lebensministerium.at

BUNDESMINISTERIUM
FÜR GESUNDHEIT

Field guide for a biodiversity inventory in the agrarian region

Vascular plants, butterflies, grasshoppers and habitat structures




Impressum

Herausgeber, Medieninhaber und Hersteller:
Bundesministerium für Gesundheit, Sektion II
Radetzkystraße 2, 1031 Wien

Für den Inhalt verantwortlich:
Mag. Ulrich Herzog

Erscheinungstermin:
November 2010

Autor:
Kathrin Pascher, Dietmar Moser, Leopold Sachslehner, Helmut Höttinger,
Norbert Sauberer, Stefan Dullinger, Andreas Traxler & Thomas Frank

University of Vienna, Faculty Centre of Biodiversity,
Department of Conservation Biology,
Vegetation Ecology and Landscape Ecology (CVL)

Gesamtprojektleitung, Koordination und Projektmanagement: Dr. Kathrin Pascher
Leitung: Univ. Prof. Mag. Dr. Georg Grabherr

Druck:
Kopierstelle des BMG, Radetzkystraße 2, 1031 Wien

Bestellmöglichkeiten:
Telefon: 0810/81 81 64
E-Mail: broschuerenservice@bmg.gv.at
Internet:. http://www.bmg.gv.at

ISBN 978-3-902611-44-4

Authors:

Kathrin Pascher, Dietmar Moser, Leopold Sachslehner, Helmut Höttinger, Norbert Sauberer, Stefan Dullinger, Andreas Traxler & Thomas Frank

University of Vienna, Faculty Centre of Biodiversity, Department of Conservation Biology, Vegetation Ecology and Landscape Ecology (CVL)

BINATS

Table of contents

Introduction

Development and application of the field guide

A uniform survey design is the prerequisite to collect standardised biodiversity data in the Austrian agrarian region in the future and to combine them with already existing data. Before its use this design should already be proven with respect to its practicability. The present field guide was developed during the research project "Biodiversity in Austrian agricultural regions with regard to the release of genetically modified crops" (**BINATS** - **BI**odiversity-**NAT**ure-**S**afety: PASCHER et al. 2007, 2008, 2009, 2010a, 2010b).

The project BINATS was commissioned and financed by the two Austrian Federal Ministries of Health (section II) and of Agriculture, Forestry, Environment and Water Management. It was realized between 2006 and 2009. BINATS focussed on the development and setup of a monitoring design to record biodiversity in agrarian regions with a maximum cost-benefit efficiency. BINATS provides an important tool for the detection and evaluation of unintended effects of genetically modified plants (GMPs). For this assessment, baseline data of the agrarian regions prior to the release of GMPs are necessary as a reference. But biodiversity inventory for risk assessment of GMPs is only one application of the developed design. Beyond that, the present field guide can also be used for all other implementations of biodiversity research. The BINATS program presents a methodical and organisational reference system into which additional indicators and their particular inventory needs can easily be integrated if necessary.

Short characterisation of the project BINATS

The project BINATS aimed at the development and setup of a monitoring program of biodiversity-related effects of GMP cropping which should ideally be applicable for both general surveillance and case specific monitoring. A classification of biodiversity for the Austrian agricultural areas exists only rudimentary (e. g. SAUBERER et al. 2004, TRAXLER et al. 2005a). For a regional risk assessment of GMPs, extensive plant and animal data have to be assembled with a systematic inquiry design.

Within BINATS, appropriate representative indicators were selected to identify GMP specific effects on biodiversity. These indicators should represent larger functional groups (e. g. primary producers, herbivores, pollinators) which are correlated with the diversity of as much un-surveyed taxonomic groups as possible. Moreover, they should respond sensitively and rapidly to changes in agrarian regions and should also be particularly relevant to the GMP topic due to specific hypothesised risks. Based on a cost-benefit calculation, the following four indicators were finally chosen: **habitat structures** and **vascular plants** -- which already have become standard elements of biodiversity monitoring programs in cultural landscapes -- as well as **butterflies** and **grasshoppers** (e. g. PASCHER et al. 2007, 2010a). Parameters such as relevance as a biodiversity indicator, significance concerning GMPs, applicability in a long-term monitoring, effort of field work, acceptance by farmers (e. g. soil entrapments), state of knowledge, experts' availability, etc. were evaluated when selecting these animal indicators.

Test areas representative for the various soil types, climatic conditions and cultivation intensities in the Austrian agricultural region were defined and chosen randomly with a focus on oilseed rape and maize cultivation areas. The developed monitoring design was tested in the field with respect to applicability and feasibility. It was standardised for future inventories of biodiversity in the agrarian region. Baseline data were collected as a reference to enable the detection of future trends in agricultural biodiversity driven by GMP cropping or by other changes in agricultural practices. With BINATS, a flexible monitoring system was implemented into which additional indicators can be integrated for an extended survey. A first nationwide risk assessment of special GMPs -- in particular oilseed rape -- was performed based on the occurrence and frequency of related species, i. e. potential hybridisation partners.

Data analysis and results are presented in the end report of the BINATS study (PASCHER et al. 2010a) as well as in other related publications (PASCHER et al. 2007, 2008, 2009, 2010b).

BINATS has created the basis for a long-term observation network of plant and animal biodiversity in the Austrian agricultural regions. It provides extensive data on habitat structures and the diversity of three different groups of organisms across the whole Austrian agricultural regions which can also be used for the general biodiversity research. As the development of the monitoring design considered a cost-benefit calculation, regular repetition should well be feasible. Time series and repeated revisions of the BINATS data are needed to be able to detect changes in biodiversity. The BINATS design meets the requirements of a flexible monitoring system into which additional indicators and their particular inventory needs can easily be integrated if needed.

The BINATS biodiversity network was particularly developed as a tool for the detection and evaluation of potential unintended effects of genetically modified plants (GMPs) on the biodiversity of agrarian regions across the whole Austrian agricultural region. To our knowledge, it is the first national monitoring and evaluation network of the European Member States which is methodically focused on GMPs. It allows for estimating site-specific biodiversity-related risks of GMP cropping even in advance of their release. Moreover, it provides a database that represents the fundamental prerequisite for detecting long-term effects of GMPs (PASCHER et al. 2000). Beyond that, BINATS can also be applied for a general biodiversity monitoring in agricultural areas as well as for OEPUL-evaluations.

Selection of test areas

We used a stratified random sampling procedure for selecting test areas for monitoring biodiversity in the Austrian agrarian regions (PASCHER et al. 2007, 2008, 2009, 2010a). For reasons of compatibility, we matched the biodiversity monitoring network to the grid of the Austrian Forest Inventory (ÖWI) and to the EEA reference grid (http://www.eea.europa.eu/data-and-maps/data/eea-reference-grids) which is used as the standard reference grid for all spatial statistic data in Austria. The cell size of the biodiversity monitoring grid was set to 625x625 m^2.

As the biodiversity monitoring program is focused on agrarian ecosystems, we restricted the area of interest to grid cells with less than 20% forests and settlement area. Because we were assigned to set up a monitoring network for the oilseed rape or maize growing areas, the area of interest was moreover restricted to areas exceeding 1% of oilseed rape and maize regional acreage during the period from 2002 to 2005, respectively, based on the database of IACS (integrated administration and control system; German acronym: InVeKoS). These restrictions resulted in a total of 1,144 grid cells (625x625 m^2) for oilseed rape and 1,568 grid cells for maize. The IACS is based on Council Regulation (EEC) No 3508/92 and Commission Regulation (EC) No. 2419/2001 and serves the handling and monitoring of the EU aid scheme. All provisions on the area and livestock aids are incorporated in this system. Among other things, it provides for a comprehensive data base system, an identification system for agricultural parcels, a system for the identification and recording of animals, more detailed information on the aid applications and the possibilities to modify them as well as for a harmonised control system.

For the stratification procedure, we chose five variables which had already proven to be good predictors for agrarian biodiversity and hence are supposed to be the basic variables which control biodiversity patterns. We were restricted, however, to variables which were available for the whole region of interest.

The five stratification variables were:

- diversity of soil types
- forest cover in close proximity of the 625x625 m^2 test area
- grassland cover
- average annual temperature
- average annual precipitation.

Spatial layers of these variables were intersected with our sample grid in a GIS and the grid cells were clustered with a K-means cluster algorithm into ten clusters (all statistical and GIS analyses were done in R and ArcGis, respectively). On a first pass, we selected 2x65 sites (for the maize and oilseed rape growing area each) which were inspected visually on aerial photographs to check if they met the monitoring requirements (i.e. less than 20% forests and settlement area). Moreover, we asked all farmers to grant permission for monitoring on their land. Denied access and rejecting of sites with more then 20% of forests resulted in a final selection of 2x50 test areas.

General recommendation for future conception:

A reserve of fifteen test areas proved to be insufficient because of the unexpected high number of farmers who denied work on their fields. For future test area selection, a higher number of reserve test areas is recommended.

General instructions for localising BINATS test areas and test circles

In contrast to the taxonomic indicators, the survey of habitat structures comprises the whole test area. Based on a methodical test in the field -- transects *versus* circles -- it was decided to collect data on the chosen biodiversity indicators vascular plants, butterflies and grasshoppers within ten test circles (each with a radius of 20 m) that were randomly distributed across each test area. The benefits of this method are a standardized sampling area and hence sampling intensity, the avoidance of a sampling bias towards specific habitat structures, a higher efficiency of field work, a more precise spatial positioning and fewer conflicts with land-owners. The survey of species number and animal individual number took place along a rectangular transect-cross with a side length of 20 m, oriented north-south and west-east, respectively.

It is not the aim of the survey to register as many scarce or valuable species as possible or perform an ecological interpretation of species composition. Equally, valuable habitats should not be acquired with priority. The surveys exclusively occur along the transect cross within the predefined, randomly positioned test circles. If records are not possible within the predefined test circles the circles have to be repositioned following an exactly defined indication (see below).

For a long-term repeatability of the assessed data the field guide for survey of the indicator groups has to be followed precisely.

<u>It is prohibited for the field surveyors to:</u>

- consider knowledge of former regional results
- disregard not identified species
- do fieldwork within a team
- include butterfly, grasshopper or vascular plant species occurring outside the predefined transect cross. (However, additional detections of interest can be recorded separately.)

If methodical decisions during field work have to be made, they should be noted in the field and immediately forwarded to the coordinator of the project who will inform the other co-workers.

Spatial setting of the test range

The test area

Size of the test area

The square test area covers a side length of 625 m. Within the test area ten test circles with a radius of 20 m are positioned randomly. In general, the position of all ten test circles is the same apart from those which had to be repositioned because of spatial necessity or abiding farmers' field entering prohibitions. These shifts should already be considered in the issued maps for the field biologists. Also the lettering of the test circles is fixed and indicated on the aerial photographs (see Fig. 1).

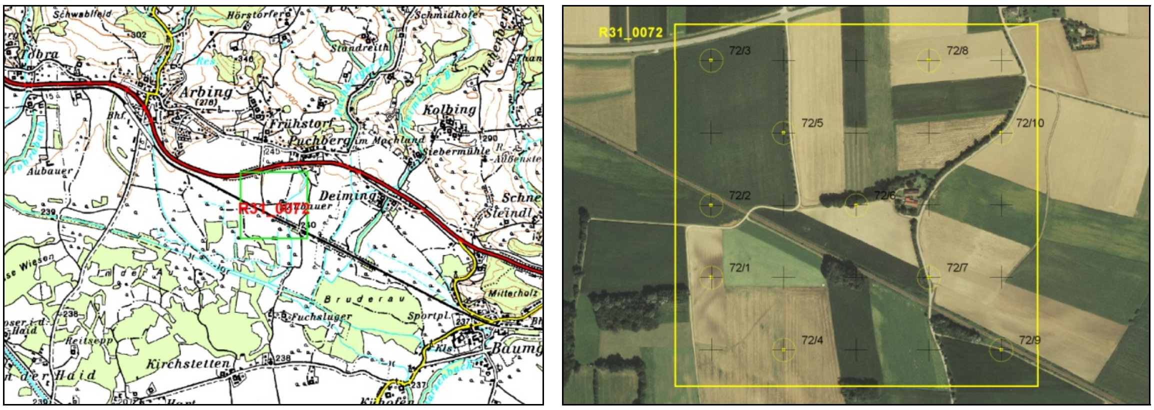


Figure 1: Position of the test area on the Austrian map (ÖK) and standardised position of the ten test circles (without repositioning, example taken from the BINATS project).

Location of the test area and the test circles

The exact position of the test area and its ten test circles can optically be identified using the Austrian map (ÖK) and the aerial photographs (Fig. 1). The location of the test circles can be determined with GPS (global positioning system) coordinates. Furthermore, a 25 m-transparent grid overlay is used for the spatial orientation which can be placed over the handed out aerial photographs. For using the scaling, the calibration of the length of personal step is necessary.

Note that there are three different transparent grid overlays in use to survey the Austrian agrarian region according to the particular meridian line (triangulation Bundesmeldenetz: BMN). Field biologists should pay attention to choose the appropriate transparent grid overlay for the particular test area. Furthermore, the transparent grid overlay has to be printed in exactly the same size of the test area maps. (Please use the same printer on which you printed the maps). With the use of compass, GPS, transparent grid overlay and calibration of pace, the localisation of the test circles should be possible. The test circle's centre will not be marked for the longer term. In case that a stone with 10 cm in diameter is present outside the test circle, the centre of that test circle -- especially when it is not located within a field -- can be marked. Thus, the process of localisation of the centre is facilitated and accelerated for the processors of succeeding indicator groups. Short-dated markers which help to guarantee that the researchers of the different indicator groups orientate exactly from the same test circle's centre are to be encouraged especially outside fields (e. g. stone cross, bamboo-cane).

