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Ökodorf Brodowin e. V. (registered association)

Concrete recommendations for action for farmers, advisers and authorities based on the results and experience gained in the 'Nature Conservation Farm Brodowin' testing and development project (supported by the German Federal Agency for Nature Conservation)

20 profiles of successfully tested nature conservation measures

17 profiles of animal and plant species particularly worthy of protection

With comprehensive instructions on long-term and effective nature conservation for the whole farm

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Leibniz-Centre for Agricultural Landscape Research (ZALF) e. V.

Ökodorf Brodowin e. V.

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Karin Stein-Bachinger

Nature Conservation in Organic Agriculture

A manual for arable organic farming in north-east Germany

German Federal Agency for Nature Conservation

Imprint

Sarah Fuchs
Karin Stein-Bachinger

in cooperation with
Frank Gottwald

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Preface

"A good example often says more than thousand words".

When we started our "Nature Conservation Farm Brodowin" testing and development project in 2001 we had above all two wishes:

– successful measures should continue to exist beyond the life of the project, and
– the insights gained should have an exemplary function and be transferable beyond the Brodowin example.

We didn't want to develop a miniature "ideal world", but rather – completely in line with the spirit of the UNESCO Biosphere Reserves and in the tradition of Brodowin – test new ways to see how agriculture and nature conservation can simultaneously be achieved on the same field.

Now it's starting to seem as if our wishes have been fulfilled. In 2008 the Brodowin biodynamic farm decided to continue running certain particularly effective nature conservation measures in collaboration with the Ökodorf Brodowin e.V., and this has been – as yet – without secure financing for the yield loss. At the same time the Brodowin example seems to have become contagious: In the Schorfheide–Chorin Biosphere Reserve, 15 of 18 large agricultural farms that were questioned by the regional habitat care association, stated that they are very interested in nature conservation consultation and the preparation of a farm-related nature conservation management plan. This shows that farmers want to take nature conservation goals into account on their farm area. At the same time however, they would like to be able to weigh up by themselves which goals can be implemented and to what extent.

And that is precisely the purpose of this manual. It gives the farmers the tools they require to carry out targeted nature conservation measures voluntarily on their own farms. At the same time, nature conservation authorities and agricultural authorities receive guidance on which programmes are worth promoting in the future.

There may well be a viable concept at the end

which allows for a reconciliation between agriculture and nature conservation on large areas, thereby giving new meaning to the empty saying that "Farmers are the best conservationists". This would be a great step forward in our agriculturally characterised cultural landscape in the sense of the Rio Convention on Biodiversity – global thinking transferred into local action.
I am convinced that this manual is a pioneer in this direction.

Dr. Martin Flade
Chairperson Ökodorf Brodowin e. V.

The 'Nature Conservation Farm Brodowin' Project

The results presented in this manual were acquired within the framework of the five year BfN project 'Nature Conservation Farm Brodowin'. The specific design of the measures is also a result of this long-term interdisciplinary collaboration. Significant contributions were made by Sarah Fuchs (scientific nature conservation project coordination; farmland and hedgerow birds, brown hare), Frank Gottwald (segetal and dry grassland flora, butterflies, saltatoria), Angela Helmecke (amphibians, farmland birds), Ralf Gottschall and colleagues (trimming, composting), Johannes Grimm (management), Karin Stein-Bachinger (scientific agricultural project coordination; crop production, animal nutrition, economy) as well as Peter Zander and colleagues (economy).
The complete presentation of the project results will be published as a scientific reference book in 2010 (Stein-Bachinger et al. 2010) and be an ideal supplement to the existing manual, in which frequent reference is made to the Nature Conservation Farm project.

Introduction

How can wild animals and plants be better protected during the production of foodstuffs? What possibilities are offered by organic farming?

