant species" suitable parameter is "Presence of alien and invasive species". The data should be obtained from Forest protection services – Varna, Sofia, and Plovdiv. *For the indicator "invasive species" no spatial data are available /only data for the presence of invasive species available. The "Invasive species" in forest area have only single distribution and they do not cause any influence on the distribution of the natural forest habitats or on their development. If the invasive species are detected in the area a camparison should be implemented to monitor the future distribution of the invasive species and in order to prevent its expansion.*
- For "Habitat diversity" should be used parameters "Unevenaged or evenaged" forests as percentage, "Fragmentation" and Deadwood volume.

"Deadwood volume". Currently, no data available for deadwood volume in the forest database. The methodology for determination and assessment of deadwood volume is under development. It was already tested in two pilot areas - State forest enterprise "Svilengrad" and in State forest enterprise "Tsarevo". According to the Ordinance № 18 for inventory and planning of forest territories it is envisaged the approvement of common methodology for inventarisation of deadwood volume in the forest territories. It is suggested that this indicator will be optional at this stage and to be included later after the Methodlogy for assessment of deadwood volume is officially approved. "Fragmentation" – The available data in forest management plans is mainly about fragmentation caused by forest fires, pests and diseases, or as a resut of the harvesting for recostrunction in planted coniferous forests.

- For other biotic diversity indicators (naturalness etc.) should be taken into account the "General condition" of the ecosystems according to Ordinance № 18 from 07.10.2015 г., "Forest health condition" when there is available data from monitoring network of ICP Forests in Bulgaria Ordinance № 12 from 16 december2011 for protection of forest territories from pest, deceases and other damages.

With those indicators "Biotic heterogenity" will be described detail enough.

The "Abiotic heterogeneity" could be assessed by following indicators:

- "Soil heterogeneity". Parameters for evaluation is five level scale for "Erosion degree" and "Soil condition".In most cases "Soil condition" should be described with soil fertility. Where available the data for chemical soil properties (pH, organic C, base saturation, C/N ratio), related to soil acidity and eutrification should be also used. Those data, collected at national level based on more of two

soil surveys, each including all level I sample plots (ICP Forest sample plots) are available. Soil condition is Indicator for forest ecosystem condition, proposed by MAES project (see above). Data source – ExEA.

- "Geomorphological heterogeneity" can be described with relief parameters
- "Disturbance regimes". Parameters for disturbance are "Fires" with number of recorded fires and burnt area, "Wind and Snow falls and breaks" and "Defoliation", which indicates the response of forest ecosystem to changes, incl. climatic conditions, weather extremes, atmospheric depositions and insect and fungal infestations.

All Grading scales can be found in Ordinance № 18 from 07.10.2015.

Step 2: Identify the parameters of each indicator

For the set of indicators describing *Woodland and forest* ecosystems condition different parameters of evaluation are proposed. The selected parameters are easy measurable and for most of the indicators there are relevant parameters in current inventories database (land cover, biodiversity, soil conditions, etc.).

The main ecosystem condition indicators with parameters and data need are presented in Table 4.

Step 3: Collecting data – national data sets

Given the broad spectrum of scientific disciplines that cover the concept of ecosystem condition and services, a full assessment of the impact of drivers and pressures requires an interdisciplinary data combining approach. Such integrated assessment needs to be translated into suitable indicators for *Woodland and forest* ecosystems condition and services and subsequently to the benefits obtained from these services. Clearly, such development requires, strong scientific cooperation and considerable IT efforts (for instance see Schröter et al. 2005; Metzger et al. 2008).

The proposed methods are designed to minimize measurement problems and maximize the ability to make a plausible (if not definitive) case for demonstrating activity impacts within resource constraints for carrying out monitoring and evaluation activities.

The data sets comprise information on the forest resources and carbon stocks, forest ecosystem health and vitality, the productive functions of forests, forest biological diversity, the protective functions in forest management as well as the socio-economic functions and conditions.

The basic indicators to be used for assessing the condition and trends of the forests in Bulgaria are forest area or cover, the total growing stock, forest biomass, function of the forests, forest stand dynamic, and forest health condition.

Step 4: How to assess the ecosystem condition

Table 5. Ecosystem conditions indicator assessment for Woodland and forest

FORESTS ECOSYSTEMS									
Ecological condition indicators		Indicator	Parameter	Units	Measurment approach	Assesment scale and score				
Type	Indicator Group					Score 1	Score 2	Score 3	Score 4	Score 5
Ecosytem structure		Plant diversity	**species composition**	% pure, % mixed	% of Growing stock of related tree species	From 0 to 20 % mixed	from 21 to 40	from 41 to 60	from 61 to 80	from 81 to 100
			Stand dynamic phase	% of the stand dynamic phase (age)	Estimation FMP	81-100% young From Initial till Optimal subphase	61-80 % young From Initial till Optimal subphase	41-60 % From Initial till Optimal subphase	21-40 % From Initial till Optimal subphase	0-20 % From Initial till Optimal subphase
			grass cover	% cover age	Estimation	0-10 91-100	11-20 81-90	21-30 71-80	31-40 61-70	41-60
		animal diversity	Red list species	Presen-ce/ab-sence	Grid data according to the Red Data Book of Bulgaria; Forest Manage-ment Plans	0	Near threatened	Vulnarable	Endangered	Critically Endangered
		habitat diversity	evenaged, unevenaged	*Num-ber of layers Stand dynamic phase	Forest Manage-ment Plans	1 (100% unevenaged)	2 Young unevenaged forest	3 Mature forest with regene-ration	4 two-storey The first floor is mature	5 (100% unevenaged)

FORESTS ECOSYSTEMS									
Ecological condition indicators		Indicator	Parameter	Units	Measurment approach	Assesment scale and score				
Type	Indicator Group					Score 1	Score 2	Score 3	Score 4	Score 5
Ecosytem structure		habitat diversity	Deadwood volume	% of Stand-ing volume	Calculation	0 >50	31-50	5-10 21-30	16-20	11-15
			Fragmen-tation**	% of forest cove, % of stand borders contact	Calculation	0%, single stand	1-40 % surrounded by forests	41-60 % surrounded by forests	61-90 % surrounded by forests	90-100 % surrounded by forests
		Invasive species	Alien and invasive species presence	presen-nce/ab-sence	% of areas compared with the previous MP	>25	16-24	6-15	1-5	0
		Other biotic heterrogeity indicators (naturalness etc.)	general condition of the stand	three level scale bad mean good		bad adjacent also bad	bad adjacent mean or good	mean	good	Good adjacent also good
			forest health condition	four level scale ICP Forests	Forest patholo-gical prognosis	Severe (demaged)	Moderate adjacents with severe damages	Moderate (2-threshold for demaged)	Slight (1-warming stage)	Healthy (0)
		soil heterogeneity	erosion degree	five level scale	Estimation FMP	Very eroded	eroded	medium eroded	slightly eroded	No erosion

FORESTS ECOSYSTEMS									
Ecological condition indicators		Indicator	Parameter	Units	Measurment approach	Assesment scale and score				
Type	Indicator Group					Score 1	Score 2	Score 3	Score 4	Score 5
Ecosytem structure		soil heterogeneity	Soil condition Soil fertility	Scale of Pogre-bnyak	Estimation FMP	A	B, AB	C, BC	CD	D
		geomorpho logical	Inclination/ slope	degree	Estimation	Very steep >30	Steep 21-30	Inclined 11-20	Aslant 5-10	Plane 0-4
		Disturbance regime	fire regime***	number of recor-ded fires and burnt area	Estimation Compare with previous MP	Recorded fire within last 10 years	Recorded fire more than 10 years ago	Recorded fire more than 20 years ago 20	Recorded fire more than 30 years ago	No fire records for more than 40 years ago
			Significant **** wind and snow breaks and falls	Recor-ded dama-ges	Estimation Data from Forest protection service Every year	Recorded damage within last 10 years	Recorded damage more than 10 years ago	Recorded damage more than 20 years ago 20	Recorded damage more than 30 years ago	No damages records for more than 40 years ago
Ecosystem processes		matter storage	stocking index	% per sample area	Estima-tion/ calculation	<0,3	0,3-0,4	0,5-0,6	0,9-1,0	0,7-0,8
		matter storage	Growing stock	m^3/ha	Estima-tion/ calculation	<50	51-100	101-250	>500	250-500

Notes:

*Number of layers – one tree storey, two storey, dominant (solitaire) trees, regeneration (young generation) and understorey floor

** Fragmentation. Fragmentation should be evaluated on forest management unit insted of stand basis. Can be used the Manual for High conservation value forests.

*** Fire regime also will be estimated on forestry unit basis

****Significant snow and wind breaks and falls – Damages that affect more than 30% from standing volume.

In order to ensure reliability of data is needed to be carried out periodic measurements and setting parameter values. Monitoring period can be found in the Monitoring guide related to this Methodology.

The above listed indicators were chosen with aim to serve for a comprehensive assessment of the condition of this ecosystem type. They must be used as described in the present methodology. At the same time, the team realizing the practical assessment may add and test in assessment, after using the above listed, other new indicators – which are being recently developed and under development on European and national level or based on the good practices and practical experience - that the experts involved will consider useful, adequate or more appropriate for the purpose to comprehensively assess the ecosystem condition. Such indicators must be used by the same methodological manner – by determining parameters, units, measurement and assessment scale from 1 to 5, and must consist with the MAES research activities, guidelines and reports on the EU scale. The more convenient indicators to assess ecosystem condition are those reflecting naturalness, wilderness, status of representative species or species group and communities, high nature value areas, etc, which can rely with the grid used for mapping. More information regarding the efforts at the EU level to determine the most adequate and appropriate indicators to the ecosystem condition can be obtained via the web-pages of the institutions and research centers involved, for ex. http://projects.eionet.europa.eu/eea-ecosystem-assessments/library , where can be found publications such as "Developing conceptual framework for ecosystem mapping - part B Ecosystem condition mapping (draft)" and other relevant documents.
Such new indicators, proposed and tested in the course of the practical assessment, must be described in the final reports for task accomplishment and motivated proposals have to be made for the use of the indicators on question in future assessments. At the same time comments and estimations regarding the usefulness and applicability of the indicators listed in this methodology have to be made, on a basis of the experience acquired in their use.

Table 6. Ecosystem condition indicator assessment template and calculation – example

The proposed example relates to supcompartment *385 б, Kotel State Forest Enterprise*, High deciduous forest ecosystem type, **G1.7 :** Thermophilous deciduous woodland.