The test circle

Localisation of the test circle

The surveyors of the vascular plants create exact drafts of the test circles during the first survey. As long as a field biologist carries a digital camera with him/her, informative digital photos serving for orientation should be made (see documentation of photos). Furthermore, exact descriptions of the test circles are to be produced which should support the mappers of the following animal indicators.

Concerning the survey of animal indicator groups, the field surveyors have to stick to the drafts and photos, also considering habitat type and type of utilisation within the test circles: e. g. 80 m maize field or 40 m sugar beet field, 35 m meadow and 5 m path.

Figure 2: Marking of test circles (photo: L. Sachslehner).

The field biologists are provided with a black-yellow tape for marking the position of the test circle within groves and forests. For a crude tagging, the tape is fixed around a (conspicuous) trunk in the centre or in close proximity to the test circle. This mark should support a faster localisation of the fixed position of test circles during following inventories (see Fig. 2).

Localisation of test circles during following inventories

The position of the test circle and its centre is documented by the person who conducts the first survey. This policy should help with a fast localisation of the exact position of the test circle when repeating surveys. The localisation should definitely be possible using map details, drafts of position, digital photos and descriptions of the first field surveyor. As the test regions are agrarian landscapes, a permanent marking of the test area is not feasible.

Necessity of a spatial shift of single test circles

After completion of test area selection the position of the ten test circles per test area is validated optically. If test circles were located within settlements, the circles are already shifted before starting the survey. Their final position is mapped on the issued aerial photographs. If the test circle cannot be mapped -- for example because of entering prohibition (private ground, fence) -- the first field biologist has to shift the position of the test circle along a predefined grid on the aerial photograph. The new position is marked on the aerial photographs which are given to the following workers. Thus the test areas which are issued on a CD or on sheets are all in an updated form. All indicated test circles on the maps that could be mapped during the first survey round have to be considered as fixed.

The test circle's centre should be reached in a way that the passage does not cross the sampling transects. This recommendation especially applies to the entomologists. Otherwise the animals could escape out of the transect. The cardinal points are measured with a compass. For the survey of animal indicators, a 20 m long tapeline has to be carried along by the biologists. Herewith, the radius in the directions N, S, W and E can be marked.

For better orientation, the width of the indicator specific sampling area can be marked using a dipstick. Independent of the projection of the test circle on the site, the grasshopper and butterfly species numbers are registered only in the predefined section in a radius of 20 m from the centre. Note: If the test circle is situated in a hillside or within a small hilly area -- strong difference in inclination -- the radius extent of the test circle will be larger than 20 m in projection.

Instructions for survey of vascular plants

The vascular plant survey takes place in a transect cross orientated towards the cardinal points. The transect cross is 20 m long and 2 m wide (1 m on the left, 1 m on the right side from the diameter). Species numbers are determined for each test circle. Within BINATS, the vascular plants serve as indicator for species diversity for the long-term and reproducible monitoring within the Austrian agrarian regions.

With regard to genetically modified crops, it is important to have knowledge about the regional occurrence and frequency of potential hybridisation partners. Hence, for a first risk assessment of oilseed rape it is required to register the relevant related species with an ordinal estimation scale. Furthermore, the occurrence of hybridisation partners of sugar beet in the test areas should be validated.

For a long-term reproducibility of the assembled data, the instructions have to be followed exactly.

<u>It is not permitted to:</u>

- consider knowledge of former regional results
- disregard non defined species
- do fieldwork in a team
- include vascular plant species occurring outside the predefined transect cross. (However, additional detections of interest should be recorded separately.)

First field biologists documentation of the test circle localisation

During the first vascular plant survey (April to the end of May) the field biologists had to create a detailed draft of all test circles -- or at least of the test circles which were difficult to localise (see draft sheet in the chapter on the report sheets of the biodiversity indicators). Drafts should give a rough glimpse of the localisation of the test circle (e. g. paced off distance and documentation of compass points from the centre for example to the next tree, mark occurring paths or dominant stones or rocks, field paths, field edges, etc.). If the field surveyor carries a digital camera, convincing photos should be taken. The 20 m tapeline should be set up towards North (minute the compass points) in the photos or the plant circle should be seen. The photo should be taken from a distance of 5 m outside the southern border of the test circle (focal length of 30 m). (If these instructions prove to be unpractical the project coordination should be informed immediately). For an oversight photo, the test circle should amount to a third of the picture. In case of a deviation from the predefined photographer position, the localisation of the photographer and the exact compass point should be marked in the draft. In some cases it could be useful to take a detailed photo (section approximately 3 m in wide) of the centre. (Please create a photo list for subsequent archiving.)

In all cases, the habitat structure types and the type of utilisation (list used for the grasshopper and butterfly survey, see report sheets in the appendix), respectively, should be pictured graphically. Their proportion should be indicated in percent of the whole test circle. The photos as well as the drafts must be forwarded to the project coordination until middle of June in the particular inventory year, at the latest. The drafts are then forwarded to the field biologists of the subsequent inventories in time, so the following inventories can be performed in the same spatial arrangement. For marking the position of the test circle within groves, the field biologists receive a black-yellow ribbon. Please fix that ribbon for a rough orientation on a log close to the test circle. Therewith it is assured that the test circle can be found quickly and in the exact position during subsequent inventories (see figure 2). For test circles which are difficult to be found a list of detailed local descriptions is made. Please note all important information and forward it to the project coordination.

Necessity of a spatial shift of single test circles

An optic validation of the position of all ten test circles directly follows the selection of test areas. If test circles are localised within settlements, the test circles will be shifted already before handing out the test area maps to the field biologists. If it is not possible to enter the test circle because of private property or a fence the position of the test circle has to be shifted along the predefined grid on the aerial photograph. The newly defined position has to be marked on the report sheet (see appendix). First of all, the test circle is shifted to 12 o'clock; if this is not possible it is shifted to three, six or nine o'clock. In case of a spatial shift of a test circle, the project coordination has to be informed immediately. The test circle should not be shifted into residential areas.

Preparation for the survey of vascular plants

Time period of survey

For vascular plant survey, each test area is mapped twice a year. Spring and summer aspects of vegetation are measured within the test circle.

vascular plant survey	**time period**
first survey (spring aspect)	15th April– 31st May
second survey (summer aspect)	1st August – 30th September

Planning the excursion

If possible, mapping should be performed considering the temperature gradient. That means, the test areas in the Eastern part of Austria (Pannonian climate) should be mapped before the test areas lying in the Western parts to capture the same flowering stage of the vegetation.

Equipment for the excursion

- synoptic table with the test areas
- Austrian map sections as a rough orientation to identify the localisation of the particular test area
- map section of the test areas including the test circles which have to be assessed
- list of GPS coordinates of the exact position of test circles
- 25 m transparent grid overlay
  Note, there are three different transparent grid overlays according to meridian lines available (triangulation Bundesmeldenetz: BMN).
- measuring wheel

- GPS and/or handheld computer
- compass
- tapeline (20 m)
- dipstick (2 m)
- if possible self-made „plant-compasses“: stick with a 20 m string
- marking tape (black-yellow)
- pocket knife or scissors
- folding magnifier
- biodiversity field guide with detailed instructions for field work
- report sheets: per test area at least 10 sheets (per test circle one complete report sheet and for the first survey a draft sheet) plus additional sheets for the plant species lists
- plant identification literature (ADLER et al. 1994)
- plastic bags for plants which cannot be identified immediately
- writing utensils: water resistant pens for marking of plastic bags as well as pencils and ball pens
- clock for measuring the exact processing time
- mobile phone for urgent queries in the field and for making arrangements with other field biologists
- driving licence or identity card to be able to identify oneself (in encounters with furious farmers this could be helpful)
- information sheet for farmers inquiring in the field (for protection, the name of each field biologist is listed there)
- notebook for recording the mileage (for verification, store it in car)
- form to fill in the kilometres which have been driven by car to be handed in to the project coordination

The day tours on the test area are to be planned in that way that the covered ways between the test circles should be kept as short as possible. The areas on the map which should not be entered are marked in red colour. Please consider these entering prohibitions when planning your walking route. Considering a calculation based on field tests it should be possible to completely map a test area with ten test circles within one working day. If this is not possible on single test areas please not the additional working time and inform the project coordination.

Performance of the vascular plant survey

Requirement

As a rule, surveys of vascular plants should be made on days without strong rain because otherwise the concentration of the field biologist could be weakened.

Before starting the vascular plant survey

First of all the exact geographic position of the test area has to be determined, and after that the position of the particular test circle. GPS coordinates, maps, transparent grid overlay and calibrated steps should enable the exact localisation of the test circles. If there could be problems to identify the exact location of the circle for the following field biologist a detailed documentation of the test circle’s centre should be made (see chapter: position of test circles). If a digital camera is available photographs can also provide essential information. On the draft sheet records concerning different types of habitats and types of utilisation, respectively should be noted. Furthermore, there should be details about the proportion of these different types to facilitate the orientation of subsequent field biologists (butterflies, grasshoppers, 2nd vascular plants survey round).

Sampling area

A transect cross serves as the sampling area. Starting in the centre of the test circle, a line of 20 m extending to the cardinal points has to be followed first in the direction North, then from the centre to South and then again starting from the centre to West and East. Data are collected on these four 20 m lines, 1 m on the right side from the line and 1 m from the left side respectively (in total 2 m in width).

Implementation of species number recording of vascular plants

- Note the exact time of the starting point of the survey for each test circle.
- All vascular plant species -- wild living as well as cultivated species -- which occur in the sampling area should be recorded on the report sheet. Additionally, the total species number should be given.
- Individual numbers of each species within the transect cross are not relevant for this survey. The only exception in connection with GMP is the mapping of hybridisation partners of oilseed rape and sugar beet (see appendix).
- Algae, mosses and fungi are not registered.
- Ornamental plants growing in private gardens and parks will not be registered.
- Planted non-native species being part of hedges or shelterbelts will be registered as well as mixed sowings for meadows.
- Parts of plants hanging over the sampling area will not be included. Only those plant individuals are counted within the transect cross (4 x 20 m x2 m) whose stems directly grow within the defined area.
- Winding and rambling plants will only be considered for the survey as long as they root in the soil within the sampling area.
- Seedlings are registered if the first two foliage leaves (except cotyledons) are unfolded and if they are identifiable by the field biologist.
- Dying or dead plants are counted as far as they have been living during the year of survey (as an example dying after herbicide application, completion of the growing season.
- Dead woody plants are not considered.
- Seeds (also germinating ones) are not considered.
- If possible, the leptophyllous *Festuca*-species should be identified because they are classified as ecologically valuable. *Rosa canina, Rubus fruticosus* and several species of the genus *Taraxacum* (see ADLER et al. 1994) have only to be registered on the level of aggregates. With the genus *Hieracium* field biologists should focus on the identification on the main species (see ADLER 1994). The detailed classification of the new identification key of FISCHER et al. (2005) is not allowed to be used. The genera *Achillea* and *Viola* should be identified exactly although there could be some problems with determination. During data input into the common biodiversity database, at the latest, it has to be ascertained that all involved field biologists specify the identified species using the same level (aggregate, subspecies).
- Species lists which directly cover fields should also contain the cultivated crops as separate species.
- If vascular plants are present and accessible also submerged parts of the sampling areas are recorded (e. g. banks of ponds and lakes, flooded areas, streams, etc.)
- The “old” version of the Austrian identification key is used for the survey (ADLER et al. 1994).

- If it is not possible to identify plant species with the provided literature, herbarium specimens have to be prepared. No more than two minutes should be exerted for the identification of a species during field work.
- It is not allowed to remove plants for herbarium specimens directly from the test circle. An individual of the same species has to be found outside the sampling area which can be removed. The herbarium specimens have to be complete which means that also the subterranean parts have to be included.
- If the species can still not be identified definitely, it should be listed in the table with additional species. If there are more than one unidentified species, address them with additional species 1, additional species 2, additional species 3, etc.
- If several identified species which cannot be determined exactly belong to the same genus or family list a continuous number after the genus or family name (e. g. Asteraceae 1, Asteraceae 2).
- Start recording of species in a list beginning in the first habitat type. If the habitat type (e. g. maize field followed by an oilseed rape field or by a field margin) changes, start a new list in a new column. Species which already occurred in habitat type 1 are marked in the habitat type 2 column with an x. Per each occurring habitat type within the sampling area (transect cross) a new complete list is produced. This information should provide the possibility that future landscape changes may be measured in data analyses. The estimated length should be measured for each habitat type along the transect cross. If a test circle as a whole is for example located in a maize field, a total length of 80 m is recorded (4x the radius of 20 m in all four cardinal points). Information about the particular compass points of the sampling line is not necessary. A separate column has to be used for each crop species (new field). But if, for example, three maize fields are located within a test circle – although not adjacent to each other -- only one plant species list is made for all maize fields. Species lists of the different habitat types (columns) will be put into the database as layering.
- Biodiversity survey in connection with genetically modified plants:
  The occurrence of potential cross breeding partners of oilseed rape as well as sugar beet (weedy beets, feral beets) has to be registered. Those species are considered which are present within the defined sampling area of the transect cross in each test circle (20 m from the centre going to N, S, W, E and 2 m in width: 1 m left and right from the radius) and are listed as relevant species on the report sheet. Their frequency has to be estimated using a logarithmic estimation scale (see vascular plant report sheet).
- In case no plant species is found within a test circle, this should also be noted. Further information should be given in the column “Comment” (e. g. totally sealed area, ploughed up fields). In each case, a separate protocol for each test circle has to be produced.
- The protocols should be legible. Illegible protocols or protocols which have severely been affected by strong rain have to be copied by the field biologist immediately after field work.
- Field biologists retain the original protocols until data input into the biodiversity database is finished. In case that the field surveyor of the “spring round” is not identical with the field biologist of the “summer round” on the same test area, a legible copy of the protocol should be passed further to the project coordination in time.