This manual addresses these questions in a focussed and practice-oriented way. The contents were intensively discussed and agreed upon with experts recruited among farmers, advisers, authorities and scientists. Suggestions and objections on the part of the farmers were thus able to be taken into consideration and both administrative problems as well as questions on the transferability of the content across the whole of north-east Germany were clarified.

Good ideas and useful knowledge – nature conservation to suit your farm

Organically farmed field in Brandenburg

The first part of the manual illustrates the benefits and potential of organic agriculture for nature conservation and the situation of the farms in north-east Germany. Explanations are given for the particular necessity of nature conservation measures in arable farming. The habitats of legume-grass

leys, grain crops and landscape elements with their ecological importance are described and basic conservation strategies are introduced.

Brief, clear information and concrete instructions

The subsequent practical section contains brief and clear instructions for the conservation of fauna and flora. 20 profiles of measures and 17 profiles of species as well as short descriptions of further relevant measures and species help the farmer to decide on which fields it is worthwhile protecting certain species and what agricultural consequences this may have. The user can quickly see how to support typical or rare animal and plant species. Suitable measures can also be selected for areas on farms for which there is no concrete information on the occurrence of species. Furthermore, concrete options for the optimisation of nature conservation across the whole farm are explained with the aid of practical examples.

What are the benefits of organic agriculture?

Organic farming serves as a role model from the viewpoint of environmental protection and nature conservation. Many features of this farming system overlap ideally with nature conservation goals. One of the most important nature conservation goals is the support of suitable living conditions for wild flora and fauna and thereby biodiversity in the agricultural landscape. Thus, for example, the preservation of soil fertility through various crop rotations at the same time also creates diverse habitats for wild animals, and the renunciation of synthetic pesticides and mineral nitrogen fertilizers brings about crop densities in which segetal flora can also thrive well. Animal husbandry must match the fodder basis of the farm and therefore generally provides a rather low nutrient level, which fits very well with the habitat requirements of almost all of the typical animal and plant species in the agricultural landscape. The integration of landscape elements not only promotes beneficial insects, but rather also offers food, cover and refuge to numerous other animals and plants.

Organic farms can achieve nature conservation goals more simply and effectively

Typical animals and plants from the agricultural landscape are therefore often more frequently found on organically managed fields, as is documented in a large number of scientific studies. The potential for nature conservation is therefore higher than on comparable conventional fields – a great opportunity for the preservation and support of biological diversity in agriculture!

Black-veined White

What is the idea behind ‘Nature Conservation in Organic Agriculture’?

Don‘t organic agriculture and nature conservation go hand in hand anyway? What happens if a legume-grass ley need mowing, while there are leverets growing up in it? Where, and when exactly, do field birds actually breed? The committed farmer asks himself such or similar questions. And he is dependent upon on receiving concise and well founded answers.

The proportion of organically farmed areas in north-east Germany is comparatively high, and farmers are often very interested in living diversity on the field – however they lack a user-oriented guide which is tailored to practice. Detailed, scientific reports are indeed informative, but for the farmer, in his daily work, inappropriate.

The central concern of this manual is to bring more specific nature conservation into organic farming. So that land users can be supported as effectively as possible in their nature conservation efforts, advisers and administrative staff are finally also dependent upon meaningfully acquired expert knowledge. In addition the manual should provide valuable service as a basis for guided farm-tours or environmental education events.

For everyone who is active in organic farming in a practical, advisory or administrative role

Ever more organic agriculture
Organic farming has developed rapidly in almost every European country since the beginning of the 1990's. Nearly 5% of the agricultural land in Germany is managed according to EC Regulation 2092/91. Brandenburg has the largest share (9.8%) in a nationwide comparison, and in some large biological reserves up to 70% of the agricultural area is already organically farmed (2008 status).

Why are nature conservation measures necessary in arable farming?