Indicator type	Indicator group	Indicator	Parameter	Units	Real data measured	Score
Structural	Abiotic	**soil heterogeneity**	erosion degree	five level scale	No erosion	5
			Soil condition	Soil fertility	C	3
		geomorphological	slope	degree	steep	2
		Disturbance regime	fire regime	number of recorded fires and burnt area	No fire records for more than 40 years ago	5
			Significant wind and snow breaks and falls	% of area	No damages records for more than 40 years ago	5
	Biotic	**Plant diversity**	**species composition**	% pure, % mixed	from 21 to 40	2
			Stand dynamic phase	age (years)	110	5
			grass cover	% coverage	30	3

Indicator type	Indicator group	Indicator	Parameter	Units	Real data measured	Score
Structural	Biotic	**animal diversity**	Red list species	number of species per unit area	<5	3
		habitat diversity	evenaged, unevenaged	% of area Number of woody structures	2	2
			Deadwood volume	% of Standing volume	No data	
			Fragmentation	% of forest cover,	e.g 85	3
		Invasive species	Alien and invasive species presence	presence/absence % of areas comared with the previous MP	No data	
		Other biotic heterrogeity indicators	general condition of the stand	three level scale	mean	3
			forest health condition	four level scale	No data	
Functional	Matter flow	**matter storage**	stocking index	%	0,7	5
			Growing stock			
	Water flow					
	…….					
	……..					
						$n_i = 46$
						IP = Σn_i 46 / Σn_{max} 65 = 0.7

*indicated condition scores: 1 – very bad; 2 – bad; 3 – moderate; 4 – good; 5 – very good

Explanation: for each indicator, according to its parameter' scoring, based on experts' assessments and further in-situ verification, the figures from 1 to 5 are assigned, according to the scale: 1 – 1 – very bad; 2 – bad; 3 – moderate; 4 – good; 5 – very good.

The scores of each indicator measured are then summed up (Σn_i).

An additional index of **ecosystem performance (IP)** is proposed for specific purposes in decision-making process. It is calculated as ratio of the sum of the indicators scores maximum possible indicator sum: - IP = $\Sigma n_i / \Sigma n_i(max)$ and belongs to the range (0 and 1)

Where:

Σn_i – the sum of the indicator's assessments

$\Sigma n_i(max)$ – sum of the maximum of indicator assessment (i.e. nx5)

The IP assessment scores for the different condition of the ecosystems are as follows:

IP 0-0,2 – very bad; 0,21-0,4 – bad; 0,41-0,6 – moderate; 0,61-0,8 – good; 0,81-1,0 – very good

In our case the ecosystem condition is 0,7 – good.

5.2. Mapping of Ecosystem condition

The following section describes the procedure of mapping the ecosystem condition, specifications of the final products for the maps and databases, and gives references to the Annexes to this document where database shema is provided in accordance to the specifications given hereafter.

5.2.1. Description of the mapping procedure

The workflow for mapping of ecosystem condition follows the steps described in section 5.1. The technical characteristics of the geodatabase are provided in section 4 and should be applied also for mapping procedures in this section.

5.2.2. Ecosystem Condition Data structure/schema

The data structure should follow the one provided in the Annex 9.00.

The schema of the database for the ecosystem states is presented in Figure 2:

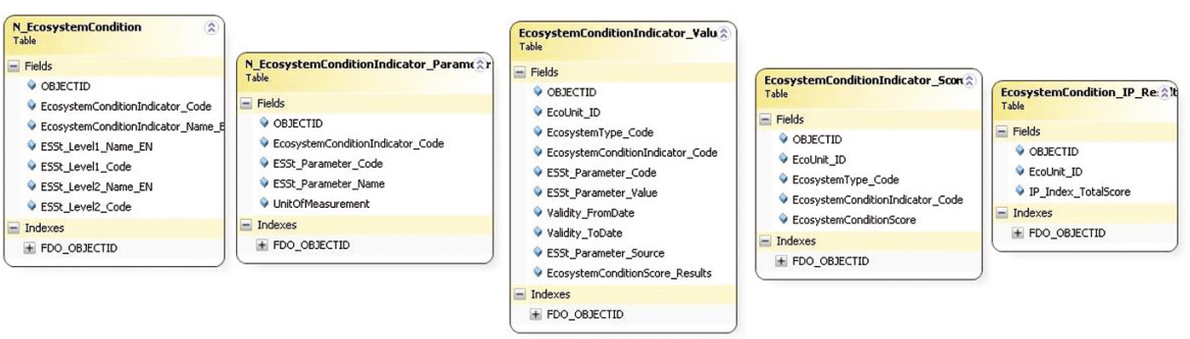


Figure 2: Ecosystem Condition Database Schema

The detailed technical description of the classes and tables of the ecosystem condition database is provided in Annex 9.01_Schema_Report_ES_Database in the file 9.01_1_Schema_Report_ES_Database.htm

The main steps of generation of the geodatabase should follow the steps described in section 5.1.:

- Table **"N_EcosystemCondition"**: Nomenclature table for ecosystem condition indicators. This table should not be changed. The nomenclatures are given in Annex 9.02_NOMENCLATURES_XLS / N_EcosystemCondition.xls. It has the following fields:

- EcosystemConditionIndicator_Code: integer codes for ecosystem condition indicators at level 3;

- EcosystemConditionIndicator_Name_EN: names in English of ecosystem condition indicators at level 3;

- ESSt_Level1_Name_EN: names in English of ecosystem condition indicators at level 1;

- ESSt_Level1_Code: integer code of ecosystem condition indicators at level 1;

- ESSt_Level2_Name_EN: names in English of ecosystem condition indicators at level 2;

- ESSt_Level2_Code: integer code of ecosystem state indicators at level 2;

- Table **"N_EcosystemConditionIndicator_Parameters"**: Nomenclature table of parameters used to determine the ecosystem condition indicator. The nomenclatures are given in Annex 9.02_NOMENCLATURES_XLS / N_EcosystemConditionIndicator_Parameter.xls. It has the following fields:

- EcosystemConditionIndicator_Code: integer codes for ecosystem state indicators at level 3;

- ESSt_Parameter_Code: integer codes for parameters used to assess the ecosystem indicators at level 3;

- ESSt_Parameter_Name: name of parameters used to assess the ecosystem indicators at level 3;

- UnitOfMeasurement: units of measurement for each parameter.

This nomenclature table should be generated using the example provided in Annex 9.02_NOMENCLATURES_XLS / N_EcosystemConditionIndicator_Parameter.xls, as well as the Table 5. *Ecosystem condition indicator assessment for XXX ecosystems*.

- Table **"EcosystemConditionIndicator_Values"**: This table is the resulting table from the assessment of the ecosystem indicators. How to perform the work on assessment of the indicators is described in Step 4 in section 5.1:

- EcoUnit_ID: field to relate with the feature class;

- EcosystemType_Code: integer codes for ecosystem types at level 3;

- EcosystemConditionIndicator_Code: integer codes for ecosystem condition indicators at level 3;

- ESSt_Parameter_Code: integer codes for parameters used to assess the ecosystem indicators at level 3;

- ESSt_Parameter_Value: value of calculated parameter used to assess the ecosystem indicators at level 3;

- Validity_FromDate: starting date for validity of the parameter;

- Validity_ToDate: end date for validity of the parameter;

- ESSt_Parameter_Source: free text to describe the source of the data used to calculate the value of the parameter;

- EcosystemConditionScore_Results: final score for each parameter calculated using the guidelines provided in Table 5. The values here should be between 1 and 5;

As this resulting table could contain enormous number of records which some GIS software could not support it is acceptable to separate it into smaller tables. In this case the records in the table should be separated based on the ecosystem types at level 3. The naming of the table should be done in the following way:

"EcosystemConditionIndicator_Values_XXX" – where XXX is the code of the ecosystem type at level 3.

- Table **"EcosystemConditionIndicator_Score"**: As for some indicator more than one parameter could be selected for measurement, additional table is required which represents the total score for each condition indicator calculated from the total score of parameters measured. Because some of the parameters could be more important than others, it is of responsibility of the expert to choose what will be the final score based on the values of the parameters calculated:

- EcoUnit_ID: field to relate with the feature class;

- EcosystemType_Code: integer codes for ecosystem types at level 3;

- EcosystemConditionIndicator_Code: integer codes for ecosystem condition indicators at level 3;

- EcosystemConditionScore: final score for each indicator calculated on the base of all parameters selected for its evaluation. The values here should be between 1 and 5;

In order the database to be more informative, one table for each condition indicator at level 3 should be prepared and named as follows: "**EcosystemConditionIndicator_Score_YYY"** where YYY is the code for condition indicators at level 3.

- Table **"EcosystemCondition_IP_Results"**: This table is the resulting table from the assessment of the ecosystem indicators and calculation of the IP for each ecosystem type at level 3. How to perform the work on assessment of the indicators is described in Step 4 in section 5.1:

- EcoUnit_ID: field to relate with the feature class;

- IP_Index_TotalScore: value for the index of ecosystem performance (IP) for each polygon representing ecosystem type at level 3. How to calculate the value is described in Step 4 in section 5.1 and an example is given in Table 7 *Ecosystem condition indicator assessment template and calculation – example*.

5.2.3. Accuracy and validation

The validation should be based on scientifically sound approach being able to assess the accuracy reached for each ecosystem condition parameter. For each validation accuracy reports should be generated and provided.

5.2.4. Digital Maps for Ecosystem Condition

Maps in scale 1:125 000 for the ecosystem condition should be delivered in PDF at size A2 presenting the results from calculation of the IP index. In addition the maps could also be prepared in paper format in the same size.

Each data frame should contain one cell from the EEA reference grid at 50km, hence up to 77 maps could be produced for all the cells from the 50km EEA gird for Bulgaria. In case that no objects from Feature Class **"EcoUnit"** fall in certain cell, map for this cell should not be delivered. Therefore, the actual number of maps to be delivered will depend on the number of cells that contain at least one object from Feature "Class **EcoUnit**". The EEA reference grid is available at:

http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids/

For visualization of the IP index graduated colors should be used. Five classes should be generated as follows: 1 – very bad (values > 0 to 0.20); 2 - bad (values > 0.20 to 0.40); 3 – moderate (values > 0.40 to 0.60); 4 – good (values > 0.60 to 0.80); 5 – very good (values > 0.80 to 1).