Completion of the vascular plant survey within the test circle

- Check the protocol for completeness.
- Critically verify all not exactly determined species.
- Note and announce a performed spatial shift of test circles.
- If necessary, clean and remove marks of the survey.
- After finishing the last of the ten test circles, note the exact total time which was needed for the whole survey also including the time for the exact determination of the position of the test circles.

If methodical decision during field work should be necessary which are not regularized in detail in these instructions they should be noted and immediately passed on to the project coordination.

Morphological description of frequently occurring species of the tribe Brassiceae (relevant potential closely related hybridisation partners of oilseed rape)

Brassica napus: occurs outside fields (roadsides, waste, docks, tips, riverbanks, etc.): feral or volunteers in follower crops, glaucous foliage leaves (FL), the buds overtopping (rarely equalling) the flowers, pedicels as long as or just a little longer than the blossoms, petals 2x as long as the sepals, upper FL half stem clasping, lower FL slightly hairy to glabrous, the upper leaves mostly totally glabrous.

Brassica rapa: Rosette leaves grass-green, steam leaf (SL) green to slightly glaucous, open flowers equalling or overtopping buds, pedicel always longer than the flowers, calyx lastly in a horizontal position, petals approximately 1.5x as long as the sepals, shortly unguiculate or at least the upper FL completely stem clasping, all FL mostly hairy to different degrees.

Raphanus raphanistrum: petals white to yellow (rarely purple), always with dark veins, fruits constricted like a string of pearls.

Sinapis alba: FL pinnate to irregularly pinnatisect, fruits terete to compressed, two-edged, fruits hairy, fruit beak at least as long as the fruiting body.

Sinapis arvensis: FL mostly simple and undivided, the lower ones with margins coarsely and irregularly toothed to lobed or pinnatisected, total fruit with beak with four edges, glabrous or covered with short retrorsely directed hair, fruit beak shorter than the remaining fruit, shoulders of steam leaves purplish.

Second vascular plant survey round – summer aspect

In general, the procedure of the second vascular plant survey round (summer aspect) is the same as in the first round (spring aspect). Because feasibility of the position of the test circles has already been confirmed in the field, there is no need for a spatial shift of a test circles. But please note an already performed test circle shift and take the adapted orthophotograph with you. New report sheets are used, the sheets of the first round are not continued. The report sheets should be carried along as a copy. Hence, wrong or impossible determinations of species can be adjusted. Field biologists of the second round should especially concentrate on species which could not been identified to the species level in the first round. The description of the first round can be used for clarification. If it is possible to identify the species it has to be corrected or added in the report sheet of the first round. In case that it is not possible to identify the species also during the second inventory round it remains in the sheet as an additional species. It is essential that after finishing the second survey each not definitely identified species is rated following the above instructions.

If the field biologists changes between the first and the second inventory round the first field biologist should contact the second biologist already before the second inventory round starts. Previous report sheets should be obtained. There should be a consultation concerning critical species or important information about particular test circles before starting the second round.

Special instructions for the field work

Motorways

After supervision of the test areas there are several motorways which cross the defined test areas. Please be aware of present motorways in test areas as well as in test circles. Please consider your own safety and do not take any risk.

Bridges

Only species which root in the soil under the bridge are registered. Plants growing in walls are not considered.

Hybrids

Hybrids are only to be considered as additional species, if both parents are missing in the transect cross. But in case that a hybrid closely related to oilseed rape is found, please note this hybrid on the report sheet as a hybridisation partner of oilseed rape. Hybrids belonging to the Brassiceae relationship will be difficult to identify.

Instructions for survey of Lepidoptera

To ensure long-term reproducibility of the collected data, please follow these instructions precisely. In particular, it is not permitted to:

- make no mention of unidentified butterfly sightings.
- include butterfly sightings outside the predefined area. Although valuable, those sightings have to be recorded separately.
- remain on the site in anticipation of butterflies.
- take pictures, to classify plants or do other interesting things at the same time. Since those activities cannot be taken into account as working time, they have to be reduced to a minimum.

Transect method

The transect method is used for the butterfly survey on test circles with a radius of 20 metres. In the last two decades, this method has become the standard for evaluating test areas by butterfly surveys. An observer registers butterfly species and counts individuals 2.5 metres to the left and to the right side, as well as 5 metres ahead, on a predefined transect line. The transect-line is walked along in slow pace (ca. 3 km / h). Pacing should be reduced in highly structured or heavily frequented habitats, to ensure recording of all butterflies flying or resting on exposed spots. It is not necessary, however, to record any butterfly resting hidden in the vegetation, which is neither spotted nor flushed when passed by. Double counts should be avoided as far as possible.

In each test circle a cross transect which is divided twice (north-south, east-west) is surveyed. Hence, the reference area per test circle is approximately 400 m^2. Starting from the centre, each stretch is walked along twice (first on the north-south transect, then on the east-west-transect). Inevitably, an area of 5 x 5 m (25 m^2) is recorded twice in the centre of a cross transect surveyed like that. In the surveys this „methodical error" was deliberately not corrected, e. g. by "leaving out" this area on the east-west-transect, because it would have complicated the method and led to a higher error-proneness.

All species and individuals are recorded separately for the eight paced transect sections, whereupon the highest individual count per pass and section is used for further calculations. The result of the transect count should not be considered a quantitative value, but displays the activity density.

Locating the test circle centre in the field results from a combination of orientation by aerial photographs, land marks, pace measure, or measuring with a tape measure, respectively. In some cases a GPS device is used as well (see chapter „General instructions to locate the sample area and test circles"). After the vascular plant survey (April-May) the field biologists already get exact descriptions of the positions of the test circles for the butterfly survey (often including photo-documentation), which help to find the centre points more quickly and unambiguously.

Please determine the centre of the test circle as well as you can, using GPS or a coloured aerial photograph. To abide by the 20 m length and 5 m width as exactly as possible, the starting point should be marked (e. g. by putting down a cloth, a piece of clothing or a backpack). A compass is used for locating the cardinal points.

Even meeting with obstacles which are hard to overcome (e. g. thick hedges), the cross transect should be followed. Impervious obstacles in the transect have to be bypassed and the base line has to be resumed afterwards. However, in cultivated areas hardly any problems should arise concerning this matter in general.

Some species have to be surveyed as “collective species“ in the field, due to their abundance or due to the fact that not all individuals can be caught for exact determination. These collective species are identified prior to the survey, to make sure that all field biologists use the same “collective names”.

Animals which are not determinable on the spot are caught and “temporarily stored“ in the net or in a suitable box. After the transect survey or “Five minutes-survey“ (see below) is finished, the butterflies are identified and usually released.

Animals leaving the transect or taking flight are taken into account. Generally, it is allowed to leave the base line of the transect for observing and determining individuals (for a short time) in between, but the walk should be continued along the base line afterwards.

Recording of characteristics of habitat and vegetation in the butterfly-cross transect or on the entire test circle

To characterise the butterfly-cross transect or the entire test circle area, a list of 21 habitat types with 20 additional attributes for the type “arable crops and structures“, as well as eight supplementary features (e. g. hydric, wet, intensive management, lean, bush encroachment, etc.) have been compiled. The same list is used in the Orthopteran survey (see chapter “Instructions for the Orthopteran survey“).

The habitat types (abbreviated in capital letters) and supplementary features (in lower case) are recorded in the butterfly-form according to the actual condition (see forms in annex). You can use up to two supplementary features per habitat type (Gcl, for example, means grassland cut lean). Field crops and accompanying structures (abbreviated to F and consecutively numbered) have to be recorded as well (e. g. F2c means oilseed rape field threshed). Percentages of habitat types per cross transect or on the entire test circle are estimated with an accuracy of five percent (for a maximum of five most common habitat types, if more than five types occur). Those values are not recorded before the butterfly survey is finished in the cross transect or the entire test circle and you have gained an overall impression of the mapping area.

„Five minutes - survey“

To supplement the transect count, a success-oriented collection of additional species per test circle is conducted in a time interval of five minutes. Within these five minutes the field biologist tries to detect as many species as possible. Time is measured with a stop watch. Time used for catching and identifying “critical“ species is not included in those five minutes.

All species observed within these five minutes are assigned a certain abundance class afterwards: rare specimen, two to ten individuals (“several“) and more than ten individuals (“abundant“). This assignment should not be based on rough estimates, but on steady counting. On test circles with a very high number of species and individuals (they will be exceptions) the completeness of the species list has to obtain priority over the counting and estimating of numbers of individuals. High numbers of individuals should not distract you from the main aim of the survey, to try to discover all present butterfly species. That is why all individuals, which – due to their morphology or behaviour – could possibly be new species, have to be identified or caught systematically.

Mapping of “moths“

Please also take into account all flying or resting “moths” that can be identified without catching, if your scope of experience allows you to do so. Examples are: *Macroglossum stellatarum* (Hummingbird Hawk moth), *Chiasmia clathrata* (Latticed Heath), *Euplagia quadripunctaria* (Jersey Tiger moth), *Diacrisia sannio* (Clouded Buff moth), *Euclidia glyphica* (Burnet Companion), *Callistege mi* (Mother Shipton moth), *Autographa gamma* (Silver Y) etc. Even if the species is not or cannot be identified exactly, certain short remarks can be very revealing (e. g. *Zygaeninae*, or *Procridinae*). But the more exact the determination, the better the data can be interpreted. The recording of these species, however, must not be done until the end of the five-minute interval, because the main aim – the butterfly survey – should not be affected time-wise.

Minimal weather conditions

The weather conditions during the survey are recorded precisely in the headline of the form (see chapter “Report sheets of the indicators of biodiversity“).

Various meteorological factors have to meet certain minimum criteria for the regular transect and five-minute surveys. Up to now, for records taken between nine a.m. and five p.m. CEST (recommended working hours for surveys), the following values proved to be suitable:

- at air temperatures between 13 and 17 ° Celsius: 100 % sunshine
  (below 13 ° C no records are taken!)

- at temperatures above 17 ° C: at least 50 % sunshine, no rainfall, maximum wind force 4 according to the Beaufort scale
  (When stronger gusts of wind occur, taking records is not permitted, except for short-termed gusts on exposed spots.)

- “Sunshine“ refers to weather conditions with clearly perceptible shadows. If the temperature ranges between 13 and 17 ° C, please wait at least three minutes after a bigger cloud has drifted past, before resuming the survey.

Since these minimum conditions originally were defined for surveys in Great Britain, please try to top temperature and sunshine requirements and remain under the wind velocity as best as you can.

It is not allowed to record butterflies you sight during a break, but you may take them down under “comments”!

Air temperature has to be measured in the shade at a height of one meter (at best after recording of a test circle is finished). Note: the thermometer might display raised values after storage in the car, initially. If there is no shade available, please measure the temperature in the shadow of your car.

You should absolutely try to exceed or remain under the minimum criteria for temperature, sunshine and wind velocity categorically, respectively. At temperatures **above 36°C no transect records** must be taken, since many species show a greatly reduced activity then!

Catching and identifying voucher specimens

For the species diagnosis only the characters of the butterfly and its behaviour may be taken into account, but under no circumstances the ecological characteristics of the habitat may be regarded for this purpose.

Generally, all butterflies are identified to species level. Exceptions to this rule are the following groups of species, which are difficult to identify:

- *Colias hyale/alfacariensis*
- *Colias crocea/erate*
- *Pieris napi/bryoniae*
- *Leptidea sinapis/reali*
- *Maculinea alcon/rebeli*
- *Aricia agestis/artaxerxes*

These groups of species can be identified as a “complex“. If possible at all, please strive for a determination to species rank (unambiguous specimen, personal special knowledge). Basically, the time involved in catching and/or identifying an individual should balance the benefits.

Groups of species, whose identification requires preparation of genitalia, are for example:

- *Melitaea aurelia/britomartis*
- *Hipparchia fagi/alcyone*
- *Plebejus argyrognomon/idas*
- *Polyommatus icarus/thersites*
- *Pyrgus alveus/armoricanus*

Normally, only a single individual is taken as a voucher specimen, even if more than one or many individuals of a species occur that cannot be identified definitely in the field. It is, however, necessary to collect more than one individual, if the occurrence of several similar species can be expected in the area. Of course, knowledge about approximate distribution patterns should come in here.

Voucher specimens should be accurately and clearly labelled and also put on a spreading board, if possible. After the determination has been checked, the voucher specimens remain with the field biologist. If you do not want to keep them for a reference collection yourself, they pass into the collection and possession of the Institute of Zoology at the University of Natural Resources and Life Sciences in Vienna.