Unfortunately the utilization interests of farmers and the requirements of nature conservation do not frequently coincide. For this reason, conflicts with nature conservation goals are well known in modern organic agriculture. This is because farming operations for example also take place at the same times during which field-dwelling animals reproduce. The nests of ground-breeding birds can be destroyed or young animals killed. And even organic agriculture cannot farm profitably on dry grassland or moist meadows and therefore withdraws from such areas. Likewise, the maintenance of field margins, hedges and buffer strips around water bodies is not in any way automatically carried out in organic agriculture. Increasing pricing pressure leads to further specialization and intensification in the production process. Crop rotations are more simplified and mechanical weed control increasingly perfected. Arable fodder (leys), meadows and pastures are used earlier and more frequently.

Combine food production and nature conservation goals

Wild flora and fauna therefore require adapted farm management procedures for their long-term survival which are frequently connected with yield and quality losses or additional expense.

Are there positive examples from practical experience?

Fallow strip in cereals

In contrast to the management of grassland in accordance with nature conservation, there had been little available until now in terms of research results or practical material concerning nature conservation on arable land. In the mid-1990's for example, the 'Gut Peetzig' organic farm was completely restructured in the course of a large co-operative research project (BMBF/DBU) carried out in the Schorfheide–Chorin Biosphere Reserve (Brandenburg), in which nature conservation goals were taken into account primarily through the equipping of the farm with wooded structures and habitat networks.

Within the framework of the five year BfN project 'Nature Conservation Farm Brodowin' it was possible – for the first time on a national basis – to comprehensively prove that arable measures in organic farming have a great impact on nature conservation. An interdisciplinary team of scientists examined the effects and costs of nature conservation measures in this project in close co-operation with the Ökodorf Brodowin GmbH & Co.KG biodynamic farm. The focal point was on procedures in modern, large-scale agriculture in north-east Germany. In the course of this, a number of measures that from a nature conservation viewpoint were goal-oriented, and from a farm point of view easily implementable, were tested and their effects scientifically documented.

'Nature Conservation Farm Brodowin': interdisciplinary and innovative; term of project 2001–2006, promoted by the Federal Agency for Nature Conservation (BfN) with funds granted by the Federal Ministry of Environment, Nature Conservation, and Nuclear Safety

Since then the interest in nature conservation in agriculture has increased: The University of Kassel has been examining similar questions on a high yield location since 2006 in an associated project also promoted by the BfN on the Hessian state-owned Frankenhausen farm. Furthermore, several farms were awarded prizes on a national level in 2007 and 2008, for integrating nature conservation measures into management in an exemplary fashion. This 'Farming Conservation Award' recognises the high level of commitment by farmers and communicates the results to a wider public.

This manual contains the results of the 'Nature Conservation Farm Brodowin' project in a condensed form. Other experience has also been incorporated, including that from the above-mentioned projects. The manual thus summarizes the current state of knowledge about nature conservation in arable organic farming.

Why is the focus on arable farming measures in north-east Germany?

Initial function: Nature conservation strategies for arable farms in Brandenburg, Mecklenburg-Western Pomerania and Saxony-Anhalt

The nature conservation strategies presented are essentially based upon practical experience gained in Brandenburg and are therefore particularly valid for the arable landscapes emerging from the Ice Age in north-east Germany. What are typical for these agricultural areas are low to medium soil qualities with wide small-scale heterogenities and a predominantly subcontinental climate with relatively little precipitation. Here large farms tend to manage large fields. With the high variety of landscapes at the same time, there is an inestimable potential for nature conservation.

The site and climatic conditions mentioned influence the occurrence and the reproduction seasons of the animals and plants – and thereby also the nature conservation measures. Thus for example, a mowing interval suitable for farmland birds on rich soils and where there is more precipitation in Germany can differ from the recommendations in this manual. The establishment of field margins or blossom strips for example, is on the other hand less of a variable measure and can also be transferred to other areas and management systems without essential constraints.

Why does organic agriculture require different measures to conventional farming?