The colour ramp should use for class 1 blue color (CMYK:50;100;5;30), class 2 violet color (CMYK:18;100;0;0), class 3 pink color (CMYK:0;70;40;0), class 4 orange color (CMYK:0;30;100;0), and for class 5 green color (CMYK:40;5;100;0).

The layout of the maps of the ecosystem types should follow the guidelines of EEA:

http://www.eionet.europa.eu/gis/docs/GISguide_v4_EEA_Layout_for_map_production.pdf

5.2.5. Metadata

Each dataset should be accompanied by INSPIRE conformal metadata. The minimum requirement is the metadata to be generated using the INSPIRE MetadataEditor:

http://inspire-geoportal.ec.europa.eu/editor/

6. Assessment of ecosystem services

6.1. Identification of indicators, parameters, data

Forests are key providers of almost all ecosystem services when they are managed in a sustainable way. Ecosystem service assessments on various temporal and spatial scale in forest ecosystems can support generation of maps of where ecosystem services are supplied and /or demand, quantify the likelihood of forest land-use and its probable impact on ecosystem functions and service supply/demand, and understand the value and flow of benefits to human populations.

*Only supplied ecosystem services will be subject of this methodology

Assessment of ecosystem services in forest ecosystems is based on indicators as developed in MAES (2013). Additional indicators and relevant parameters are listed in table 6 in order to support more detailed assessment.

Provisioning services

The provisioning section includes those forest services related to forest production of biomass, water and energy. In this section there are a reasonably large number of indicators. Most of these services are related to forest biomass supply and the indicators' data are derived from Forest Inventories and statistics.

Within the provisioning FES the situation regarding water-related services seems more problematic because the identified indicators require some additional assessments and assumptions.

Regulating/ maintenance services

This section of FES seems to be not very well covered by available indicators. Most of the information to describe the indicators is derived from available data in Management plan and National statistics but in some cases some expert assusmptions are needed.

One of the important services provided by forests regarding “global climate regulation” is carbon storage (and carbon sequestration). Indicators for this service could be found in ExEA datasets.

Cultural services

Forest cultural services include the non-material outputs of forest ecosystems. Cultural services should be regarded as the physical settings, locations or situations that produce benefits in the physical, intellectual or spiritual state of people. They can involve individual species, forest habitats and whole ecosystems.

Important aspect for cultural indicators is the availability and access of readily available data on, for instance, number of visitors, data on distribution of wildlife, number of hunters, etc. as well as the availability of GIS maps usually needed for computing spatial indicators such as accessibility to forested areas.

The indicators and parameters for assessing the ecosystem services of *Woodland and forest* ecosystems are listed in Table 7 below.

The below listed indicators for ecosystem services were chosen with aim to assess these services as developed in CICES, the classification scheme accepted by the MAES-initiative. As said above concerning the ecosystem condition indicators, after using the indicators for ecosystem services assessment listed in this methodology, the experts involved in the assessment may propose other new indicators for assessment of the services, considered by them useful or more adequate for the purpose to comprehensively assess the ecosystem services that this ecosystem type provide. Such indicators, if any, must be used by the same methodological manner, as described in this methodology, and, after being tested, must be described and motivated proposals have to be made for their use in future assessment. Also comments and estimations regarding the usefulness and applicability of the indicators listed in this methodology have to be made, on a basis of the experience acquired in their use by the experts performing the assessment.

Full list of ecosystem servises provided by the ecosystems and the relevant ecosystem servises provided by the forest ecosystems are listed in **Annex 7_B4_ Table_ Indicators_ES_Services_Forests.**

Table 7. Indicators for assessing and mapping Ecosystem Services of woodlands and forest ecosystems

Section	Division	Group	Class	Indicator Measuring method	Parameters and units	Data sources	% error
Provisioning	Nutrition	Biomass	Cultivated crops	Harvest	m3/ha	Y	
			Reared animals and their outputs	Yield	livestock units/ha	Y	
			Wild mushrooms and their outputs	presence of mushrooms for food	number of species / kg/ha buying stations	Y	
			Wild animals and their outputs	Heads of animals reared for hunting	number/ha	Y	
				Fishing stock			
		Water	Surface water for drinking	forest cover, age	percentage of forest, age class	Y	
			Ground water for drinking	forest cover, age	percentage of forest, age class	Y	
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	timber, medicinal plants	m3, number of species	Y	
			Genetic materials from all biota	plant composition	trees composition, understory composition	Y	
		Water	Surface water for non-drinking purposes	forest cover, age	percentage of forest	Y	
			Ground water for non-drinking purposes	forest cover, age	percentage of forest	Y	
	Energy	Biomass-based energy sources	Plant-based resources for energy	trees and shrubs	stock, m3/ha	Y	

Section	Division	Group	Class	Indicator Measuring method	Parameters and units	Data sources	% error
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by biota	Filtration/sequestration/storage/ accumulation by micro-organisms, algae, plants, and animals	age distribution, increment	age class, m3/ha	Y	
		Mediation by ecosystems	Filtration/sequestration/storage/ accumulation by ecosystems	function of forests	% of protection forests and forests with other special functions	Y	
			Mediation of smell/noise/visual impacts	forest cover, age	Percentage of forest cover, age class distribution	Y	
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	Soil erosion rate	soil erosion rate	Y	
			Buffering and attenuation of mass flows	vegetation cover	area [ha]	Y	
		Liquid flows	Hydrological cycle and water flow maintenance	forest cover, age, stocking index	Percentage of forest cover, age class distribution	Y	
			Flood protection, incl. avalanche protection				
		Gaseous / air flows	Storm protection				
			Ventilation and transpiration				
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	Biodiversity	number of plants, number of pollinators	Y/N	
			Maintaining nursery populations and habitats	habitat diversity	number of habitats	Y	
		Pest and desease control	Pest control	General condition	4 level scale	Y	
			Disease control				

Section	Division	Group	Class	Indicator Measuring method	Parameters and units	Data sources	% error
Regulation & Maintenance	Maintenance of physical, chemical, biological conditions	Soil formation and composition	Weathering processes	site type	site type classification	Y	
			Decomposition and fixing processes	site type	site type classification	Y	
		Water conditions	Chemical condition of freshwaters			N	
		Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	C storage in forest, C sequestration by forest , Forest growth, growing stock		Y	
		Maintenace and protection of facilities	Protection of infrastructure , objects and facilities	Protection forests	%, type	Y	
			Micro and regional climate regulation			Y/N	
Cultural	Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	farm tourism,visitors (birdwatch, plantwatch	Number per year	Y/N	
			Physical use of land-/seascapes in different environmental settings	Visitors, rural tourism, walking and biking trails	Number per year	Y/N	
		Intellectual and representative interactions	Heritage, cultural	cultural monuments	number of monuments/products	Y/N	
			Entertainment	visitors, hunters	number of visitors, number of hunters	Y/N	
			Aesthetic				
	Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Spiritual and/or emblematic	Symbolic	Aesthetic landscapes,	presence of regional management plans	Y/N	
		Other cultural outputs	Existence	Conservation significance	Number of sites in protectedareas (e.g. Natura2000, Biosphere reserves,etc.)	Y/N	
			Bequest	Aesthetic landscapes		Y/N	

Y – supported with data based on expert opinion N – data available only for some regions

NB. Full description of Ecosystem services referred to specific urban ecosystems sub-types in listed in Annex 7.

6.2. Steps for assessment of ESS

The assessment of ecosystem services is a further step in the valuation process. There are various methods for ecosystem services assessment but common standards require to be quantifiable, replicable and affordable. Burkhard et al. (2012) propose general matrix for ecosystem service demands and provisions including all main ecosystem types. This matrix could be applied at national or regional level for decision making. For more accurate estimation, also for valuation economic potential, it should be considered that each service type is dependent on two factors: ecosystem area and condition. The better condition and larger the area the higher value of service should be provided. On some cases the provided ecosystem service doesn't depend strictly on condition of the ecosysytem. Some ecosystems in relatively bad condition provide high value service. It is not appropriate to compare between services as they are represented by different measurements. The applicants should collect precise data by each parameter and further on it will be subject of valuation.

Step 1. Indicators for Ecosystem services assessment for forests

Provisioning services are one of the most easy to understand. Food provision is fundamental service ensuring existence of human society. It includes plants, their fruits, reared and wild animals. Fibers, medicinal plants and other material from plant and animal species could be mapped using different parameters, but for the current purpose only one should be applied depending on the available data. Forests take part in regulating and maintenance process as control of erosion, buffering mass flow, pollination potential, maintaining existence of particular species and habitats. Assessment of this group of services is to be based on maps or models on national or European scale. Currently only scarce national or regional data is available. Further projects for additional measures and field data collection should be implemented.

Cultural services can be assessed in many different ways. They mostly are of non-material benefit for the society, but play important role. This is why selected parameters are more numerous as compared to other services.

Step 2: Collect data – national datasets

Egohetal et al. (2012) underlines that the primary data leads to more accurate representation of spatial distribution. However, currently most of the data should be derived from existing national and sub-national data sources. Methods that can quantify the uncertainty and validity of ES maps should be further explored.

The following data sources are to be considered:

- *Forest inventory data, Forest management plan*
- *MOEW - ExEA - CORINE project, national data bases*
- *Scientific publications*
- *In-situ data*
- *EU data sources*
- *Additional remote sensing data*

Step 3: How to assess

For the estimation of ecosystem services provided by given sub type of ecosystem the ecosystem service matrix should be used. It consist of ecosystem services (currently 12 regulating, 11 provisioning and 7 cultural services; according to Tables 7) on the x-axis and geobiophysical spatial units (e.g. the CORINE8 land cover types used here) on the y-axis. At the intersections, the different spatial units' ecosystem service potentials were assessed on a scale from 1 (Low relevant *capacity*) to 5 (*very high relevant capacity*) for a hypothetical 'normal' European landscape at one time point in summer before harvest. The normalization to this relative 1-5 scale aims at making different ecosystem services (measured and assessed by various indicators and units) comparable with each other.

The indicators and their parameters that should be used to assess ecosystem services for woodlands and forest ecosystems are listed in table 7 above.

The applicants should collect precise data by each parameter, filling data in “Scoring” table (table 8) which to allow to set up the dimensions of each indicator's parameter. Applicant should analyze the dimensions obtained and to elaborate appropriate scoring system. The scores values must be put in range from 1 to 5 where score 1 equals to the lowest rate of particular service provision and 5 equals to the highest rate respectively.