Procedure for butterflies which cannot be identified definitely

In principle, there are the following options in this case:

- catching and identifying in the butterfly net or in your hand
- catching and identifying at home (voucher specimen)
- recording an “indefinite determination“ under “indeterminate species“. Examples: “*Clossiana selene/euphrosyne*“, “*Pieris rapae/napi*“. Additional characteristics further narrow down the spectrum of possible species; e. g. “white *Colias* sp.“, ”blue Blues (Bläulinge blau), possibly *Polyommatus semiargus*“. This option is only reasonable and permissible if the butterfly cannot be caught.

Time requirement

For an experienced field biologist, the surveys above take 10-20 minutes (15 minutes on average) on a single test circle. The exact localisation and locating of the test circle will often require more time!

Using this method you can examine one to a maximum of three test areas per day, depending on the distance between the 625 x 625 m^2 test areas, as well as on the habitat diversity of the test circles.

Recording of flower visits and searching for preimaginal stages

Visit of flowers is recorded by using the attributes “yes“ or “no“ in this survey. Please make a note of the visited flowering plant, according to your expertise. Visit of flowers on cultivated plants (e. g. oilseed rape, sunflower, etc.) must be recorded as such and has to be entered in the data base as a “comment”.

A selective search for preimaginal stages (eggs, caterpillars, chrysalises), which raises the chances of detection considerably for some butterflies, is not performed due to high time requirements, the clear dependence on the horizon of experience of the field biologist and the virtual impossibility of standardisation.

However, preimaginal stages of certain species can be detected “at a glance”, for example the communal webs of larvae of the European Peacock (*Inachis io*) or the Small Tortoiseshell (*Aglais urticae*). It is essential to make a note of such sightings within the test circles, since they prove the viability of the particular species in this test circle. An entry referring to such observations should be made under “comments” in the data base.

Recording of habitat types

The percentages of area (simplified categories, see form) of habitat types in the cross transect should be roughly estimated (2.5 m^2 equal 5 %, 5 m^2 equal 10 % of the 50 m^2 survey area and so on). Habitat types are recorded using capital letters, for further characterisation (if possible) add lower case letters. To further characterise fields and accompanying structures, 20 different subcategories are available. Please also specify the dominant height of vegetation in meters for each habitat type.

Equipment for the butterfly survey

The following aids have to be taken along for the survey:

- synoptic table with test areas to work on
- general map for rough orientation to identify the localisation of the particular test area
- Austrian map of test area (scale 1:50.000)
- list of GPS coordinates of the exact position of the test areas and test circles
- map section of the test areas including the test circles which have to be assessed
  25 m transparent grid overlay: Note that there are three different transparent grid overlays according to the meridian lines available (triangulation Bundesmeldenetz: BMN)
- descriptions, rough drafts and photos of the position of test circles from the vascular plant survey
- GPS and/or field pad
- compass
- thermometer
- tapeline (20 m)
- optionally a dipstick (2 m) or a commensurate piece of rope
- optionally a self-made ”animal-compass“: stick with a 20 m string
- measuring wheel
- wrist watch with seconds hand to abide by the survey intervals and for measuring the processing time
- stop watch
- pedometer
- butterfly net
- binoculars with short focus
- magnifying glass
- killing glass and ethyl acetate (Essigäther)
- closed vessel for storing insects that cannot be identified on the spot
- digital camera for documentation
- field guide
- writing utensils: water resistant pens for marking of plastics as well as pencils and ball pens
- instructions for field work
- report sheets or notebook for recording data
- mobile phone for urgent queries in the field and for making arrangements with other field biologists
- information sheet for farmers enquiring in the field (for protection, the name of each field biologist is listed there)
- driving licence or identity card to be able to identify oneself (in cases of furious farmers this could be helpful)
- notebook for recording the mileage (for verification, stored in car)
- form to fill in the kilometres which have been covered by car (to be handed in at the project coordination).

The day tours on the test area are to be planned in a way that the covered distances between the test circles are kept as short as possible. Areas which should not be trespassed are marked in red on the map. Please consider these areas when planning your walking route. Please write down the exact processing time per test circle and for an entire test area (locating and mapping the test circle, time for documentation and determination) in the appropriate form and forward it to the project coordinator.

Survey period

Due to the predefined number of test areas and the available funds for this project the butterfly fauna can only be assessed once per test area. This survey is carried out between the 15th of July and the 15th of August. According to long-term empirical values, within this period the highest number of butterflies can be found at the same time, at least in the agricultural landscape in the east of Austria. Since the survey starts in the middle of July, evidence of additional species, whose flight time ends in the middle/at the end of July and which cannot be detected at all during a survey starting later, could be provided. In agricultural landscapes this mainly applies to the species *Brenthis ino* (Lesser Marbled Fritillary), *Melitaea aurelia* (Nickerl's Fritillary), *Melitaea britomartis* (Assmann's Fritillary), *Coenonympha arcania* (Pearly Heath) as well as a number of Hairstreak-species like *Callophrys rubi* (Green Hairstreak), *Satyrium spini* (Blue-spot Hairstreak), *Satyrium ilicis* (Ilex Hairstreak), *Satyrium acaciae* (Sloe Hairstreak), *Satyrium pruni* (Black Haistreak) and *Satyrium w-album* (White-letter Hairstreak).

It has to be mentioned at this point, that some species invariably will be under-represented or not present at all during the selected survey period, if they fly in spring only (in one generation), e.g. *Anthocharis cardamines* (Orange Tip), or the flight time of the single generation starts very late (in August), e.g. *Arethusana arethusa* (False Grayling). The survey period must not be too long, in order to keep the results comparable in terms of phenology (flight times of the individual species). If the survey interval is too short, however, there is a risk of not finishing all test areas during the chosen period, e. g. due to persistent bad weather conditions. The four weeks chosen represent a compromise solution for those two problems. If the worst comes to the worst (e.g. bad weather for weeks), it is permissible to make up for the missed recordings up to five days after the end of the period. Nevertheless, the field biologists are urged to “set to work with alacrity” right at the beginning of the survey period, weather permitting, to minimise the chances of getting into a situation like that.

It has to be stressed that due to the single recording of butterflies per test area only very rough conclusions about the “quality“ of the test areas can be drawn. According to unanimous expert opinion, for monitoring purposes it would be necessary to have at least five to six transect recordings per year (May to September) and test area (BÜHLER 2007). This essential aspect should be seriously taken into consideration for the set-up and implementation of GMO monitoring programmes in the future.

Instructions for survey of Orthoptera

It has to be stressed in advance that the best way to conduct a large-scale survey of orthopterans, keeping the time involved down to a reasonable amount, is using transect methods even though they do not show the same accuracy as closed isolation squares, which are used for small areas, and tend to underestimate the actual abundance of orthopterans (GARDINER et al. 2005, GARDINER & HILL 2006, INGRISCH & KÖHLER 1998).

Basically, the ten meter transects to be worked on for the orthopteran inventory run along the same four cross-transect axes (north, east, south and west) as for the vascular plant and the butterfly surveys. The transect width is laid down to 2.5 m left and right of the transect axis, respectively. The processing time is limited to eight minutes per transect. In order to avoid double counts in already disturbed areas, the transect lines are started in five meters distance to the centre of the test circle.

Transect method

A transect method is used for the biodiversity monitoring program. The numbers of species and individuals on the ten meter transects are identified by sound detection (male stridulation) and direct observation. Coverage is limited to 2.5 m to the left ad the right side of the base line. Thus, the survey is based on a sector of 10 m x 2.5 m x 2 = 50 m² per transect. Within the transect area records are taken sideways and to the front. The time for walking along the ten meter transect is limited to eight minutes (mean 1.25 m/min). If the abundance of grasshoppers is very low (or no grasshoppers are present at all), recording of a transect area may be done quicker. However, the minimum processing time per transect is five minutes (2 m/min at average). A quicker recording is justified, if a maximum of one individual has been detected after two minutes and the abundance does not rise along the transect line. Grasshoppers, which are not determinable on the spot, are either caught in glass tubes, identified and released after recording of the transect is finished, or the time for determination is taken into account additionally. Animals flying or fleeing out of the transect area are included. Generally, it is allowed to leave the base line of the transect for observing and determining individuals for a short time in between, but the walk should be continued along the base line afterwards.

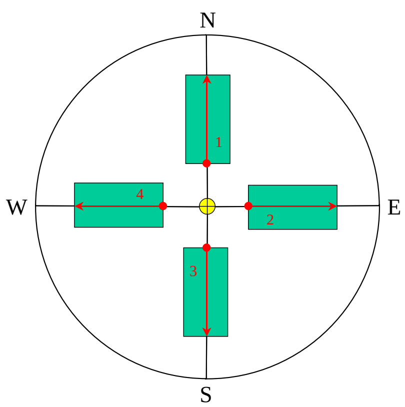


Figure 3. Diagram showing a test circle with four transects (red arrows) and their reference areas (in green) for the quantitative orthopteran survey (L. Sachslehner).

To abide by the 10 m length and 2.5 m width on each side as exactly as possible, the starting point should be marked by putting down a cloth, a piece of clothing or a backpack. Please carry along a two to three meter fold-up dipstick or measuring tape as well.

Position of transects in the test circles

Four transects (200 m² in total) are examined for each of the ten test circles with a radius of 20 m (1 257 m² area) within a test area (see figure 3). To standardise the transect routes within the 20 m-test circles, please proceed according to the following protocol:
All four transects start in five meters distance to the centre of the test circle. Please determine the centre of the test circle as well as you can, using GPS or a coloured aerial photograph. Please carry along a compass, too. The first transect points exactly to the North (0°), the second to the East (90°), the third to the South (180°) and the fourth to the West (270°). Thus, the four transect base lines spread out crosswise to the cardinal points at a distance of 5 to 15 m from the centre of the test circle. This mode of conduct contributes to standardisation and should be followed even when meeting with obstacles that are hard to overcome (e. g. thick hedges). Impervious obstacles have to be bypassed and the transect base line has to be resumed afterwards. In cultivated areas, however, hardly any problems arise concerning this matter in general. Using this method "independent" data are produced, since the transects are kept apart far enough. By spreading the transect routes at angles of 90°, usually all relevant habitat and structure types of a test circle are covered.

Time span for survey

Since the method strongly depends on the activity of the grasshoppers, records are taken generally at a temperature above 20 ° Celsius between 9 a.m. and 7 p.m. (in shady conditions 6 p.m.). Augmented by optical detection, the major part of the native orthopteran species can thus be investigated in a short span of time. The survey is performed in July and August only, when most orthopteran species have reached their adult stage. Larvae are recorded on principle as well, because they can represent a significant proportion of the total number of individuals of a locality. Determination of most larvae, however, can only be done to genus or subfamily-level (e. g. Gomphoceriae – slant-faced grasshoppers) without being too time-consuming. That is why the form (see appendix) is designed to record males, females and larvae separately. "Problems concerning larvae" should be limited by choosing a favourable survey period for a region, though. Therefore the Pannonian East and the lowlands should be surveyed mainly in July, whereas regions higher up or plateaus should be focused on in August.

Taking records

The number of observed or sound-detected individuals along the transect line is taken down for each recorded orthopteran species (including larvae) in the form (see appendix). Species, which are not listed yet, are added. Each transect of a test circle is assigned a separate column in the form.

Recording of habitat type and height of vegetation

A standardised survey of vegetation structures is performed for each transect area. Since the orthopteran survey is done in summer, the processing or harvesting stage of a field is relevant for the species diversity and abundance. In each transect the percentages of area (simplified categories, see form) of habitat types should be roughly estimated (2.5 m² equal 5%, 5 m² equal 10% of the 50 m² survey area and so on). During the method test, usually up to four habitat types occurred in one transect. Habitat types are recorded using capital letters, for further characterisations (if possible) add one to two lower case letters (Table 1). Twenty different subcategories are available to further characterise fields and accompanying structures. Please specify also the dominant height of vegetation in meters for each habitat type (e. g. 0.4 for a meadow with 40 cm height, or 3.0 for a hedge three meters high).

Table 1: Abbreviations of habitat types for surveying vegetation characteristics in the transects for orthopterans (see text and form). The habitat types A to X and the supplementary features c to f in Table 1 are for the better part consistent with the abbreviations used in the orthopteran survey in eastern Austria. Up to two supplements may be used (e. g. F2c means oilseed rape field threshed).