Organic agriculture renounces synthetic pesticides and mineral nitrogen fertilizers. The control of pests or weeds is focussed on the crop rotation and tillage measures. In livestock farming, the feedstuff must be produced on the farm. Changes of crop production practices for the purpose of nature conservation must take these principles into consideration and require longer-term planning. This is taken into account in the suggested measures. This is the only way for example to avoid subsequent weed infestation or feedstuff scarcity brought about by nature conservation measures.

Take the peculiarities of farm management procedures into consideration

Several measures have different or no effects in organic agriculture however when compared with conventional agriculture:

- *Example 'Skylark plots' in cereals*

This is a popular measure in conventional cereal cropping. Effect there: Small areas in the field with a low vegetation density which allow the Skylark to land in the crop, to find food and to build its nest in the adjacent cereals. Effect in organic agriculture: Creation of wild plant islands within the field, which are not very suitable for Skylarks (too dense and tall), but make excellent nesting locations for corn buntings and yellow wagtails.

- *Example 'Reduction in sowing density' in cereals*

A reduction in sowing density in conventional cereal cropping must as a rule have completely different dimensions in order to reduce the coverage of the vegetation to such an extent that the areas become useful for wild flora and fauna. However, even a well penetrable cereal field is of little value to farmland birds or Brown Hare if herbicides and insecticides are used, because then there will be too few wild plants and insects available as food and cover.

- *Example 'Late cut and high cut' in legume-gras leys*

Intensively used, heavily fertilised legume-grass often forms such a dense crop stand (which consequently at ground level is cool, moist, and hard to traverse), that it has but little value as a habitat

Weed control in organic agriculture

for farmland birds and Brown Hare. A late or high cut is in that case not worthwhile as relatively few individuals profit from it.

Certainly some of the measures proposed in the manual can also be transferred to conventional farms, especially when the crop is cultivated to take sufficient account of the habitat requirements of the animal and plant species. A universal transferability of the results presented in the manual however requires review.

Why the selected measures?

Effective and practical: Over 90 % of the recommended protective measures were thoroughly tested in the 'Nature Conservation Farm Brodowin' project.

The recommended measures are based upon practical experience as well as on available knowledge concerning the habitat requirements of the species. The highest success can be achieved through targeted measures with sometimes only minor changes in crop production practices. The renunciation of weed control only helps a farmland bird in places where it is breeding at the time in question. Butterflies need an abundant supply of nectar especially when laying eggs in the summer.

The recommended measures were therefore selected according to the following criteria:

- **Effective from a nature conservation viewpoint:** The central habitat requirements of the typical animals and plants of the agricultural landscape are to be fulfilled.

- **Agriculturally useful:** The principles of organic farming must be observed, including among other things, the preservation of soil fertility, the protection of environmental assets through a reduction in nitrate leaching and erosion, and animal welfare.

- **Practical:** The measures must be agronomically sensible, technically feasible and capable of being integrated into work schedules.

- **Useful for different farming systems:** The requirements of livestock farms concerning fodder quality must be observed, for example.

- **Safe:** The risk of long-term negative effects on agriculture that are hard to calculate (e.g. an increase in weed infestation) should to be kept as low as possible.

We would like to mention here that additional measures could also be useful. The manual is therefore designed so that new profiles resulting from an increase in knowledge can be added in a new edition.

Perhaps there are also other effective measures for your farm?

How can the effort and cost of a measure be estimated?

Due to economic constraints, many farms only adopt nature conservation measures if the losses incurred and adverse consequences are financially compensated. Some of the measures proposed are not yet included in nature conservation programmes as they are presented here for the first time, for some others there are indirect possibilities for funding. Moreover, it is well known that agri-environmental schemes will in future remain subject to strong variations in the different federal states of Germany and calculations on the basis of gross margins are ultimately dependent on pricing.