The assessment scale and scores given bellow are based on real parameters (measurable and available statistical data) and presents expert evaluations of the parameter`s dimensions, as an average on national scale, and can be seen as research hypotheses which are to be tested in further case study applications with data from measurements, modelling or additional expert assumptions.

Table 8. Scoring table for ecosystem service assessment

FOREST ECOSYSTEMS											
Section	**Division**	**Group**	**Class**	**Indicator**	**Parameters and units**	**Measur-ment approach**	**Assesment scale and score**				
							Score 1	**Score 2**	**Score 3**	**Score 4**	**Score 5**
Provisioning	Nutrition	Biomass	Cultivated crops	Harvest	m3/ha						
			Reared animals and their outputs	Yield	livestock units/ha						
			Wild mushrooms and their outputs	presence of mushroo ms for food	number of species / kg/ha buying stations						
			Wild animals and their outputs	Heads of animals reared for hunting Fishing stock	number/ha						
		Water	Surface water for drinking	forest cover, age	percentage of forest, age class						
			Ground water for drinking	forest cover, age	percentage of forest, age class						

FOREST ECOSYSTEMS											
Section	Division	Group	Class	Indicator	Parameters and units	Measur-ment approach	Assesment scale and score				
							Score 1	Score 2	Score 3	Score 4	Score 5
Provisioning	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	timber, medicinal plants	m3, number of species						
			Genetic materials from all biota	plant composi-tion	trees composition, understory composition						
		Water	Surface water for non-drinking purposes	forest cover, age	percentage of forest						
			Ground water for non-drinking purposes	forest cover, age	percentage of forest						
	Energy	Biomass -based energy sources	Plant-based resources for energy	trees and shrubs	stock, m3/ha						
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by biota	Filtration/sequestration/ storage/accumulation by micro-organisms, algae, plants, and animals	age distribution, increment	age class, m3/ha						
		Mediation by ecosystems	Filtration/sequestration/ storage/accumulation by ecosystems	function of forests	% of protection forests and forests with other special functions						
			Mediation of smell/noise/visual impacts	forest cover, age	Percentage of forest cover, age class distribution						
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	Soil erosion rate	soil erosion rate						
			Buffering and attenuation of mass flows	vegetation cover	area [ha]						
		Liquid flows	Hydrological cycle and water flow maintenance	forest cover, age, stocking index	Percentage of forest cover, age class distribution						
			Flood protection								
		Gaseous / air flows	Storm protection								
			Ventilation and transpiration								
		Lifecycle mainte-nance, habitat and gene pool protection	Pollination and seed dispersal	Biodiver sity	number of plants, number of pollinators						
			Maintaining nursery populations and habitats	habitat diversity	number of habitats						

FOREST ECOSYSTEMS											
Section	Division	Group	Class	Indicator	Parameters and units	Measur-ment approach	Assesment scale and score				
							Score 1	Score 2	Score 3	Score 4	Score 5
	Maintenance of physical, chemical, biological conditions	Pest and desease control	Pest control	General condition	4 level scale						
			Disease control								
		Soil formation and composition	Weathering processes	site type	site type classification						
			Decomposition and fixing processes	site type	site type classification						
		Water states	Chemical state of freshwaters								
			Chemical state of salt waters								
		Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	C storage in forest, C sequestration by forest , Forest growth, growing stock		National data, EFISCEN calculations					
			Micro and regional climate regulation								
		Maintenance and protection of facilities	Protection of infrastructure, objects and facilities	Protection forests	%, type	National data					
Cultural	Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	farm tourism, visitors (birdwatch, plantwatch	Number per year						
			Physical use of land-/seascapes in different environmental settings	Visitors, farm tourism, walking and biking trails	Number per year						
		Intellectual and representative interactions	Heritage, cultural	cultural monuments	number of monuments /products						
			Entertainment Aesthetic	visitors, hunters	number of visitors, number of hunters						
		Spiritual and/or emblematic	Symbolic	Aesthetic landscapes,	presence of regional management plans						

FOREST ECOSYSTEMS											
Section	Division	Group	Class	Indicator	Parameters and units	Measur-ment approach	Assesment scale and score				
							Score 1	Score 2	Score 3	Score 4	Score 5
Cultural	Spiritual, symbolic and other interact-ions with biota, ecosystems and land-/seascapes [environ-mental settings]	Other cultural outputs	Existence	Conser-vation significance	Number of sites in protected areas (e.g. Natura2000, Biosphere reserves,etc.)						
			Bequest	Aesthetic landscapes							

1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity

The assessment scale and score is based on real parameters (measurable and available statistical data) and presents expert evaluations of the parameter`s dimensions, as an average on national scale, and can be seen as research hypotheses which are to be tested in further case study applications with data from measurements, modelling or additional expert assumptions.

Each ecosystem service relevant to and provided by forest ecosystems then should be assessed at national level. After analysing information for the listed indicators, describing relevant ecosystem services for different types of forest ecosystems (from G1…. to G1…), the lowest and the highest values should be determined at national level. This allows assessing 100% of national coverage. Same approach could be applied at regional level (following Eurostat NUTS 2 regions for Bulgaria - http://ec.europa.eu/eurostat/documents/3859598/5916917/KS-RA-11-011-EN.PDF)
for more precise studies if necessary. The assessment score of relevant class of ecosystem service is the basis for further mapping of the real capacity of forest ecosystem to supply specific ES at national level as shown in Table 9.

Step 4: Fulfill the matrix

The template of the matrix with the proposed subtypes is presented in Table 10.

The ecosystem service matrix at national level consists of relevant ecosystem services (extracted from the table in annex 7) on the y-axis and each woodland and forest ecosystem sub-type on the x-axis. At the intersections, the different sub-type for realized ecosystem service supply should be assessed on a scale from 0 (no relevant supply) to 5 (maximum relevant supply) for a hypothetical 'normal' woodland and

Table 9. Matrix of scores given to each Class of ESs presented by ES/ES subtype – Example of scoring a representative ES.

	Type	High deciduous forest
	Subtype	G1.8
ESs class code	P2	1
	P3	3
	P4	3
	P5	5
	P6	5
	P7	4
	P8	3
	P9	2
	R1	3
	R2	3
	R3	4
	R4	3
	C1	4
	C2	4

Assessment scale: 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity

forest ecosystem defined by the experts at regional (national) level after completing step 3, having into consideration the complexity of woodland and forest ecosystems and their specifics. The score (1 to 5) obtained in Table (9) should be used as a basis to define the scores for each ecosystem service and the relevant ecosystem subtypes and the results should be filled in table (10). All services which are defined as not relevant for particular woodland and forest ecosystem subtypes (see annex7) will have 0 score in table 10. Furthermore, the ecosystem services marked as “not supported by data'' in annex 7 will have 0 score. This indicates that they have no relevant capacity at the time of the assessment due to the lack of data but could have higher scores in future assessments. The normalization to this relative 0 - 5 scale aims at making different ecosystem services (measured and assessed by various indicators and units) comparable with each other. The values obtained in the matrix are useful for detailed mapping of pilots and monitored regions (seeMonitoringGuide). It should be underlined that these values are indicative only for woodland and forest ecosystems.

Table 10. Summarized data for the forest types on a national level

		Forest ecosystem subtypes						
		G1.2	**G1.6**	**G1.7**	**G1.8**	**G1.A**	**G1.C**	**G1.D**
ESs class codes CICES	1111	0	0	0	0	0	4	4
	1112	1	3	3	2	2	1	0
	1113	1	3	3	2	2	1	0
	1114	1	3	3	2	2	1	0
	1121	4	5	5	3	2	1	1
	1122	3	4	4	4	2	2	2
	1211	5	5	5	5	5	5	5
	1213	2	2	2	2	2	2	2
	1221	2						
	1222	3	3	3	3	3	4	2
	1311	2	2	2	2	2	2	2
	2112	2	2	2	2	2	2	2
	2121	2	3	3	3	3	2	2
	2123	4	4	4	4	3	2	2
	2211	3	3	3	3	3	2	2
	2212	2	3	3	3	1	1	1
	2221	2	2	2	2	2	2	2
	2222	1	2	2	2	2	2	2
	2231	3	3	3	3	3	3	3
	2232	2	3	3	3	1	1	1
	2311	2	2	2	2	2	2	2
	2312	1	2	2	2	2	2	2
	2321	3	3	3	3	3	3	3
	3111	1	2	2	2	2	1	1
	3112	1	3	1	3	3	1	1
	3123	1	2	2	2	2	1	1
	3124	1	4	4	4	4	1	1
	3211	1	2	3	2	2	1	1
	3221	1	2	3	3	2	0	1
	3222	1	2	3	3	2	0	1

*The assessment scale reaches: 0 = no relevant capacity of the urban subtype to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. * ES is not supported by data at national level and value 0 is additionally attributed and indicates the lack of data.*

6.3. Mapping of Ecosystem services

The following section describes the procedure of mapping the ecosystem services, specifications of the final products for the maps and databases, and gives references to the Annexes to this document where database shema is provided in accordance to the specifications given hereafter.

6.3.1. Description of the mapping procedure

The workflow for mapping of ecosystem services follows the steps described in section 6.2. The technical characteristics of the geodatabase are provided in section 4 and should be applied also for mapping procedures in this section.

6.3.2. Data structure/schema

The data structure should follow the one provided in the Annex 9.00.