Initial	Type of biotope	Initial	Field crops and structures
A	excavation sites, landfill area	**F1**	cereals
B	fallow land (grassland)	**F2**	oilseed rape
C	shrubbery, felled areas	**F3**	maize
D	pasture	**F4**	root crop
E	rocky land	**F5**	stubble field
F	field crops and structures (F1-F20)	**F6**	feshly ploughed land/ bare field
G	grassland	**F7**	cover-cropping
H	mesoxerophytic grassland	**F8**	field margin with perennial herbs (eutrophic)
I	residential areas	**F9**	field margin with grass (oligotroph)
K	tall herb communities	**F10**	ruderal field egde
L	deciduous forest (woodlots)	**F11**	lean field edge
M	mixed forest (woodlots)	**F12**	field edge with shrubs/hedge
N	coniferous forest (forest/woodlots)	**F13**	farm road/drive/sunken lane
O	mire	**F14**	tarmac road
R	ruderal habitats (fields excluded)	**F15**	vineyard/hop fields
S	edge (forest egde)	**F16**	young fallow arable land
T	xeric grasslands	**F17**	perennial fallow arable land
U	stand of trees	**F18**	ruderal flora
V	silted up zone	**F19**	other not listed types
W	ashelterbelt	**F20**	leguminosae/clover/lucerne
X	other not listed types		

Additional factors	
c	recently cut/chopped/threshed
w	moist, wet
i	intensive
l	lean (fresh)
r	rich (fresh)
s	sparsely covered
d	dry
f	edged, shrubbed, fallowed

Moving and recording in the transect area

Basically, records are taken sideways and to the front, commencing with the starting point and following along the imagined base line of the transect area. In habitats with low orthopteran abundance (e. g. in extensively bare fields) additional walking up and down and back and forth in search of individuals can be tolerated within the transect area. The three essential points of the survey method are (1) strict adherence to the transect area as a spatial reference, (2) compliance with the time limit and (3) avoidance of double counts as far as possible.

Day time of recordings

On sufficiently hot and sunny days you may start working as early as 9 a.m. CEST and go on taking records until 7 p.m. CEST. At a temperature of at least 20° Celsius in the shade, grasshoppers show enough activity on sunny days. In eastern Austria *Chorthippus mollis* can also serve as an indicator for ensuring usable data, since it stridulates at temperatures above 20° C in suitable habitats.

This prolongation of daily working hours at especially favourable conditions may also contribute to a higher efficiency of mapping tours and we know from experience that no negative effects on survey results have to be expected.

Instructions for survey of habitat structures

Please determine the exact position of the test area using GPS-coordinates or an aerial photograph. In addition, a 25 m transparent grid overlay can be used for orientation. It is essential to calibrate your own step length beforehand. Furthermore, handheld computers are available for orientation or retaining the exact location of patches for the landscape survey. Measuring wheels can also be used for determining exact distances.

It is not permitted to:
- take results of earlier regional surveys into account.
- do field work in teams.

Survey period

Depending on weather conditions, the landscape survey of the test areas can be carried out from April to the end of October. The preferred months for acquiring data are August and September. Field margins, for example, can be seen clearly and it is easier to estimate their width during these months. More importantly, no damage is caused on the crops, since many fields have been harvested by then.

Equipment for the excursion

- synoptic table with test areas to work on
- list of GPS coordinates of the exact position of the test areas and test circles
- general map for rough orientation to identify the localisation of the particular test area
- Austrian map (scale 1:50.000) of test area to work on, for exact localisation
- map section of the test areas including the test circles which have to be assessed
- 25 m transparent grid overlay
  Note that there are three different transparent grid overlays according to the meridian lines available (triangulation Bundesmeldenetz: BMN)
- GPS
- handheld computer and/or measuring wheel
- compass
- folding magnifier and plant identification literature (ADLER et al. 1994), if plant species are recorded for any later assignment of habitat types by consulting the red list of endangered habitats
- watch for measuring the processing time
- if available, mobile phone for urgent queries in the field
- writing utensils: water resistant pens for marking of plastics as well as pencils and ball pens
- instructions for field work
- report sheets: at least one form per test area plus one additional sheet for detailed information on landscape elements
- notebook for recording the mileage (for verification, stored in car)
- form to fill in the kilometers which have been covered by car (to be handed in at the project coordination)

- driving licence or identity card to be able to identify oneself (in cases of furious farmers this could be helpful)
- information sheet for farmers enquiring in the field (for protection, the name of each field biologist is listed there).

Areas which should not be trespassed are marked on the map sections as well. Please consider these areas as far as possible when planning your walking route. If you cannot avoid trespassing, please proceed quickly. We know from experience in the landscape survey for the project BINATS, that it is possible to finish one to a maximum of two test areas completely in one day of work, depending on the landscape structure of the test area and the time for the journey.

Finalising the survey of a test area

- check protocol for completeness
- sum up and take down total working time.

If any methodical decisions which are not clearly regulated in these instructions should be necessary during field work (e. g. introduction of an additional element of habitat structures), please make a handwritten addition in the field and inform the project coordinator promptly.

Special instructions

Motorways

If motorways cross the test area, caution is advised. For your own safety, please do not take any risks!

Additional comments for selected habitat structure types

For some habitat structures an assignment of a listed habitat structure type may not be possible unambiguously. It is recommended to add a remark on the form, e. g. on the species composition, and consult the habitat type catalogue (Red Lists of Austrian Endangered Biotopes (Essl et al. 2002, 2004, 2008; Traxler et al. 2005a) following the field work in such cases.

Additional entry „shrubbery“

Here, the main habitat type is determined and the percentage of shrubbery is estimated.

Photo example: field margin with percentage of bush encroachment

Field for game browsing

A field for game browsing is laid out for game to feed.

Field margins

Field margins with a width up to 25 cm are recorded. Please specify the exact width of the field margin on the map for digitising this part of the map subsequently.

Fallow vineyards

Remaining stock of vines has to be found on the uncultivated land, to assign it to the category "fallow vineyard".

Near-natural strips of riparian woodland

The

sparse remainders of flood-plain galleries (poplars, willows) that accompany small streams in a linear way with little spatial extension are also counted among the near-natural strips of riparian woodland.

near-natural strip of riparian woodland

Single trees and bushes

For fruit trees and fruit-bearing single bushes the particular species is recorded; for deciduous and coniferous trees as well as non-fruit-bearing single shrubs no specifications are made.

Line of trees

Example of a line of trees which may be recorded as such (i.e. you do not have to take down single trees). A line of trees has to show an obvious crown closure.

Group of trees

A group of trees is defined as a group of abutting trees (standing close together). This definition applies to a minimum number of three trees.

For example:
legend:✱..single tree; ...wayside shrine

✱ ✱
no group of trees,
but single trees

✱
✱ ✱
group of trees

Hedge with shrubs

Young trees can also be part of a hedge with shrubs, but the character of shrubbery is dominating.

“Internal“ meadow orchards

Meadow orchards with a bigger area which are situated in the middle or on the edges of a village are not recorded as part of the category residential area “RESI“, but as separate elements.

Ravine forests

Ravine forests are counted among the category “RAVINE” (scree, ravine, boulder and talus forests).

Streams

Small streams and their accompanying structures are recorded as a single complex, using percentages. If the accompanying structures have a very striking or atypical character, they are recorded as separate elements.

Poles

The category "POLE" refers to pylons alone, telephone poles are not included!

"WASTE" (waste industry areas)

Areas on which solid matters like bricks, gravel etc. are deposited.

"DUMP" (agricultural dump sites)

The category "DUMP" describes areas used for disposal of compost, organic materials, silage, wood, etc.

Residential area („RESI")

Residental areas are recorded as complex elements, using percentages for the different categories like buildings and sealed areas, ruderal areas, gardens and groves.

Acknowledgements

The project BINATS was financially supported by the two Austrian Federal Ministries of Health and of Agriculture, Forestry, Environment and Water Management.

The listed field biologists together with the core project team performed the field surveys, tested the monitoring design in the field and added essential adaptations experienced in the field. We are grateful to Manuel Denner, Patrick Gros, Roland Hainz, Karl Hülber, Anton Koschuh, Thomas Moertelmaier, Alexander Panrock, Christa Renetzeder, Alois Schmalzer, Rudolf Schmid, Ingrid Schmitzberger, Martin Strausz, Werner Weißmair and Wolfgang Willner.

We thank our Swiss colleagues for making the field guides of the Swiss Biodiversity Monitoring (BDM) available to us (commissioned by the BAFU, Bern, coordination: BDM Switzerland, Hintermann & Weber, Reinach).

We thank Stefanie Rechnitzer for assistance in translating parts of the German fieldguide and Günter Gollmann for language editing on the manuscript. Christa Renetzeder was involved in the predefinition of the English terminology of the habitat structure list. Martin Prinz helped with formatting the field guide.

References

ADLER, W., OSWALD, K. & FISCHER, R. 1994: Exkursionsflora von Österreich. Bestimmungsbuch für alle in Österreich wildwachsenden sowie die wichtigsten kultivierten Gefäßpflanzen (Farnpflanzen und Samenpflanzen) mit Angaben über ihre Ökologie und Verbreitung. Verlag Eugen Ulmer, Stuttgart und Wien: pp. 1180.

BÜHLER, C. 2007: Wunsch und Wirklichkeit – Wie lässt sich ein GVO-Monitoring kosteneffizient realisieren? In: BRECKLING, B., DOLEK, M., LANG, A., REUTER, H. & VERHOEVEN, R. (Hrsg.): GVO-Monitoring vor der Umsetzung. Münster (Landwirtschaftsverlag). Naturschutz und Biologische Vielfalt, Vol. 49, pp. 57-69.

ESSL, F.; EGGER, G. & ELLMAUER, T. 2002: Rote Liste der gefährdeten Biotoptypen Österreichs: Wälder, Forste, Vorwälder. UBA-Monographien Band 156, Umweltbundesamt, Wien: pp. 104.

ESSL, F., EGGER, G., KARRER, G., THEISS, M. & AIGNER, S. 2004: Rote Liste der gefährdeten Biotoptypen Österreichs: Grünland, Grünlandbrachen und Trockenrasen; Hochstauden- und Hochgrasfluren, Schlagfluren und Waldsäume; Gehölze der Offenlandschaft, Gebüsche. UBA-Monographien M167, Wien: pp. 272.

ESSL, F., EGGER, G., POPPE, M., RIPPEL-KATZMAIER, I., STAUDINGER, M., MUHAR, S., UNTERLERCHER, M. & MICHOR, K. 2008: Rote Liste gefährdeter Biotoptypen Österreichs. Binnengewässer, Gewässer- und Ufervegetation, Technische Biotoptypen und Siedlungsbiotoptypen. Neuer Wissenschaftlicher Verlag, Wien: pp. 316.

GARDINER, T. & HILL, J. 2006: Comparison of three sampling techniques used to estimate the population density and assemblage diversity of Orthoptera. Journal of Orthoptera-Research 15: 45-51.

GARDINER, T., HILL, J. & CHESMORE, D. 2005: Review of the methods frequently used to estimate the abundance of Orthoptera in grassland ecosystems. Journal of Insect Conservation 9: 151-173.

INGRISCH, S. & KÖHLER, G. 1998: Die Heuschrecken Mitteleuropas. Die Neue Brehm-Bücherei Bd. 629, Westarp Wissenschaften, Magdeburg: pp. 460.

PASCHER, K., MACALKA-KAMPFER, S. & REINER, H. 2000: Vegetationsökologische und genetische Grundlagen für die Risikobeurteilung von Freisetzungen von transgenem Raps und Vorschläge für ein Monitoring. Studie im Auftrag des Bundeskanzleramtes, Sektion IX, Bundesministerium für soziale Sicherheit und Generationen, Forschungsberichte 7/00: pp. 153 + pp. 24 Anhang.

PASCHER, K., MOSER, D., TRAXLER, A., FRANK, T., DULLINGER, S., SAUBERER, N., SACHSLEHNER, L., HÖTTINGER, H. & GRABHERR, G. 2007: Untersuchungsdesign zur Erfassung der Biodiversität in österreichischen Ackerbaugebieten. In: BRECKLING, B., DOLEK, M. LANG, A., REUTER, H. & VERHOEVEN, R. (Hrsg.): „GVO-Monitoring vor der Umsetzung", Veröffentlichung zur Tagung vom 28. und 29. November 2006 am Bundesamt für Naturschutz, Bonn, Schriftenreihe Naturschutz und Biologische Vielfalt 49: 33-43.

PASCHER, K., MOSER, D., DULLINGER, S., SACHSLEHNER, L., HÖTTINGER, H., TRAXLER, A., SAUBERER, N., FRANK, T. & GRABHERR, G. 2008: Monitoring design to evaluate biodiversity in Austrian agricultural regions. In: BRECKLING, B., REUTER, H. & VERHOEVEN, R. (Eds.): Implications of GM-Crop Cultivation at Large Spatial Scales. Theorie in der Ökologie 14. Frankfurt, Peter Lang: 146-150.

PASCHER, K., MOSER, D., DULLINGER, S., SACHSLEHNER, L., GROS, P., TRAXLER, A., SAUBERER, N., FRANK, T. & GRABHERR, G. 2009: Establishment of an Austrian monitoring design of genetically modified plants. Proceedings of the Fourth International Conference on Coexistence between Genetically Modified (GM) and non-GM based Agricultural Supply Chains - GMCC09, 10-12th November 2009, Melbourne, Australia: pp.11. http://www.gmcc-09.com/

PASCHER, K., MOSER, D., DULLINGER, S., SACHSLEHNER, L., GROS, P., SAUBERER, N., TRAXLER, A., & FRANK, T. 2010a: Biodiversität in österreichischen Ackerbaugebieten im Hinblick auf die Freisetzung und den Anbau von gentechnisch veränderten Kulturpflanzen (BINATS – Biodiversity-Nature-Safety). Forschungsbericht im Auftrag der Bundesministerien für Gesundheit, Sektion II und für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft: pp. 107.

PASCHER, K., MOSER, D., DULLINGER, S., SACHSLEHNER, L., GROS, P., SAUBERER, N., TRAXLER, A., GRABHERR, G. & FRANK, T. 2010b: Setup, efforts and significance of a GMO monitoring program - an Austrian case study. BRECKLING, B. & VERHOEVEN, R. (Eds.) Implications of GM-Crop Cultivation at Large Spatial Scales. Theorie in der Ökologie 16. Frankfurt, Peter Lang: 110-111.