For this reason, concrete sums detailing financial compensation (in Euros/ha) were left out of the profiles of the measures in consensus with all of the interest groups involved. In place of this, information is provided on losses in yield and degradation of quality as well as on the efforts of implementation. This allows for an estimation of the actual expenditure according to farm type, regardless of whether and to what extent a measure is actually supported with subsidies. In some measures for example, it can be quickly seen that they only bring about slight losses from the farmers point of view.

Discussion with farmers

It is also worthwhile implementing nature conservation measures on a small area – this remains easy to manage economically.

We therefore hope that some farmers will be prepared, both out of conviction and out of a love of nature, to integrate nature conservation measures into their management systems, at least on parts of the land under their cultivation.

Why the selected species?

For all of the animals and plants presented in this manual, arable land is a very important habitat and for some (e.g. Fire-bellied Toad, Forking Larkspur) also the most important. The long-term survival of these species therefore depends on the quality of the arable land.

'Common or garden species' Corn Bunting', Farm bird' Skylark, 'Mass bird' Quail, 'Harvest pest' Brown Hare, 'Weed' Lamb's Succory … is this still true?

Urgent action is required as massive population decreases have been registered for a large number of species throughout Europe in recent decades. And the negative trends are continuing. The main causes of this are intensive conventional agriculture and the consequences of Europe's common agricultural policy.

> *"If one analyzes the nature conservation situation today, one comes to the sobering conclusion that previous efforts to preserve biodiversity have not yet achieved a breakthrough."* (Quotation: NABU 2006)

What is characteristic of the species presented is that they react sensitively to changes in agricultural land use. As a result of this trait they are also particularly responsive to nature conservation measures. Most of the species have already been thoroughly examined scientifically, and their habitat requirements are well known. All of the species described in the profiles were moreover studied intensively for a number of years within the framework of the 'Nature Conservation Farm Brodowin' project. That is why it is possible to derive effective conservation measures for these species in organic agriculture.

Which animals and plants live on arable fields?

Although all of the animals and plants presented in the species profiles are typical for north-east Germany, not all of them are to be found on every farm. On the other hand the list is by no means complete. Threatened species are missing for example, such as the Montagu's Harrier or the European Hamster which require very specific and costly species protection programmes.

The Skylark, Brown Hare or the Queen of Spain Fritillary are widespread throughout the arable landscapes in north-east Germany and are likely to be found on all organic farms. The occurrence of amphibians is in contrast restricted to areas with an abundance of water bodies. Farmland birds settle predominantly in sparsely wooded fields. Segetal flora species are bound to specific soil properties and many butterflies to very specific caterpillar food plants. Some species, such as the hedgerow bird Barred Warbler or the segetal plants Lamb's Succory and Field Nigella are only found at a few suitable sites. Such species are highly endangered due to their very special requirements. The targeted support of these species is therefore especially important.

Young European Tree Frog

We hope the farmer will be able to find "his" typical species for his farm in this manual. This will enable him to set specific priorities for the protection of nature.

What possibilities do agri-environmental programmes offer today and in the future?

Nature is a valuable asset, and to protect it costs money!

Many farmers are quite prepared to integrate nature conservation measures into their farms, which go above and beyond 'good agricultural practice'.

However this is hardly possible without financial assistance from nature conservation programmes.

International consent
Since the 1992 agreement at the Earth Summit in Rio de Janeiro, the conservation and sustainable use of biodiversity has been a declared goal of all countries, in order to decisively combat the decline in species. It has also been accepted that this is a task for society as a whole, which cannot be performed by agriculture alone.

In order to compensate for losses in income, the federal states of Germany offer financial, usually measure-oriented support through agri-environmental programmes and nature conservation by contract. These voluntary contractual agreements go beyond the standards given in the framework of the 'Cross Compliance' regulations. Admittedly, the programmes which organic farms would qualify for are often not sufficiently aligned with the farming requirements and the specific nature conservation challenges of this kind of farming system.

Effective nature conservation programmes funded by the EU and the German federal states which target organic farming have so far been in short supply. This could change soon.