The schema of the database for the ecosystem services is presented in Figure 3:

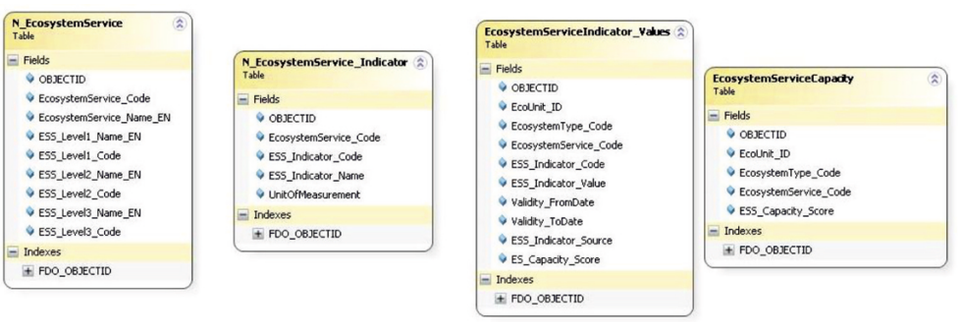


Figure 3: Ecosystem Services Database Schema

The detailed technical description of the classes and tables of the ecosystem services database is provided in Annex 9.01_Schema_Report_ES_Database in file
9.01_1_Schema_Report_ES_Database.htm

The main steps of generation of the geodatabase should follow the steps described in section 6.2.:

- Table **"N_EcosystemService"**: Nomenclature table for ecosystem services. This table should not be changed. The nomenclatures are given in Annex 9.02_NOMENCLATURES_XLS / N_EcosystemService.xls. It has the following fields:

  - EcosystemService_Code: integer codes for ecosystem services at level 4;
  - EcosystemService_Name_EN: names in English of services at level 4;
  - ESS_Level1_Name_EN: names in English of ecosystem services at level 1;
  - ESS_Level1_Code: integer code of ecosystem services at level 1;
  - ESS_Level2_Name_EN: names in English of ecosystem services at level 2;\
  - ESS_Level2_Code: integer code of ecosystem services at level 2;
  - ESS_Level3_Name_EN: names in English of ecosystem services at level 3;
  - ESS_Level3_Code: integer code of ecosystem services at level 3;

- Table **“N_EcosystemService_Indicator”**: Nomenclature table of indicators used to determine the ecosystem services. The nomenclatures are given in

Annex 9.02_NOMENCLATURES_XLS / N_EcosystemService_Indicator.xls.

It has the following fields:

- EcosystemService_Code: integer codes for ecosystem service at level 4;
- ESS_Indicator_Code: integer codes for indicators used to assess the ecosystem services at level 4;
- ESS_Indicator_Name: name of indicators used to assess the ecosystem services at level 4;
- UnitOfMeasurement: units of measurement for each indicator.

This nomenclature table should be generated using the example provided in Annex

9.02_NOMENCLATURES_XLS / N_EcosystemService_Indicator.xls, as well as the table 7 *Additional optional indicators, which could be applied in assessing and mapping ESs in XXX ecosystems* from this methodology.

- Table **“EcosystemServiceIndicator_Values”**: This table is the resulting table from the assessment of the ecosystem services. How to perform the work on assessment of the indicators is described in Step 3 in section 6.2:

- EcoUnit_ID: field to relate with the feature class;
- EcosystemType_Code: integer codes for ecosystem types at level 3;
- EcosystemService_Code: integer codes for ecosystem service at level 4;
- ESS_Indicator_Code integer codes for indicators used to assess the ecosystem services at level 4;
- ESS_Indicator _Value: value of calculated indicator used to assess the ecosystem service at level 4;
- Validity_FromDate: starting date for validity of the indicator;
- Validity_ToDate: end date for validity of the indicator;
- ESS_Indicator_Source: free text to describe the source of the data used to calculate the value of the indicator;

- ES_Capacity_Score: calculated value for ES; how to define the score for each indicator is explained in Chapter 6.2. / Step 1;

As this resulting table could contain enormous number of records which some GIS software could not support it is acceptable to separate it into smaller tables. In this case the records in the table should be separated based on the ecosystem types at level 3. The naming of the table should be done in the following way:

“EcosystemServiceIndicator_Values_XXX” – where XXX is the code of the ecosystem type at level 3.

- Table **“EcosystemServiceCapacity”**: As for some services more than one indicator could be selected for measurement, additional table is required which represents the total score for each service calculated from the total score of indicators measured. Because some of the indicators could be more important than others, it is of responsibility of the expert to choose what will be the final score based on the values of the indicators calculated:

- EcoUnit_ID: field to relate with the feature class;

- EcosystemType_Code: integer codes for ecosystem types at level 3;

- EcosystemService_Code: integer codes for ecosystem service at level 4;

- ESS_Capacity_Score: final score for each service calculated on the bases of all indicators selected for its evaluation. The values here should be between 1 and 5 and 0 for not relevant capacity; In order the database to be more informative, one table for each service at level 4 should be prepared and named as follows: "**EcosystemServiceCapacity_ZZZ"** where ZZZ is the code for services at level 4.

6.3.1. Accuracy and validation

The expert should provide scientifically sound approach to describe the accuracy reached for each ecosystem service indicator; hence validation approach should be applied. For each validation, accuracy reports should be generated and provided.

6.3.2. Digital Maps for Ecosystem Services

Maps in scale 1:125 000 for the ecosystem types should be delivered in PDF at size A2 presenting the results from calculation for Ecosystem Capacity. In addition the maps could also be prepared in paper format in the same size

Each data frame should contain one cell from the EEA reference grid at 50 km, hence up to 77 maps could be produced for all the cells from the 50km EEA gird for Bulgaria. In case that no polygons from Feature Class **"EcoUnit"** fall in certain cell, map for this cell should not be delivered. Therefore, the actual number of maps to be delivered will depend on the number of cells that contain at least one polygon from Feature "**Class EcoUnit**". The EEA reference grid is available at:

http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids/

At least one set of maps for the ecosystem services should be prepared. The maps representing the results for calculating the ecosystem services capacity is mandatory. For visualization of the capacity graduated colors corresponding to the colors in example matrix table (table 10) should be used. Six classes should be generated as follows: 0 - no relevant capacity of the freshwater sub-type type to provide this particular ecosystem service, 1 - low relevant capacity, 2 - relevant capacity, 3 - medium relevant capacity, 4 - high relevant capacity and 5 - very high relevant capacity.

The layout of the maps of the ecosystem services should follow the guidelines of EEA:

http://www.eionet.europa.eu/gis/docs/GISguide_v4_EEA_Layout_for_map_production.pdf

6.3.3. Metadata

Each dataset should be accompanied by INSPIRE conformal metadata. The minimum requirement is the metadata to be generated using the INSPIRE MetadataEditor:

http://inspire-geoportal.ec.europa.eu/editor/

7. Annexes

ANNEX 1 – B4

Terms and definitions

Term	Definition
Forest ecosystems	
Assessment	The analysis and review of information derived from research for the purpose of helping someone in a position of responsibility to evaluate possible actions or think about a problem. Assessment means assembling, summarising, organising, interpreting, and possibly reconciling pieces of existing knowledge and communicating them so that they are relevant and helpful to an intelligent but inexpert decision-maker (Parson, 1995).
Benefits	Positive change in wellbeing from the fulfilment of needs and wants (TEEB, 2010).
Biodiversity	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 (cf. Article 2 of the Convention on Biological Diversity, 1992).
Biophysical valuation	A method that derives values from measurements of the physical costs (e.g., surface requirements, labour, biophysical processes, material inputs).
Drivers of change	Any natural or human-induced factor that directly or indirectly causes a change in an ecosystem. A direct driver of change unequivocally influences ecosystem processes and can therefore be identified and measured to differing degrees of accuracy; an indirect driver of change operates by altering the level or rate of change of one or more direct drivers (MA, 2005).
Economic valuation	The process of expressing a value for a particular good or service in a certain context (e.g., of decision-making) in monetary terms (TEEB, 2010).
Ecosystem:	A dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit (MA, 2005). For practical purposes it is important to define the spatial dimensions of concern.
Ecosystem assessment	A social process through which the findings of science concerning the causes of ecosystem change, their consequences for human well-being, and management and policy options are brought to bear on the needs of decision-makers (UK NEA, 2011).
Ecosystem condition	The capacity of an ecosystem to yield services, relative to its potential capacity (MA, 2005). For the purpose of MAES, ecosystem condition is, however, usually used as a synonym for 'ecosystem state'.

Ecosystem function	Subset of the interactions between biophysical structures, biodiversity and ecosystem processes that underpin the capacity of an ecosystem to provide ecosystem services (TEEB, 2010).
Ecosystem process	Any change or reaction, which occurs within ecosystems, physical, chemical or biological. Ecosystem processes include decomposition, production, nutrient cycling, and fluxes of nutrients and energy (MA, 2005).
Ecosystem service	The benefits that people obtain from ecosystems (MA, 2005). The direct and indirect contributions of ecosystems to human well-being (TEEB, 2010). The concept 'ecosystem goods and services' is synonymous with ecosystem services. The service flow in MAES conceptual framework refers to the actually used service.
Ecosystem state:	The physical, chemical and biological condition of an ecosystem at a particular point in time which can also be referred to as its quality.
Even-aged stand	A stand of trees composed of a single age class in which the range of tree ages is usually ±20 percent of rotation
Floods	Number of recorded floods per year and % damaged areas of the total area
Fragmentation	fragmented habitats are those that were once contiguous but are now separated into smaller, isolated areas.
Functional groups of the species and their relative frequency	Set of species in given community constitute a functional group if they have similar functional characteristics related to one ecosystem service. This dependence on ecosystem service is defined by theoretical framework or by empirical evidence. Functional groups in vegetation science are known as plant functional types and in animal science as guilds. Relative frequency - relative representation of a functional group in a particular ecosystem.
Forest inventory	a set of objective sampling methods designed to quantify the spatial distribution, composition, and rates of change of forest parameters within specified levels of precision for the purposes of management
Habitat:	The physical location or type of environment in which an organism or biological population lives or occurs. Terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, whether entirely natural or seminatural.
Indicator	Observed value representative of a phenomenon to study. In general, indicators quantify information by aggregating different and multiple data. The resulting information is therefore synthesised.
Invasives (plant, animals)	invasive alien species (IAS) are non-native species that are deliberately or unintentionally introduced by human action outside their natural habitats where they establish, proliferate and spread in ways that cause damage to biological diversity.
Land cover	Land cover is the observed (bio)physical cover on the earth's surface.
Leaf area index	(LAI) the sum of all the upper or all-sided leaf surface areas projected downward per unit area of ground beneath the canopy

Management plan	a predetermined course of action and direction to achieve a set of results, usually specified as goals, objectives, and policies
Protected plant species	Habitats Directive in 1992 (Council Directive 92/43/EEC of 21 May 1992)
Relief	Plain (mean altitude 130-170 m a.s.l.), plain-hill (mean altitude 200-290 m a.s.l.), hill-lowlands (to be precised), mountainous (mean altitude 800-100 m a.s.l.), high-mountainous (mean altitude 1260 m a.s.l.) relief types based on hypsometric zoning
Restoration	Refers to the process of actively managing the recovery of an ecosystem that has been degraded, damaged or destroyed as a means of sustaining ecosystem resilience and conserving biodiversity (CBD, 2012).
Species diversity	Number of animal species for specified area incl. protected animal species - Habitats Directive in 1992 (Council Directive 92/43/EEC of 21 May 1992) and Birds Directive (Directive 2009/147/EC)
Standing volume	The volume of standing trees, living or dead, above stump measured over bark to the top. Includes all trees regardless of diameter, tops of stems, large branches and dead trees lying on the ground which can still be used for fibre or fuel. Excludes small branches, twigs and foliage.
Type of vegetation cover	Type of plant cover on the earth's surface – forest land, grassland, abandoned, pasture, allotment.
Understory	all forest vegetation growing under an overstory
uneven-aged stand	a stand with trees of three or more distinct age classes, either intimately mixed or in small groups
Value	The contribution of an action or object to user-specified goals, objectives, or conditions (MA, 2005).
Vegetation cover	the observed plant cover on the earth's surface
Woodland	A woodland is a small area of trees with an open canopy (often defined as having 40% canopy closure or less, i.e. 60% or more of the sky is visible) such that plenty of light reaches the ground, encouraging other vegetation beneath the trees. Since the trees are well spaced they tend to be short-trunked with spreading canopies. The term forest, by contrast, is usually reserved for a relatively large area of trees forming for the most part a closed, dense canopy (although canopy closure as low as 20% is accepted in some definitions).