SAUBERER, N., ZULKA, K., ABENSPERG-TRAUN, M., BERG, H.-M., BIERINGER, G., MILASOWSZKY, N., MOSER, D., PLUTZAR, C., POLLHEIMER, M., STORCH, C., TRÖSTL, R., ZECHMEISTER, H. & GRABHERR, G. 2004: Surrogate taxa for biodiversity in agricultural landscapes of eastern Austria. Biological Conservation 117: 181-190.

TRAXLER, A., MINARZ, E., HÖTTINGER, H., PENNERSTORFER, J., SCHMATZBERGER, A., BANKO, G., PLACER, K., HADROBOLEC, M. & GAUGITSCH, H. 2005a: Biodiversitäts-Hotspots der Agrarlandschaft als Eckpfeiler für Risikoabschätzung und Monitoring von GVO. Forschungsberichte der Sektion IV, Band 5/2005: pp. 177.

TRAXLER, A., MINARZ, E., ENGLISCH, T., FINK, B., ZECHMEISTER, H. & ESSL, F. 2005b: Rote Liste gefährdeter Biotoptypen; Biotoptypengruppen: Moore, Sümpfe und Quellfluren; Hochgebirgsrasen, Pionier-, Polster- und Rasenfragmente, Schneeböden; Äcker, Ackerraine, Weingärten und Ruderalfluren; Zwergstrauchheiden; Geomorphologische Biotoptypen. Monographien des Umweltbundesamtes, M-174. Neuer wissenschaftlicher Verlag GmbH: pp. 286.

Report sheets of the indicators of biodiversity

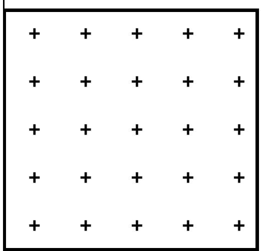
Report sheet – vascular plants

Field surveyor (no initials):
Test area (name of region and number see list):
Test circle (number, see map):
Inventory circle (spring / summer):
Date of inventory:
Processing time: start of inventory: – end of inventory:
Processing time of the whole test area, driving time exclusive:
Processing time of the whole test area, driving time inclusive:
Test circles difficult to localise: description of the centre and the surrounding area, see draft
Comment:
Phone number for consultation:

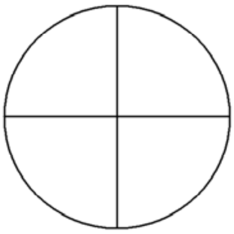
Spatial shift of a test circle:

If a spatial shift of a test circle is necessary -- e. g. a fence prevents access -- the new position of the test circle can be marked in draft 1 (see below). The spatial shift of a test circle is predefined clockwise starting with 12. If this position is also not possible, continue with 3, 6 and 9 o'clock. In case of an indispensable shift please immediately inform the coordinators of the field work.

Draft 1: location of shifted test circle



Draft 2: Proportion of habitat types in the test circle (see list)



Habitat list:

hm	hay meadow
pa	pasture
om	orchard meadows
wb, wbv	fallow meadow / fallow pasture (without shrubbery, with shrubbery)
xg	xeric/mesoxeric grassl
xgf, xgsh	fallow xeric/semixeric grasslands, with
thcw, thcfr, thcd	tall herb communities (wet: *Filipendula* , fresh: *Impatiens* , *Urtica* , *Arctium* , dry: *Solidago canadensis*)
mi	mire
ruds	ruderal sites
Ss	special sites: rock vegetation, natural pioneer vegetation (gravel riverbank,...), saline habitats, periodically
	flooded areas,...
ws	water surface
ex	excavation, landfill, construction site
f, field crop	field (information on the field crop - if not possible note cereals, root cro
fal1, fal2, fal3, fal4	fallow arable land (information on age 1y, 2y, >2y, grasland fallow not mowed - chopped -- otherwise meadow)
flg	fallow land green (e. g. phacelia...)
fc	forage crops (lucerne, perennial clover)
fb	bare fallow (stubble field included)
vy	vineyard
fmg, fmr, fmp, fmsh	field margins (grassy, ruderal, with perennial herbs, with shrubbery): "with shrubbery" stands for single bush
pmg, pmr, pmp, pmsh	path margins (grassy, ruderal, with perennial herbs, with shrubbery)
ht, hb, hs	hedge (tree, bush, she
wlt, wlb	woodlots (tree, bush)
fod, fom, foc, fofe, fofa	forest (deciduous, mixed, coniferous, forest edge,
ts, tgr, th, tg, tsl	track (sealed, gravel track, track with herbaceaous or grassy strips, grassy, sunken lane)
ra	residential area (private gardens, buildings, car p

ad fal3: all fallows which are older than 2 years, still +/- incomplete with biennial species, but already containing grasses; these fallows often have a particular quality, because they are still patchy but show only little disturbance.

ad fal4: fallows with grassland species stand for long lasting fallows which are managed at larger internals. In almost all cases they are chopped.

ad th, tg, tsl: herbaceous or grassy strips are typical tracks along fields, meadow paths are grassy; only use the term „sunken lane", if this habitat structure cannot be divided into single habitat types.

Species list of test circles (please start a new column for each new type of habitat structure):

Nr. of test area / nr. of test circle **habitat type and length along the transect cross in m**

Species names of vascular plants								

Relevant potential hybridisation partners of oilseed rape and sugar beet

Number of test area:

logarithmic estimation scale:
1...1-3 individuals
2...3-10 individuals
3...11-30 individuals
4...31-100 individuals
5...101-300 individuals
6...301-1000 individuals

	Nr. of test circle	Nr. of test circle		Nr. of test circle	Nr. of test circle
(Brassica elongata)			***(Hirschfeldia incana)***		
(Brassica juncea)			***Raphanus raphanistrum***		
***Brassica napus* (ruderal)**			***Raphanus sativus***		
Brassica nigra			***Rapistrum perenne***		
***Brassica oleracea* (ruderal)**			***Rapistrum rugosum***		
***Brassica rapa* (wild and feral forms)**			***Sinapis alba***		
(Conringia austriaca)			***Sinapis arvensis***		
Conringia orientalis			***Sisymbrium altissimum***		
(Crambe tatarica)			***Sisymbrium austriacum***		
Diplotaxis muralis			***(Sisymbrium irio)***		
Diplotaxis tenuifolia			***Sisymbrium loeselii***		
Eruca sativa			***Sisymbrium officinale***		
Erucastrum gallicum			***Sisymbrium orientale***		
Erucastrum nasturtiifolium			***Sisymbrium strictissimum***		
additional species of the listed genera					

Remark: The registration of the species which are listed in brackets is assumed to be improbable during field work because of their rare occurence in Austria.

Sugar or fodder beet
(*Beta vulgaris* subsp. *vulgaris* var. *altissima* or *B. vulgaris* subsp. *vulgaris* var. *alba*):

	frequency Nr. of test circle	culture	frequency Nr. of test circle	culture
weed beet				
feral beet				

weed beets (volunteers) appear in follower crops. Please also note the estimated number of individuals.
feral beets: outside fields, mostly on ruderal sites

Description of location of test circles

Drafts and descriptions of test circles

Number of test area:

Number of test circle:	**Number of test circle:**	**Number of test circle:**	**Number of test circle:**	**Number of test circle:**

if necessary, short description of the test circle:

Number of test circle:	**Number of test circle:**	**Number of test circle:**	**Number of test circle:**	**Number of test circle:**

if necessary, short description of the test circle:

Report sheet – butterflies

date of inventory	field surveyor	temperature	wind (Beaufort)	cloudiness
number of test area and test circle	federal state	location	centre of coordinates	time span: beginning to finishing
sunshine in % for each transect				comments:
	habitat type in %	habitat type in %	habitat type in %	

butterfly species	N-S-transect				O-W-transect				success-oriented collection	remark (flower visit,...)
I. podalirius										
P. machaon										
C.alfacariensis										
C. hyale										
C. alfacariensis/hyale										
C. croceus										
C. erate										
C. croceus/erate										
Colias										
G. rhamni										
L. sinapis/reali										
P. brassicae										
P. napi										
P. rapae										
P. napi/rapae										
P. daplidice										
A. urticae										
A. levana										
A. paphia										
A. adippe										
B. dia										
I. io										
I. lathonia										
M. athalia										
P. c-album										
V. atalanta										
V. cardui										
A. hyperantus										
B. circe										
C. arcania										
C. glycerion										
C. pamphilus										
L. megera										
M. jurtina										
M. galathea										
M. dryas										
P. aegeria										
A. agestis										
C. rubi										
C. argiolus										
C. argiades										
C. minimus										
L. dispar										
L. phlaeas										
L. tityrus										
P. argus										
Plebeius										
P. icarus										
Satyrium										
E. tages										
H. comma										
H. morpeus										
O. sylvanus										
P. malvae										
T. lineola										
. sylvestris										
T. lineola/sylvestris										

Cross-transect - butterflies

The list of the habitat types, field crops and field structures and of additional information is in accordance with the list which was used for the inventory of grasshoppers. In that respect the surveys can be compared with each other.

For habitat types a capital letter (A to X) and for supplementary features lower case letters g to v are recorded according to the actual conditions. You may use up to two supplements (e.g. Glc means grassland lean cut.) Fields and accompanying structures have to be taken from the right hand column, e.g. F2c means oilseed rape field threshed.

The percentages of area of habitat types are estimated in increments of 5% per transect (for a maximum of five most common habitat types, if more than five types occur, which should be an exception). Those values are better not recorded before the survey of the Lepidoptera is finished for the transect (e.g. when walking back to the centre of the test circle) and you have gained an overall impression of the mapping area.

Please record the dominant (most relevant) height of vegetation per habitat type in meters for height (e.g. 0.4 for a meadow with 40 cm height, or 3.0 for a hedge three meters high).

Survey of Lepidoptera

Initial	Type of biotope	Initial	Field crops and structures
A	excavation sites, landfill area	**F1**	cereals
B	fallow land (grassland)	**F2**	oilseed rape
C	shrubbery, felled areas	**F3**	maize
D	pasture	**F4**	root crop
E	rocky land	**F5**	stubble field
F	field crops and structures (F1-F20)	**F6**	feshly ploughed land/ bare field
G	grassland	**F7**	cover-cropping
H	mesoxerophytic grassland	**F8**	field margin with perennial herbs (eutrophic)
I	residential areas	**F9**	field margin with grass (oligotroph)
K	tall herb communities	**F10**	ruderal field egde
L	deciduous forest (woodlots)	**F11**	lean field edge
M	mixed forest (woodlots)	**F12**	field edge with shrubs/hedge
N	coniferous forest (forest/woodlots)	**F13**	farm road/drive/sunken lane
O	mire	**F14**	tarmac road
R	ruderal habitats (fields excluded)	**F15**	vineyard/hop fields
S	edge (forest egde)	**F16**	young fallow arable land
T	xeric grasslands	**F17**	perennial fallow arable land
U	stand of trees	**F18**	ruderal flora
V	silted up zone	**F19**	other not listed types
W	ashelterbelt	**F20**	leguminosae/clover/lucerne
X	other not listed types		

Additional factors

c	recently cut/chopped/threshed
w	moist, wet
i	intensive
l	lean (fresh)
r	rich (fresh)
s	sparsely covered
d	dry
f	edged, shrubbed, fallowed

Report sheet – grasshoppers

Grasshoppers	**Transect 1**			**Transect 2**			**Transect 3**			**Transect 4**			
Species	**M**	**F**	**L**	**M**	**F**	**L**	**M**	**F**	**L**	**M**	**F**	**L**	
Mantis religiosa													
Phaneroptera falcata													*Initials of test area:*
Phaneroptera nana													
Isophya camptoxypha													*Number of test circle:*
Isophya kraussii													
Isophya costata													*Name of field surveyor:*
Isophya modestior													
Barbitistes serricauda													*Date:*
Leptophyes albovittata													
Leptophyes boscii													*Time of starting the survey:*
Polysarcus denticauda													
Meconema thalassinum													*Time of finishing the survey:*
Conocephalus discolor													
Conocephalus dorsalis													*Temperature (° C):*
Ruspolia nitidula													
Tettigonia viridissima													*Wind (Beaufort 0-6):*
Tettigonia caudata													
Tettigonia cantans													*Clouds (^{x}/10):*
Dectivus verrucivorus													
Platycleis grisea													*Sun (0-5):*
Metrioptera brachyptera													
Metrioptera bicolor													**Transect 1:**
Metrioptera roeselii													%-proportion height
Pholidoptera aptera													*Type of biotope 1:*
Pholidoptera fallax													
Pholidoptera griseoaptera													*Type of biotope 2:*
Ephippiger ephippiger													
Gryllus campestris													*Type of biotope 3:*
Modicogryllus frontalis													
Nemobius sylvestris													*Type of biotope 4:*
Pteronemobius heydenii													
Oecanthus pellucens													*Type of biotope 5:*
Gryllotalpa gryllotalpa													
Tetrix subulata													**Transect 2:**
Tetrix undulata													%-proportion height
Tetrix bipunctata													*Type of biotope 1:*
Tetrix tenuicornis													
Miramella alpina													*Type of biotope 2:*
Calliptamus italicus													
Psophus stridulus													*Type of biotope 3:*
Oedipoda caerulescens													
Mecostethus parapleurus													*Type of biotope 4:*
Stethophyma grossum													
Arcyptera fusca													*Type of biotope 5:*
Chrysochraon dispar													
Euthystira brachyptera													**Transect 3:**
Omocestus haemorrhoid.													%-proportion height
Omocestus viridulus													*Type of biotope 1:*
Stenobothrus lineatus													
Stenobothrus nigromacul.													*Type of biotope 2:*
Stenobothrus stigmaticus													
Gomphocerippus rufus													*Type of biotope 3:*
Myrmeleotettix maculatus													
Chorthippus apricarius													*Type of biotope 4:*
Chorthippus vagans													
Chorthippus mollis													*Type of biotope 5:*
Chorthippus brunneus													
Chorthippus biguttulus													**Transect 4:**
Chorthippus albomargin.													%-proportion height
Chorthippus dorsatus													*Type of biotope 1:*
Chorthippus parallelus													
Chorthippus montanus													*Type of biotope 2:*
Euchorthippus declivus													
													Type of biotope 3:
													Type of biotope 4:
Tetrix. sp. Larven													*Type of biotope 5:*
Chorthippus sp.-Larven													
Gomphocerinae-Larven													