As money is generally scarce moreover, new strategies to increase the effectiveness of agri-environmental programmes will be necessary in future. Result-oriented approaches are increasingly being discussed, i.e. payments should be made dependent upon whether the desired nature conservation effects actually occur. It is also to be expected that available resources will flow predominantly into regions which are valuable from a nature conservation viewpoint, and there to farms whose carefully targeted measures can bring about visible successes for nature conservation.

At present, result-oriented approaches predominantly exist in the sector of the biodiversity of plants (for example the promotion of species-rich grassland in Baden-Württemberg). Animals are mobile and can only be recorded at considerable expense. They are thus less easy to include in such concepts. Moreover, most agri-environmental measures are currently subject to certain EU standards in the structure and calculation of their premiums: Funding is currently oriented towards the estimated average losses in income associated with participation.

It would be useful to combine result-oriented approaches with measure-oriented agri-environmental schemes. A great opportunity for organic farms! It will become more difficult for farmers however to acquire the knowledge required for the successful implementation of nature conservation measures. The manual should stand them in good stead. We also hope that the measures proposed in the manual will – even with scarcer funds – be offered in future within the framework of agri-environmental programmes or nature conservation by contract.

Working in a harmonious landscape with living nature – we hope very much that this manual is able to support people in their efforts for the preservation of biodiversity.

Well prepared for the nature conservation of the future? Organically managed farms have the potential for this.

The 'Nature Conservation Farm' idea: To observe production as a whole, attract new customers and remain pioneers

Legume-grass leys as a habitat

The composition of legume-grass leys from different crop species with different growth heights leads to a very favourable vegetation structure for wild animals. For example farmland birds: They find suitable landing places to reach their nests, and good opportunities for movement and good visibility on the ground for them to hunt or to flee from enemies.

High ecological potential

The potential for nature conservation in legume-grass leys is extraordinarily high, as almost all of the species presented in this manual (and many others) often settle here in above-average numbers in comparison with other field crops. All farmland bird species, the Brown Hare, the Common Blue and grasshoppers are among them. Legume-grass alongside small water bodies is used by the Tree Frog, Fire-bellied Toad and Common Spadefoot Toad as a summer habitat. Large populations of mice and small mammals can develop, especially in perennial cultivation, which are within easy reach of and an indispensable source of food in the legume-grass leys for the Screech Owl, Common Buzzard, Red Kite or Lesser Spotted Eagle. When clover and lucerne blossom, they are used extensively as nectar plants by a multitude of butterflies. Partridge, Corn Bunting and Brown Hare also live here in winter and find sufficient food and cover in the mixtures.

High proportion of legumes

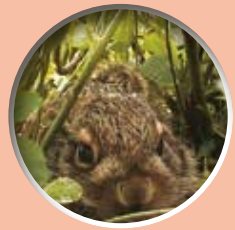
Farmland birds prefer to build their nests beneath dicotyledonous plants offering good cover. The Common Blue gladly lays its eggs on clover-species and lucerne.

Insect-rich habitats

Farmland birds such as the Corn Bunting and the Red-backed Shrike, which breeds in hedges, find sufficient food for their young, who are only fed on protein-rich invertebrates during their first few weeks.

No tillage

Common Spadefoot Toads, butterfly caterpillars and eggs of saltatoria survive the winter in the soil, in the litter layer or inside plant stalks.



Soft, thin stalks not in rows

Leverets, young farmland birds and young amphibians which are not yet very mobile can move around easily on the ground and at the same time find shelter near to the ground.

After the harvesting of cereals, the Partridge has no food and shelter on large parts of the farm area. During this time, it can withdraw into the legume-grass leys for example.

Significance for agriculture

Legume-grass is cultivated on 20 to 40 % of the arable land on organic farms. For the farms, it is the most important source of nitrogen and the basic protein and energy fodder for the livestock. Frequently it is undersown in spring in cereals. On stockless farms, the usually one-year-old crops are mulched several times during the year. A two-year cycle is customary for livestock farming. Mowing is carried out three to at most four times a year for the production of high-quality fodder in north-east Germany. The 1st cut takes place around 10th May, the 2nd cut about five or six weeks later, and the 3rd cut in August.