ANNEX 2 – B4

List of acronyms

CICES	Common International Classification of Ecosystem Services
CLC	CORINE Land Cover
CORINE	Coordination of Information on the Environment
ExEA	Executive Environment Agency
EC	European Commission
EEA	European Environment Agency
EFA	Executive Forestry Agency
EFDAC	European Forest Data Centre
EFFIS	European Forest Fire Information System
FRA	Forest Resources Assessments
FAO	Food and Agriculture Organization of the United Nations
FMP	Forest Management Plan
ES	Ecosystem
ESC	Ecosystem Capacity
ESS	Ecosystem Services
EU	European Union
EUNIS	European University Nature Information System
GIS	Geographic Information System
GMES	Global Monitoring for Environment and Security programme
HD	Habitats Directive
ICP forest	the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
INSPIRE	Infrastructure for Spatial Information in the European Community
IP	Index of ecosystem Performance
JRC	Joint Research Centre
MAES	Mapping and Assessment of Ecosystems and their Services
MOEW	Ministry of Environment and Water
NGOs	Non-Governmental Organization(s)
UN	United Nations

ANNEX 3 – B4

Woodlands and forest ecosystem typology (Level 3 and Level 4)

	Level 3		Level 4 Description by EUNIS	Nomenclature(s)
1.	High decidious	**G1.** Broadleaved deciduous woodland Woodland, forest and plantations dominated by summer-green non-coniferous trees that lose their leaves in winter. Includes woodland with mixed evergreen and deciduous broadleaved trees, provided that the deciduous cover exceeds that of evergreens. Excludes mixed forests (**G4**) where the proportion of conifers exceeds 25%. The differences between same types at high deciduous and coppice are the stand origin and their longevity (forest stand dynamic).	**G1.1 + G1.2 + G1.3:** **G1.1.** Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix. Riparian woods of the boreal, boreo-nemoral, nemoral and submediterranean and steppe zones, with one or few dominant species, typically *Alnus*, *Betula*, *Populus* or *Salix*. Includes woods dominated by narrow-leaved willows *Salix alba*, *Salix elaeagnos*, *Salix purpurea*, *Salix viminalis* in all zones including the mediterranean. Excludes riverine scrub of broad-leaved willows, e.g. *Salix aurita*, *Salix cinerea*, *Salix pentandra* **G1.2.**Mixed riparian floodplain and gallery woodland - Mixed riparian forests, sometimes structurally complex and species-rich, of floodplains and of galleries beside slow- and fast-flowing rivers of the nemoral, boreo-nemoral, steppe and submediterranean zones. Gallery woods with Acer, Fraxinus, Prunus or Ulmus, together with species listed for **G1.1.** Floodplain woodland characterized by mixtures of *Alnus*, *Fraxinus*, *Populus*, *Quercus*, *Ulmus*, *Salix*. **G1.3** Alluvial forests and gallery woods of the mediterranean region. Dominance may be of a single species, of few species or	EUNIS classification Bulgarian forest site type classification 2011. **G1** **(G1.1, G1.2, G1.3, G1.6, G1.7, G1.A, G1.C, G1.D, G1.7D, G1.0)**

			mixed with many species including *Fraxinus*, *Liquidambar*, *Platanus*, *Populus*, *Salix*, *Ulmus*. Excludes mediterranean *Salix* woods (G1.1) and shrubby riparian vegetation (F9.3). **G1.6** - Beech woodland - Forests dominated by beech *Fagus sylvatica* in western and central Europe, and *Fagus orientalis* and other *Fagus* species in southeastern Europe and the Pontic region. Many montane formations are mixed beech-fir or beech-fir-spruce forests, which are listed under **G4.6** **G1.7 :** Thermophilous deciduous woodland - Forests or woods of submediterranean climate regions and supramediterranean altitudinal levels, and of western Eurasian steppe and substeppes zones, dominated by deciduous or semideciduous thermophilous *Quercus* species or by other southern trees such as *Carpinus orientalis*, *Castanea sativa* or *Ostrya carpinifolia*. Thermophilous deciduous trees may, under local microclimatic or edaphic states, replace the evergreen oak forests in mesomediterranean or mediterranean areas, and occur locally to the north in central and western Europe. **G1.A** : Meso- and eutrophic Quercus, Carpinus, Fraxinus,	

			Acer, Tilia, Ulmus and related woodland - Woods, typically with mixed canopy composition, on rich and moderately rich soils. Includes woods dominated by *Acer*, *Carpinus*, *Fraxinus*, *Quercus* (especially *Quercus petraea* and *Quercus robur*), *Tilia* and *Ulmus*. Excludes acid Quercus woodland (G1.8) and woodland with a large representation of southern species such as *Fraxinus ornus* or *Quercus pubescens* (G1.7). **G1.C** : Highly artificial broadleaved deciduous forestry plantations - Cultivated deciduous broad-leaved tree formations planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in clearly unnatural stands, often as monocultures. **G1.D** : Fruit and nut tree orchards - Stands of trees cultivated for fruit or flower production, providing permanent tree cover once mature. Extensively cultivated and old orchards are habitats supporting rich flora and fauna. **G1.7D** - *Castanea sativa* woodland, G1.7D1 - Helleno-Balkanic *Castanea sativa* forests *Castanea sativa*-dominated forests and naturalised plantations of the *Quercion frainetto* zone of the	

			Balkan peninsula, of northern Greece, including the Chalkidike peninsula, with irradiations in the *Ostryo-Carpinion orientalis aegeicum* zone. They appear to represent the main area of indigenousness of the species. **G1.0: Mixed Broadleaved deciduous woodland.** All other mixed broadleaved, with different species composition	
2 **G1.**	coppice	Broadleaved deciduous woodland Woodland, forest and plantations dominated by summer-green non-coniferous trees that lose their leaves in winter. Includes woodland with mixed evergreen and deciduous broadleaved trees, provided that the deciduous cover exceeds that of evergreens. Excludes mixed forests (G4) where the proportion of conifers exceeds 25%.	**G1.1 + G1.2 + G1.3:** **G1.1.** Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix. Riparian woods of the boreal, boreo-nemoral, nemoral and submediterranean and steppe zones, with one or few dominant species, typically *Alnus*, *Betula*, *Populus* or *Salix*. Includes woods dominated by narrow-leaved willows *Salix alba*, *Salix elaeagnos*, *Salix purpurea*, *Salix viminalis* in all zones including the mediterranean. Excludes riverine scrub of broad-leaved willows, e.g. *Salix aurita*, *Salix cinerea*, *Salix pentandra* **G1.2.**Mixed riparian floodplain and gallery woodland - Mixed riparian forests, sometimes structurally complex and species-rich, of floodplains and of galleries beside slow- and fast-flowing rivers of the nemoral, boreo-nemoral, steppe and submediterranean zones. Gallery woods with Acer, Fraxinus, Prunus or Ulmus, together with species listed for	**G1** **(G1.1, G1.2, G1.3, G1.6, G1.7, G1.A, G1.C, G1.0)**

			G1.1. Floodplain woodland characterized by mixtures of *Alnus*, *Fraxinus*, *Populus*, *Quercus*, *Ulmus*, *Salix*. **G1.3** Alluvial forests and gallery woods of the mediterranean region. Dominance may be of a single species, of few species or mixed with many species including *Fraxinus*, *Liquidambar*, *Platanus*, *Populus*, *Salix*, *Ulmus*. Excludes mediterranean *Salix* woods (G1.1) and shrubby riparian vegetation (F9.3). **G1.6** - Beech woodland - Forests dominated by beech *Fagus sylvatica* in western and central Europe, and *Fagus orientalis* and other *Fagus* species in southeastern Europe and the Pontic region. Many montane formations are mixed beech-fir or beech-fir-spruce forests, which are listed under **G4.6** **G1.7** : Thermophilous deciduous woodland - Forests or woods of submediterranean climate regions and supramediterranean altitudinal levels, and of western Eurasian steppe and substeppe zones, dominated by deciduous or semideciduous thermophilous *Quercus* species or by other southern trees such as *Carpinus orientalis*, *Castanea sativa* or *Ostrya carpinifolia*. Thermophilous deciduous trees may, under local microclimatic or edaphic states, replace the	

			evergreen oak forests in mesomediterranean or thermomediterranean areas, and occur locally to the north in central and western Europe. **G1.A** : Meso- and eutrophic Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus and related woodland - Woods, typically with mixed canopy composition, on rich and moderately rich soils. Includes woods dominated by *Acer*, *Carpinus*, *Fraxinus*, *Quercus* (especially *Quercus petraea* and *Quercus robur*), *Tilia* and *Ulmus*. Excludes acid *Quercus* woodland (**G1.8**) and woodland with a large representation of southern species such as *Fraxinus ornus* or *Quercus pubescens* (G1.7). **G1.C** : Highly artificial broadleaved deciduous forestry plantations - Cultivated deciduous broad-leaved tree formations planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in clearly unnatural stands, often as monocultures. **G1.0: Mixed Broadleaved deciduous woodland.** All other mixed broadleaved, with different species composition	