Survey of Orthoptera

Initial	Type of biotope
A	excavation sites, landfill area
B	fallow land (grassland)
C	shrubbery, felled areas
D	pasture
E	rocky land
F	field crops and structures (F1-F20)
G	grassland
H	mesoxerophytic grassland
I	residential areas
K	tall herb communities
L	deciduous forest (woodlots)
M	mixed forest (woodlots)
N	coniferous forest (forest/woodlots)
O	mire
R	ruderal habitats (fields excluded)
S	edge (forest egde)
T	xeric grasslands
U	stand of trees
V	silted up zone
W	ashelterbelt
X	other not listed types

Initial	Field crops and structures
F1	cereals
F2	oilseed rape
F3	maize
F4	root crop
F5	stubble field
F6	feshly ploughed land/ bare field
F7	cover-cropping
F8	field margin with perennial herbs (eutrophic)
F9	field margin with grass (oligotroph)
F10	ruderal field egde
F11	lean field edge
F12	field edge with shrubs/hedge
F13	farm road/drive/sunken lane
F14	tarmac road
F15	vineyard/hop fields
F16	young fallow arable land
F17	perennial fallow arable land
F18	ruderal flora
F19	other not listed types
F20	leguminosae/clover/lucerne

Additional factors

c	recently cut/chopped/threshed
w	moist, wet
i	intensive
l	lean (fresh)
r	rich (fresh)
s	sparsely covered
d	dry
f	edged, shrubbed, fallowed

For habitat types a <u>capital letter (A to X)</u> and for supplementary features <u>lower case letters g to v</u> are recorded according to the actual conditions. You may use up to two supplements (e.g. Glc means grassland lean cut.) Fields and accompanying structures have to be taken from <u>the right hand column</u>, e.g. F2c means oilseed rape field threshed.

The percentages of area of habitat types are estimated in <u>increments of 5%</u> per transect (for a maximum of five most common habitat types, if more than five types occur, which should be an exception). Those values are better not recorded before the Orthoptera survey is finished for the transect (e.g. when walking back to the centre of the test circle) and you have gained an overall impression of the mapping area.

2.5 m² = 5 % (ca. 1.5 x 1.5 m or 2.5 x 1.0 m)

5 m² = 10 % (ca. 2.2 x 2.2 m or 5 x 1.0 m)

7.5 m² = 15 % (ca. 2.7 x 2.7 m or 5 x 1.5 m)

10 m² = 20 % (ca. 3.2 x 3.2 m or 5 x 2 m)

and so on.

Please record the <u>dominant (most relevant) height of vegetation per habitat type in meters</u> for height (e.g. 0.4 for a meadow with 40 cm height, or 3.0 for a hedge three meters high).

The <u>number of observed or sound-detected individuals along the transect</u> line is taken down for each recorded Orthoptera-species (including larvae). Please add species, which are not listed yet.

Report sheet – habitat structures

Field surveyor (no initials):
Test area (name of region and number, see list):
Date:
Processing time: start of inventory: - end of inventory:
Processing time of the whole test area, driving time inclusive:
Comment:
Phone number for consultation:

List of the mapped habitat structures:

nr.	initials	additional information

nr.	initials	additional information

Number:	Additional comments

List of habitat structures

Based on the Austrian Red Data Book of Endangered Biotopes:
monograph M-156 (Essl et al. 2002): forests, afforestations, pioneer forests.
monograph M-167 (Essl et al. 2004): grassland, fallow land and xeric grasslands, tall herb and grass communities, felled areas and forest edges, woods in open landscapes and shrubbery.
monograph M-174 (Traxler et al. 2005): mires, swamps and periodically flooded areas (spring horizon), high mountain grasslands, cushion plant communities, fragments of alpine grasslands and snow-bed communities, fields, field margins, vineyards and ruderal flora, shrub heath, geomorphologically determined biotope types.
monograph (Essl et al. 2008): inland water, riverine vegetation, technical biotope types and biotopes of residential areas.

nr. in Red Lists	code	habitat structures	for comparison: habitat structures in German language	additional information
'2.		mires, swamps and periodically flooded areas	Moore, Sümpfe und Quellfluren	
'2.1	FLOOD	periodically flooded areas	Quellfluren	
'2.2	-	non-forested swamps and mires	Waldfreie Sümpfe und Moore	
'2.2.1	TASWA	tall-sedge swamp	Großseggenrieder	
'2.2.2	REED	reed-bed	Röhrichte	also included are water ditches along fields with bulrush, sedges, purple loosestrife
'2.2.3	SMASWA	small-sedge swamp	Kleinseggenrieder	consider field management for the differentiation with other categories
'2.2.4	QUABOGS	transitional mires and quaking bogs	Übergangsmoore und Schwingrasen	
'2.2.5	RAIBOGS	raised bogs	Hochmoore	
'3.	-	grassland, fallow land and xeric grasslands	Grünland, Grünlandbrachen und Trockenrasen	shrubbery as additional classification
'3.1		moist to waterlogged grassland	Grünland feuchter bis nasser Standorte	delimitation with small-sedge swamp: see description of biotopes in the Red Lists
'.1	WAM	moist to waterlogged meadow	BT Wiese feuchter bis nasser Standorte	
'.2	WAP	moist to waterlogged pasture	BT Weide feuchter bis nasser Standorte	
'3.2	FALLMO	moist to waterlogged fallow land	Grünlandbrachen feuchter bis nasser Standorte	
'3.3		fresh grassland	Grünland frischer Standorte	
'.1	MEAFR	fresh meadow	BT Wiese frischer Standorte	
'.2	PASFR	fresh pasture	BT Weide frischer Standorte	
'3.4	FALLFR	fresh fallow land	Grünlandbrachen frischer Standorte	
'3.5		dry grassland	Grünland +/- trockener Standorte	
'.1	MEADR	dry meadow	BT Wiese +/- trockener Standorte	
'.2	PASDR	dry pasture	BT Weide +/- trockener Standorte	
'3.6	FALLDR	dry fallow land	Grünlandbrachen +/- trockener Standorte	
'3.7	XEGRA	semi-xeric and xeric grassland	Halbtrocken- und Trockenrasen	Meadow consisting of brome grass
'3.8	XEFALL	fallow xeric grassland	verbrachende Trockenrasen	
'3.9	SALT	salt meadows and salt xeric grassland	Salzwiesen und Salztrockenrasen	
'3.10	SERP	serpentine and heavy metal flora	Serpentinrasen und Schwermetallfluren	

nr. in Red Lists	code	habitat structures	for comparison: habitat structures in German language	additional information
'5.		**fields, field margins, vineyards and ruderal flora**	**Äcker, Ackerraine, Weingärten und Ruderalfluren**	
'5.1		**fields**	**Äcker**	
'5.1.1		**intensively managed fields**	**Intensiv bewirtschaftete Äcker**	
'.1	**FI**	intensively managed fields	BT Intensiv bewirtschafteter Acker	
'5.1.2		**extensively managed fields**	**Extensiv bewirtschaftete Äcker**	diverse associated flora or wide diverse field margin
'5.1.2.1.	**FEAC**	***extensively managed fields with average habitat conditions***	***Extensiv bewirtschaftete Äcker durchschnittlicher Standorte***	soil without extreme characteristics (e. g. moisture)
'5.1.2.2.		***extensively managed fields with extreme habitat conditions***	***Extensiv bewirtschaftete Äcker der Extremstandorte***	
'.1	**FECALC**	field with xeric, calcarous habitat conditions	BT Acker auf trockenem, karbonatreichem Standort	
'.2	**FEAC**	field with acid, nutrient poor habitat conditions	BT Acker auf bodensaurem, nährstoffarmem Standort	
'.3	**FEWET**	field with watterlogged habitat conditions	BT Acker auf vernässtem Standort	
'.4	**FESALT**	field with saline habitat conditions	BT Acker auf salzhaltigem Standort	
'5.1.3	**FGB**	**fields for game browsing**	**Wildäcker** photos see inventory instructions	Habitat structure is applied for feeding the game.
'	**FORCROP**	**forage crops**	**Feldfutter**	additional entry during field work: mixture of Fabaceae
'5.1.4	**FALLOW**	**fallow arable land**	**Ackerbrachen**	
'5.1.4.1	**FALLOW1**	***annual***	***1-jährig***	
'5.1.4.2	**FALLOW2**	***2 to 5 years***	***2- bis 5-jährig***	rosette plants
'5.1.4.3	**FALLOW5**	***5 years and longer***	***5- bis mehrjährig***	only a few occurring rosette plants
'5.2		**field margins**	**Ackerraine**	Map field margins up to 25 cm. Please note the width.
'5.2.1		**nutrient-rich field margins**	**Nährstoffreiche Ackerraine**	
'.1	**MRSHRUB**	shrub-rich field margin	BT Staudenreicher Ackerrain	
'.2	**MRGRASS**	field margin with grassland species	BT Grünland-Ackerrain	
'.3	**MRRUD**	field margin with ruderal species	BT Ruderaler Ackerrain	
'5.2.2		**nutrient-poor field margins**	**Nährstoffarme Ackerraine**	
'5.2.2.1	**MPSHRUB**	***dominated by shrubs***	***staudenreich***	
'5.2.2.2	**MPGRASS**	***dominated by grasses***	***gräserdominiert***	
'5.2.2.3	**MPRUD**	***dominated by ruderals***	***ruderal***	
'5.3		**vineyards and hop fields**	**Weingärten und Hopfenkulturen**	
'.1	**VY**	**vineyard**	**BT Weingarten**	Please note if associated flora is rich or poor in species.
'.2	**FALLVY**	**fallow vineyard**	**BT Weingartenbrache** photos see inventory instructions	Grapevine is still present.
'.3	**HOP**	**hop field**	**BT Hopfenkulturen**	

nr. in Red Lists	Code	habitat structures	for comparison: habitat structures in German language	additional information
'5.4		**ruderal flora**	**Ruderalfluren**	
'5.4.1		**ruderal flora of fresh habitat conditions**	**Ruderalfluren frischer Standorte**	
'.1	**RUFLFRO**	ruderal flora of fresh conditions with open pioneer vegetation	BT Ruderalflur frischer Standorte mit offener Pioniervegetation	eutrophic, good water supply, frequent + strong disturbances
'.2	**RUFLFRCL**	ruderal flora of fresh conditions with closed vegetation	BT Ruderalflur frischer Standorte mit geschlossener Vegetation	only a few strong disturbances, note % coverage, 90% closed
'5.4.2	**-**	**ruderal flora of dry habitat conditions**	**Ruderalfluren trockener Standorte**	
'.1	**RUFLDRO**	ruderal flora of dry conditions with open pioneer vegetation	BT Ruderalflur trockener Standorte mit offener Pioniervegetation	
'.2	**RUFLDRCL**	ruderal flora of dry conditions with closed vegetation	BT Ruderalflur trockener Standorte mit geschlossener Vegetation	Please note coverage in %! from 90% closed vegetation
'6	**-**	**tall herb and grass communities, felled areas and forest edges**	**Hochstauden- und Hochgrasfluren, Schlagvegetation und Waldsäume**	
'6.1	**THERB**	**tall herb and grass communities**	**Hochstauden- und Hochgrasfluren**	comm. with *Petasites*, *Filipendula*, *Senecio*, *Urtica*, neophytes
'6.2	**FELLED**	**flora of felled areas**	**Schlagfluren**	pioneer community which can develop up to nurse crop
'7.	**DWARF**	**dwarf-shrub heathland**	**Zwergstrauchheiden**	
'8	**-**	**woods in open landscapes, shrubbery**	**Gehölze der Offenlandschaft, Gebüsche**	
'8.1	**-**	**hedges**	**Hecken**	
'8.1.1	**SNH**	**semi-natural hedges**	**Naturnahe Hecken**	
'.1	**SHRUBH**	hedge with shrubs photos see inventory instructions	BT Strauchhecke	also young trees occurring, but character of shrubbery
'.2	**TREEH**	hedge with trees	BT Baumhecke	
'8.1.2	**NNH**	**non-natural hedges**	**Naturferne Hecken**	non native forest trees dominant, untypical for the habitat, stand of only one tree species, care
'8.2	**-**	**gallery forest**	**Ufergehölzstreifen**	
'8.2.1	**SNGALL**	**semi-natural gallery forest** photos see instructions	**Naturnahe Ufergehölzstreifen**	also a small rudiment of a flood plain gallery
'8.2.2	**NNGALL**	**non-natural gallery forest**	**Naturferne Ufergehölzstreifen**	
'8.3	**-**	**woodlots**	**Feldgehölze**	def. following the Austrian forestry regulation: < 0.1 ha
'.1	**WLD**	deciduous trees	Laubbäume	
'.2	**WLC**	coniferous trees	Nadelbäume	
'.3	**WLM**	mixed forest	Mischwald	
'.4	**WLS**	shrubbery and coppiced woodlots	Strauchgruppen, u.a. auf Stock gesetzte Feldgehölze	
'8.4	**-**	**single trees and bushes, lines of trees and allées, tree stands**	**Einzelbäume und –sträucher, Baumreihen und Alleen, Baumbestände**	
'8.4.1	**-**	**single trees and bushes** photos see inventory instructions	**Einzelbäume und -sträucher**	
'.1	**EFT**	fruit tree	BT Obstbaum	fruit tree cultivar – consumption: note species type!
'.2	**EDT**	deciduous tree	BT Laubbaum	all species of deciduous trees, no species information
'.3	**ECT**	coniferous tree	BT Nadelbaum	no species information necessary
'.4	**EB**	single bush and shrubbery	BT Einzelbusch und Strauchgruppe	no species information necessary