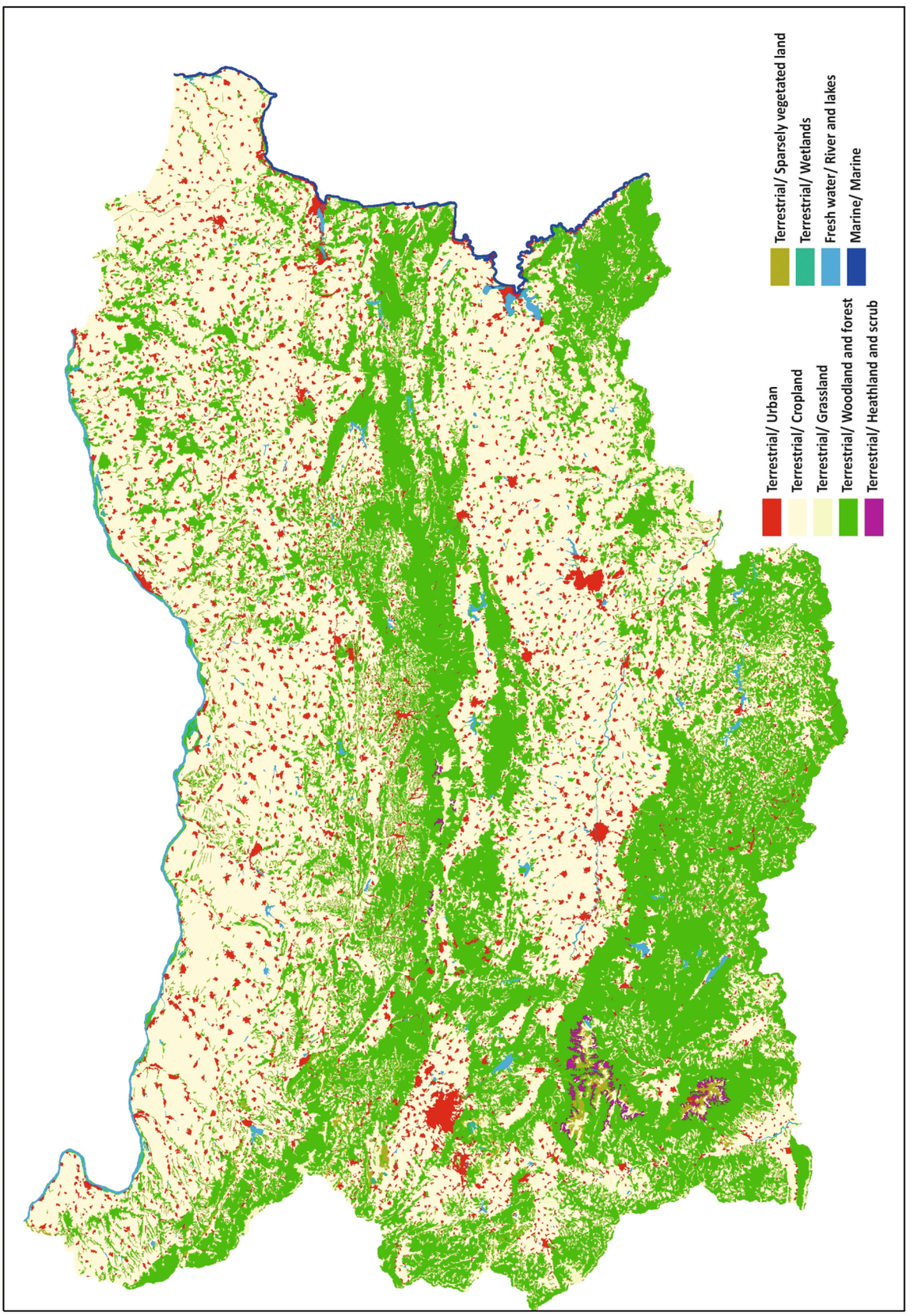
3	coniferous	**G3.** Coniferous woodland Woodland, forest and plantations dominated by coniferous trees, mainly evergreen (*Abies Cedrus*, *Picea*, *Pinus*, *Taxus*, Cupressaceae) but also deciduous *Larix*. Excludes mixed forests (**G4**) where the proportion of broadleaved trees exceeds 25%.	**G3.1** Fir and spruce woodland - Woodland dominated by *Abies* or *Picea*. **G3.4** Fir and spruce woodland - Forests of Pinus *sylvestris ssp. sylvestris and Pinus* sylvestris *ssp. hamata* of the Nemoral and Mediterranean zones and of their transitions to the Steppe zone. Included are, in particular, the forests of Scotland, of the Alpine system, of the Mediterranean peninsulas, of the lowlands of Central Europe, of the East European Nemoral zone and its adjacent wooded steppes, formed by *Pinus sylvestris ssp. sylvestris*, as well as those of Anatolia, of the Caucacus and of Crimea, formed by *Pinus sylvestris ssp.* hamata. Excluded are the formations situated within the range of natural lowland occurrence of *Picea abies*. **G3.5** Black pine (*Pinus nigra)* woodland - Forests dominated by pines of the Pinus nigra group. **G3.6 : Subalpine mediterranean Pinus woodland** Woods of *Pinus heldreichii*, *Pinus leucodermis* or *Pinus peuce*. **G3.9 : Coniferous woodland dominated by Cupressaceae or Taxaceae.** Woods dominated by Cupressus sempervirens, Juniperus spp. or Taxus baccata of the nemoral and Mediterranean mountains and hills.	**G3 (G3.1, G3.4, G3.5, G3.6, G3.9, G3.E, G3.F, G3.0)**

			G3.E : Nemoral bog conifer woodland. Woods of *Pinus* spp. or *Picea* spp., sometimes mixed with *Betula pubescens*, colonizing bogs and fens in the nemoral zone. Conifer-dominated bog woodland occurs mainly in the boreal and boreonemoral zones, but extends into the nemoral, wooded steppe and steppe zones. **G3.F** Highly artificial coniferous plantations - Plantations of exotic conifers or of European conifers out of their natural range, or of native species planted in clearly unnatural stands, typically as monocultures in situations where other species would naturally dominate. **G3.0 – Mixed coniferous forests.** All other mixed coniferous forests, with different species composition	
4	Mixed deciduous and coniferous woodland	**G.4 Mixed deciduous and coniferous woodland** Forest and woodland of mixed broad-leaved deciduous or evergreen and coniferous trees of the nemoral, boreal, warm-temperate humid and mediterranean zones. They are mostly characteristic of the boreonemoral transition	**G4.5** : Mixed Pinus sylvestris - Fagus woodland - *Pinus sylvestris* woodland south of the taiga (**G3.4**) intimately mixed with Fagus woodland (**G1.6**). **G4.6** : Mixed Abies - Picea - Fagus woodland - Forests in which *Fagus sylvatica* in western and central Europe or other *Fagus* species including *Fagus orientalis* in southeastern Europe and Pontic Asia (**G1.6**), is associated in the main canopy with fir *Abies* spp. and/or spruce *Picea* spp. (**G3.1**), sometimes with an admixture of	**G.4** **(G4.0, G4.F, G4.6, G4.5)**

		zone between taiga and temperate lowland deciduous forests, and of the montane level of the major mountain ranges to the south. Neither coniferous, nor broadleaved species account for more than 75% of the crown cover. Deciduous forests with an understorey of conifers or with a small admixture of conifers in the dominant layer are included in unit G1. Conifer forests with an understory of deciduous trees or with a small admixture of deciduous trees in the dominant layer are included in unit **G3**.	other conifers, in particular, pines *Pinus* spp. Characteristic of the montane level of the major European mountains south of the boreal zone. **G4.F** : Mixed forestry plantations - Mixed plantations of coniferous and deciduous species where at least one constituent is exotic or outside its natural range, or if composed of native species then planted in clearly unnatural stands. **G4.0. Mixed deciduous and coniferous woodland** All other mixed coniferous and deciduous forests, with different species composition and origin.	

* - G 1.0, G 3.0 and G4.0 are introduced stateally to comply with the hierarchical level. These include ecosystem types from the type, which can be found throughout the country but are with relatively small area.

Map of ecosystem types



ANNEX 5 – B4

National data sets

Subtype	DATABASE Sources – main stakeholders	
	Spatial	Quantitative/Qualitative
High deciduous forests	Forest management plans, MOEW – ExEA – ICP Forests, National Database for Biodiversity, National Soil Monitoring Network. Cadastre www.icadastre.bg National Concept for Spatial Development 2013-2025 EEA – CORINE – Land Cover	Executive forest agency - forest information system – forest inventory data Maps of restituted property, Action Plans for Programmes of Environmental protection, National Concept for Spatial Development 2013-2025, National Statistical Institute, , JRC, Publications, Project Reports, Environmental NGO FRA 2015/FAO/UN Forest Europe – Quantitative assessment
Coppice forests		
Coniferous		

Available as a spreadsheet at:
http://www.metecosmap-sofia.org/methodological-framework/

ANNEX 6 – B4

ECOSYSTEM CONDITION INDICATORS

Ecological condition indicandum			COPPICE FORESTS														
			G1,2,3					G1.6					G1.7				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			COPPICE FORESTS														
			G1,2,3					G1.6					G1.7				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			COPPICE FORESTS													
			G1.A					G1.C					G1.0				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			COPPICE FORESTS														
			G1.A					G1.C					G1.0				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			DECIDUOUS HIGH														
			G1,2,3					G1.6					G1.7				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			DECIDUOUS HIGH														
			G1,2,3					G1.6					G1.7				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			DECIDOUS HIGH														
			G1.A					G1.C					G1.D				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			DECIDOUS HIGH														
			G1.A					G1.C					G1.D				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			DECIDOUS HIGH										CONIFEROUS				
			G1.7D					G1.0					G3.1				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			DECIDUOUS HIGH										CONIFEROUS				
			G1.7D					G1.0					G3.1				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS														
			G3.4					G3.5					G3.6				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS														
			G3.4					G3.5					G3.6				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS														
			G3.9					G3.E					G3.F				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS														
			G3.9					G3.E					G3.F				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS					MIXED DECIDOUS AND CONIFEROUS WOODLAND									
			G3.0					G4.5					G4.6				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A					N/A				
		air heterogeneity	N/A					N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A					N/A				

Ecological condition indicandum			CONIFEROUS					MIXED DECIDOUS AND CONIFEROUS WOODLAND									
			G3.0					G4.5					G4.6				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)															
		entropy production	N/A					N/A					N/A				
		metabolic efficiency	N/A					N/A					N/A				
		other energy budget indicators	N/A					N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A					N/A				
		water storage	N/A					N/A					N/A				
		other state indicators	N/A					N/A					N/A				
		efficiency measures	N/A					N/A					N/A				

Ecological condition indicandum			MIXED DECIDOUS AND CONIFEROUS WOODLAND									
			G4.F					G4.0				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosytem structure	Biodiversity	plant diversity	species composition	% pure, % mixed	Y	-	once per 10 years	species composition	% pure, % mixed	Y	-	once per 10 years
			stand dynamic phase	age (years)	Y	-	once per 10 years	stand dynamic phase	age (years)	Y	-	once per 10 years
			grass cover	% coverage	Y	-	once per 10 years	grass cover	% coverage	Y	-	once per 10 years
		animal diversity	Red list species	number of species per unit area	Y	-	once per 10 years	Red list species	number of species per unit area	Y	-	once per 10 years
		habitat diversity	evenaged, unevenaged	% of area	Y	-	once per 10 years	evenaged, unevenaged	% of area	Y	-	once per 10 years
			Deadwood volume	m^3	N	V	once per 10 years	Deadwood volume	m^3	N	V	once per 10 years
			Fragmentation	% of forest cover	Y	V	once per 10 years	Fragmentation	% of forest cover	Y	V	once per 10 years
		Invasive species	Alien and invasive species presence	presence/ absence	Y	V	once per year	Alien and invasive species presence	presence/ absence	Y	V	once per year
		other biotic heterrogeity indicators (naturalness etc.)	general condition	three level scale	Y	-	once per 10 years	general condition	three level scale	Y	-	once per 10 years
			forest health condition	four level scale	Y		annualy	forest health condition	four level scale	Y		annualy
	Abiotic heterogeneity	soil heterogeneity	erosion degree	five level scale	Y	-	once per 10 years	erosion degree	five level scale	Y	-	once per 10 years
			Soil condition		Y		once per 10 years	Soil condition		Y		once per 10 years
		Hydrological heterogeneity	N/A					N/A				
		air heterogeneity	N/A					N/A				
		geomorphological heterogeneity	slope	degree	Y	-	once per 10 years	slope	degree	Y	-	once per 10 years
		Disturbance regime	fire regime	number of recorded fires and burnt area	Y	-	each year	fire regime	number of recorded fires and burnt area	Y	-	each year
			wind and snow breaks and falls	% of area	Y	-	each year	wind and snow breaks and falls	% of area	Y	-	each year
		other abiotic heterogeneity indicators	N/A					N/A				

Ecological condition indicandum			MIXED DECIDOUS AND CONIFEROUS WOODLAND									
			G4.F					G4.0				
Orientor type	Indicandum group		Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)	Parameters	Dimensions (measuring unit)	Available data (Y/N)	New data needed (tick by "V")	Periodisity of measuring (years etc.)
Ecosystem processes	Energy budget	energy balance (capture, storage)										
		entropy production	N/A					N/A				
		metabolic efficiency	N/A					N/A				
		other energy budget indicators	N/A					N/A				
	Matter budget	matter balance (input, output)	N/A					N/A				
		matter storage	stocking index	%	Y	-	once per 10 years	stocking index	%	Y	-	once per 10 years
			growing stock	m3/ha	Y		once per 10 years	growing stock	m3/ha	Y		once per 10 years
		element concentrations (other state variables)	N/A					N/A				
		efficiency measures	N/A					N/A				
	Water budget	water balance (input, output)	N/A					N/A				
		water storage	N/A					N/A				
		other state indicators	N/A					N/A				
		efficiency measures	N/A					N/A				

Available as a spreadsheet at:
http://www.metecosmap-sofia.org/methodological-framework/

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INDICATORS - ECOSYSTEM SERVICES

Section	Division	Group	Class	Indicator	Parameters and units	Data sources	coppice forests						decidous high								coniferous								Mixed deciduous and coniferous woodland			
							G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.0	G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.D	G1.7D	G1.0	G3.1	G3.4	G3.5	G.3.6	G3.9	G3.E	G3.F	G3.0	G4.5	G4.6	G4.F	G4.0
Provisioning	Nutrition	Biomass	Cultivated crops	Harvest	m3/ha	Statistics;												Y	Y													
			Reared animals and their outputs	Yield	livestock units/ha	Statistics;	Y	Y	Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
			Wild mushrooms and their outputs	presence of mushrooms for food	number of species / kg/ha buying stations	Statistics;	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Wild animals and their outputs	Heads of animals reared for hunting Fishing stock	number/ ha	Statistics;	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Water	Surface water for drinking	forest cover, age	percentage of forest, age class	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Ground water for drinking	forest cover, age	percentage of forest, age class	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	timber, medicinal plants	m3, number of species	Statistics;	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Genetic materials from all biota	plant composition	trees composition, understory composition		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Water	Surface water for non-drinking purposes	forest cover, age	percentage of forest	Water permits for the water body	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Ground water for non-drinking purposes	forest cover, age	percentage of forest	Water permits for the water body	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Energy	Biomass-based energy sources	Plant-based resources for energy	trees and shrubs	stock, m3/ha	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Section	Division	Group	Class	Indicator	Parameters and units	Data sources	coppice forests						decidous high								coniferous								Mixed deciduous and coniferous woodland			
							G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.0	G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.D	G1.7D	G1.0	G3.1	G3.4	G3.5	G3.6	G3.9	G3.E	G3.F	G3.0	G4.5	G4.6	G4.F	G4.0
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by biota	Filtration/ sequestration/ storage/ accumulation by micro-organisms, algae, plants, and animals	age distribution, increment	age class, m3/ha	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Mediation by ecosystems	Filtration/ sequestration/ storage/ accumulation by ecosystems	function of forests	% of protection forests and forests with other special functions	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Mediation of smell/noise/ visual impacts	forest cover, age	Percentage of forest cover, age class distribution	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	Soil erosion rate	soil erosion rate	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Buffering and attenuation of mass flows																														
		Liquid flows	Hydrological cycle and water flow maintenance	forest cover, age, stocking index	Percentage of forest cover, age class distribution	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Flood protection, incl. avalanche protection				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Gaseous / air flows	Storm protection				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Ventilation and transpiration				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Section	Division	Group	Class	Indicator	Parameters and units	Data sources	coppice forests						decidous high								coniferous								Mixed deciduous and coniferous woodland			
							G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.0	G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.D	G1.7D	G1.0	G3.1	G3.4	G3.5	G.3.6	G3.9	G3.E	G3.F	G3.0	G4.5	G4.6	G4.F	G4.0
Regulation & Maintenance	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	Biodiversity	number of plants, number of pollinators	Joint Research Center - IES	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Maintaining nursery populations and habitats	habitat diversity	number of habitats	national data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Pest and desease control	Pest control	General condition	4 level scale	ICP forest data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Disease control				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Soil formation and composition	Weathering processes	site type	site type classification	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Decomposition and fixing processes	site type	site type classification	Management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Water conditions	Chemical condition of freshwaters				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Chemical condition of salt waters																													
		Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	C storage in forest, C sequestration by forest , Forest growth, growing stock		National data, EFISCEN calculations	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Micro and regional climate regulation				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Maintenace and protection of facilities	Protection of infrastructure, objects and facilities	Protection forests	%, type	National data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Section	Division	Group	Class	Indicator	Parameters and units	Data sources	coppice forests						decidous high								coniferous								Mixed deciduous and coniferous woodland			
							G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.0	G1,2,3	G1.6	G1.7	G1.A	G1.C	G1.D	G1.7D	G1.0	G3.1	G3.4	G3.5	G.3.6	G3.9	G3.E	G3.F	G3.0	G4.5	G4.6	G4.F	G4.0
Cultural	Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Physical and experiential interactions	Experiential use of plants, animals and land-/seascapes in different environmental settings	farm tourism, visitors (birdwatch, plantwatch)	Number per year	national data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Physical use of land-/seascapes in different environmental settings	Visitors, rural tourism, walking and biking trails	Number per year	national data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Intellectual and representative interactions	Heritage, cultural	cultural monuments	number of monuments/products	national data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Entertainment	visitors, hunters	number of visitors, number of hunters	statistic	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Aesthetic																														
	Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]	Spiritual and/or emblematic	Symbolic	Aesthetic landscapes,	presence of regional management plans	national data	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
		Other cultural outputs	Existence	Conservation significance	Number of sites in protected areas (e.g. Natura2000, Biosphere reserves,etc.)	national data management plan	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
			Bequest	Aesthetic landscapes			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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ANNEX 9 – B4

Database templates and nomenclature tables

The baseline data set out in the methodological part and the tables and vector strata contained therein, as well as the ecosystem types and status indicators and ecosystem services nomenclature tables, are in digital format to this methodology.

The structure and content of the data under Appendix 9 is as follows:

1. Directory: 9.00_EcosystemDatabase_Schema

Database content of the methodology in several different formats:
- Ecosystem_DB_v07.diagram: Database Structure for Review in ArcGIS Diagrammer - Free software for creating, editing and analyzing schematics of geobase data
- Ecosystem_DB_v07.mdb: database structure in MDB format;
- Ecosystem_DB_v07. XML: database structure in XML format;
- Ecosystem_DB_v07. jpg: database schema in jpg format.

2. Directory: 9.01_Schema_Report_ES_Database

It contains a descriptive geobase data document including the specifications of all the tables and vector strings in it, as well as a description of all the attribute fields in them:
- 9.01_0_Schema_Report_ES_Database.htm: document describing the structure of the database.

3. Directory: 9.02_NOMENCLATURES_XLS

Contains nomenclature tables for ecosystem types and status and ecosystem services indicators:
- N_EcosystemType.xls: table in MS Excel format containing all ecosystem types at different hierarchical levels;
- N_EcosystemCondition.xls: MS Excel table containing nomenclatures for ecosystem status indicators up to level 3;
- N_EcosystemConditionIndicator_Parameter.xls: MS Excel table containing information on how to create a table for ecosystem status parameters for each specific ecosystem type;
- N_EcosystemService.xls: MS Excel table containing ecosystem services nomenclatures up to level 4
- N_EcosystemService_Indicator.xls: an MS Excel table containing information on how to create a table for ecosystem service indicators for each specific ecosystem type;
- Instruction_Nomenclature_Tables_ES_Condition_Services.docx: document in MS Word format containing a description of the sequence and specifics for filling in all the nomenclature tables of the Methodology as well as the tables in the database for each specific ecosystem type.

4. Directory: 9.03_Data_Maps

Contains the country map for Bulgaria for the EEA (European Environment Agency) reference grid with a country size of 50 km.

The data and documents in Annex 9 are available on:

http://www.metecosmap-sofia.org/methodological-framework/