'8.4.2	**-**	**lines of trees and allées:** photos see inventory instructions	**Baumreihen und Alleen**	crown closure required, otherwise map as single tree
'.1	**FRUITLINE**	line of fruit trees	BT Obstbaumreihe und -allee	
'.2	**DECILINE**	line of deciduous trees	BT Laubbaumreihe und -allee	
'.3	**CONILINE**	line of coniferous trees	BT Nadelbaumreihe und -allee	
'.4	**DECOLINE**	line of deciduous and coniferous trees	BT Laubbaum-Nadelbaumreihe und -allee	
'8.4.3	**-**	**tree stand in parks and gardens**	**Baumbestände in Parks und Gärten**	map parks or gardens as complex, note tree proportion in %
'.1	**PARKO**	old tree stand in parks and gardens	BT Altbaumbestand in Park und Garten	
'.2	**PARKY**	young tree stand in parks and gardens	BT Junger Baumbestand in Park und Garten	
'		**group of trees**	**Baumgruppen**	additional entry during field work, closely standing together
'	**TREEGRF**	group of fruit trees	Gruppe von Obstbäumen	
'	**TREEGRD**	group of deciduous trees	Gruppe von Laubbäumen	
'	**TREEGRC**	group of coniferous trees	Gruppe von Nadelbäumen	
'8.5	**-**	**shrubbery**	**Gebüsche**	
'8.5.1	**BUSHWET**	**shrubbery of water-logged and moist habitat conditions**	**Gebüsche nasser bis feuchter Standorte**	small shrubs under wet and humid condition
'8.5.2	**BUSHFR**	**shrubbery of fresh habitat conditions**	**Gebüsche frischer Standorte**	elder, hazel, dogwood, blackthorn, broom, bramble, dew berry, neophyte, etc..
'8.5.3	**BUSCHDR**	**thermophilous shrubbery of dry habitat conditions**	**Thermophile Gebüsche trockener Standorte**	warm and dry site, immature soil with shallow layer (rocks, rendzina) situated above carbonate
'8.6	**LAMEA**	**larch meadows and pastures**	**Lärchwiesen und –weiden**	
'8.7	**WOOPA**	**wood pastures**	**Weidewälder**	
'8.8	**TREENURS**	**tree nurseries**	**Gehölzkulturen**	Christmas tree farm, energy crop, tree nursery
'8.9	**-**	**orchards**	**Obstgehölzbestände**	
'.1	**ORCHMEA**	orchard meadows see inventory instructions	BT Streuobstbestand	If large in a residential area, map as a separate structure!
'.2	**FRUPLAN**	fruit tree plantation	BT Intensiver Obstbaumbestand	
'.3	**BEPLAN**	berry plantation	BT Fruchtstrauchkultur	
'9	**-**	**forests, afforestations, pioneer forests**	**Wälder, Forste, Vorwälder**	definition following the Austrian forestry regulation: > 0.1 ha
'9.2	**-**	**alluvial forests**	**Auwälder**	
'9.2.1	**ALLUFOS**	**alluvial forests with shrubby willows**	**Strauchweidenau**	
'9.2.2	**SOFTWOOD**	**softwood alluvial forests**	**Weichholzauwälder**	
'9.2.3	**HARDWOOD**	**hardwood alluvial forests**	**Hartholzauwälder**	
'9.2.4	**ALLUFOC**	**alluvial forests with coniferous trees**	**Nadelbaumreiche Auwälder**	mixed forest
'9.3	**MARSH**	**marshland forests**	**Bruch- und Sumpfwälder**	
'9.4	**BOGFO**	**bog forests and mire edge forests**	**Moor- und Moorrandwälder**	

nr. in Red Lists	code	habitat structures	for comparison: habitat structures in German language	additional information
'9.5	RAVINE	scree and ravine forests see inventory instructions	Block-, Schutt- und Hangwälder	Forest ravine also belongs to this category.
'9.6	OAKFO	mixed Oak forests and Oak-Hornbeam forests	Eichenmischwälder und Eichen-Hainbuchenwälder	
'9.7	BEECHFO	Beech forests and Spruce-Fir-Beech forests	Buchenwälder und Fichten-Tannen-Buchenwälder	
'9.8	CHESTFO	mixed forests with Chestnut	Edelkastanienreiche Mischwälder	
'9.9	HOPFO	Hop-hornbeam forests	Hopfenbuchenwälder	
'9.10	LAFO	Larch and Larch-Swiss stone pine forests	Lärchen- und Lärchen-Zirbenwälder	
'9.11	SPRUFO	Spruce forests and Spruce-Fir forests	Fichtenwälder und Fichten-Tannenwälder	
'9.12	PINEFO	Pine forests	Föhrenwälder	
'	ASHMAFO	Ash and Maple dominated deciduous forest	Eschen- und Ahorn-dominierter Laubwald	additional category defined during field work
'9.13	-	afforestations	Forste	pops consisting of regional and community foreign species
'9.13.1	COAFF	coniferous afforestations	Nadelbaumforste	
'9.13.2	DECAFF	deciduous afforestations	Laubbaumforste	
'9.13.3	MIAFF	deciduous and coniferous mixed afforestations	Laub- und Nadelbaummischforst	
'9.14	PIOFO	pioneer forest	Vorwälder	stage after anthropogenic. or natural disturbances (windfall), succession with pioneer trees, following flora of felled areas
'10.	-	geomorphologically determined biotope types	Geomorphologisch geprägte Biotoptypen	
'10.4	ROCK	rock	Fels	
'10.5	SCREES	screes	Block- und Schutthalden	gravel exploitation
'10.6	CLIFF	cliff (unconsolidated rocks)	Steilwände aus Lockersubstrat	cliffs constisting of sand, loess, soil or gravel
'10.7	WALL	clearance cairn and dry walls	Lesesteinriegel und Trockenmauern	anthropogenically made linear habitat structures
'10.8	DUNE	inland dune	Binnendünen	permanent redeposition of sand influenced by wind
'11.	-	inland water, riverine vegetation	Binnengewässer, Gewässer- und Ufervegetation	
'11.3	-	watercourse	Fließgewässer	
'11.3.2	STREAM	streams and rivers see inventory instructions	Bäche und Flüsse	Apart from a few exceptions map as a complex!
'11.3.4	BANK	alluvial and riverbank	Alluvionen und Ufer der Fließgewässer	
' 11.4	-	standing waterbodies	Stillgewässer	
'11.4.1	LAKE	natural lakes and ponds	Natürliche Seen und Weiher	State “salt lake” separately in additional information!
'11.4.2	OXBOW	oxbow lake and dead water	Alt- und Totarme	
'11.4.3	-	man-made standing waterbodies	Anthropogen geschaffene Stillgewässer	
'.1	SNSW	semi-natural man-made standing waterbodies	Naturnahe anthropogen geschaffene Stillgewässer	created by man, small to medium size standing water-bodies, rarely or never falling dry
'.2	NNSW	non-natural man-made standing waterbodies	Naturferne anthropogen geschaffene Stillgewässer	see above, appearance shaped by intensive human utilisation
'11.4.4	RIPARIAN	riparian pioneer habitats of standing waterbodies	Uferpionierstandorte der Stillgewässer	e.g. mud embankments, seasonal flooded grassland

nr. in Red Lists	Code	habitat structures	for comparison: habitat structures in German language	additional information
‘11.4.5		**riverine vegetation**	**Gewässervegetation**	
‘11.4.5.1	**SUBVEG**	***submerged vegetation***	***Unterwasservegetation***	
‘11.4.5.2	**FLOAT**	***floating vegetation***	***Schwimmblatt- und Schwimmpflanzenvegetation***	
‘	**TEMP**	**temporary waterbodies**	**Temporäre Gewässer**	watercourse and standing waterbodies, e.g. pool, temporary streams: add. info
‘12.		**technical biotope types, biotopes of residential areas**	**Technische Biotoptypen, Siedlungsbiotoptypen**	
‘	**DITCH**	**ditch**	**Graben**	additional category defined during field work: draining ditch
‘	**DYKE**	**dyke**	**Damm**	additional category defined during field work
‘ 12.1	**EXCA**	**excavation sites**	**Abbaubereiche in Abbau**	
‘ 12.2	**HEAPS**	**landfill and heaps**	**Aufschüttungsflächen und Halden**	young , fine-grained material, rare or no vegetation
‘ 12.3	**RECRE**	**recreational and green areas**	**Freizeit-, Erholungs- und Grünflächen**	lawn, ski slope, sports facilities without vegetation
‘ 12.5		**traffic facilities and squares**	**Verkehrsanlagen und Plätze**	
‘12.5.1		**roads and railways**	**Straßen und Bahnstrecken**	
‘.1		tracks	BT Straße unbefestigt	
‘	**TARRO**	***tarmac roads***	***Straße asphaltiert***	
‘	**GRARO**	***gravel roads***	***Straße geschottert***	
‘	**MIDRO**	***track with herbaceaous or grassy strips***	***Weg Mittelstreifen grün***	
‘	**HERRO**	***herbaceaous / grassy tracks***	***Weg grün - Wiesenweg***	Also terreous paths belong to this category.
‘.3	**RAIL**	railway	BT Bahnstrecke	
‘ 12.6		**constructions**	**Bauwerke**	
‘12.6.1	**BUILD**	**buildings**	**Gebäude**	
‘12.6.2		**other constructions**	**Sonstige Bauwerke**	
‘.1	**WIND**	**Wind energy plant**	**BT Windenergieanlage**	freestanding plant for energy usage of wind
‘.2	**POLE**	**poles and stations** see inventory instructions	**BT Masten und Sender**	Within this category only power lines are mapped.
‘.4	**SMALL**	**small architectural constructions**	**BT Kleinarchitektur**	freestanding small buildings: e.g. wayside shrine, small chapel
‘ 12.7	**RESI**	**residential area** see inventory instructions	**Siedlung**	Note sealed areas, forests, gardens, ruderal areas, etc. in %.
‘ 12.8	**WASTE**	**areas of waste management:** see inventory instructions	**Flächen der Abfallwirtschaft**	Areas where solids are stored. e.g. bricks
‘	**DUMP**	**agricultural dump sites** see inventory instructions	**Landwirtschaftliche Lagerstätten**	compost heap, organic substances, silage, lumber, etc.

Additional aspects which have to be considered using the list of habitat structures:

- Spots such as trees are also considered with a size under 25 m^2.
- The same number on the report sheet can be assigned to similar elements. It is not obligatory to classify each element with a new number.
- Crops are only recorded to serve for the orientation of the field biologist. Information concerning cultivation proportion of different crops for the whole test area should be available from the IACS data-base (see explanations above). But each field in the test area has to be defined separately by the field surveyor.
- Complexes have to be mapped as one unit providing additional information. The main covering type of the complex is termed, for an example: fallow, additional information: shrubbery 30% (e. g. 1st biotope type: x, 2nd biotope type: y, etc.)
- Residential area: e. g. buildings: 20%, single trees: 10%, grassland: 40%, kitchen garden: 10%, tarmac roads: 20%
- Fallow land with shrubs: is assigned as a complex structure with the indication of % (fallow 70%, shrubbery 30%)
- Linear complex structures: consider also structures which are < 25 cm in wide (e. g. small field margins, etc.).
- Embankment – stream: assign embankment as a complex, if the embankments are not developed particularly; otherwise record stream and embankment separately (see detailed instructions in the field guide).
- If you map linear complex structures, please also note the proportion of single linear structures in %.
- Do not map several linearly ranged trees as a line of trees, when they do not show crown closure. Please map them as single trees! If they are identified as the same type of tree, assign them to the same number.
- „Shrubbery" as additional information: specify proportion of shrubbery in %. The main type of the complex is the ground cover.

The present brochure contains a field guide for a representative biodiversity inventory in the agrarian region based on the four indicator groups vascular plants, butterflies, grasshoppers and habitat structures.

Number for oder:

0810 81 81 64