With an optimal 1st cutting date, the energy content necessary for feeding dairy cattle is usually higher than the 6.0 MJ NEL/kg DM required; the fibre content should not exceed 25 %. These values are not often reached in the 2nd cut even with a favourable cutting date. As the 1st cut also brings the highest yield, it contributes decisively to the success of a dairy farm.

Advantages and disadvantages of mowing

Usual management practice has both advantages and disadvantages for the wild animals. On the one hand, mowing thins out the vegetation several times a year and brings new growth at times when other crops already either have dense and high levels of growth, or do not provide favourable living conditions for animals following threshing or ploughing operations. This certainly suits ground-breeding birds for example, which require low to medium height crops for their nest sites between April until July. Grasshopper larvae which hatch in the summer also benefit from the increase in light and warmth which penetrates through to the ground after mowing, and hunters of mice and insects find ideal conditions for hunting in the low crops.

On the other hand however, there is also a large potential threat, as the customary cutting dates fall in the reproductive season of the species and mowing leads to losses among the animals living or breeding on the ground and their young. Thus for example, only about half of the Skylark broods and one-quarter of the Yellow Wagtail broods survive the mowing processes. Up to more than two-thirds of the saltatoria are injured, killed or collected along with the plant biomass. The leverets do not yet display flight behaviour towards the mowing machinery; young amphibians dry out on the sparsely covered fields after mowing. Farmland birds cannot at first build new nests in the low vegetation. Bird species such as the Whinchat and Yellow Wagtail, amphibians and many insects migrate from the mown fields. The customary mowing dates can therefore result in a reproductive rate that is too low or significantly worsen living conditions.

Conservation measures are worthwhile

The negative consequences of cultivation can be reduced by appropriate measures so that the species can reproduce sufficiently and their long-term preservation is ensured. At the same time, nature conservation measures in legume-grass leys are very efficient as many species and individuals can be reached on each field. The recommended measures are explained in more detail in profiles M 1 to M 6 and M 14.

Conservation strategies

The conservation measures follow three strategies:

- Adaptation of the cutting times to the breeding seasons of the farmland birds and the Brown Hare with the aim of ensuring that the most important times have a phase undisturbed by cultivation which suffices to raise at least one annual brood or a kindle of leverets. Moreover the periods of rest and migration of amphibians are taken into consideration.
- Changes of the cutting height, mowing direction and speed in order to minimize direct losses among broods, young birds and leverets, amphibians and insects. At the same time the deterioration in habitat is less drastic for the ground-dwelling and ground-breeding wildlife.
- Preservation of refuge areas, breeding areas, cover and food during and after mowing for all legume-grass dwellers by leaving strips unmown or by sowing blossom strips.

Grain crops as a habitat

Wild animals and plants find a suitable habitat in relatively low, varied cereals and grain legumes. Skylarks, Corn Buntings and Yellow Wagtails can raise more offspring successfully in spring crops than in most winter cereals.

Large variety of plants
The segetal flora are fundamentally dependent upon agriculture. It is regular soil tillage that provides them – in the same way as the crop plants – with suitable site conditions. These plants grow especially well on organically farmed fields because no herbicides are used, and because the competition for light and space for rooting from the crop plants is less intense than in conventional farming systems. The gappier the crop and the more open the soil, the higher the seed production of rare segetal species for example.

Spring crops and mixtures
Most of the species presented in this manual prefer crop species or varieties which remain relatively low and do not form dense, homogeneous stands. Spring cereals and grain legumes rarely grow above 40 cm before the end of May, and their coverage ratio is also approximately 40 %. Mixtures in particular are often rich in species and individuals because the composition of different crops supports a diversified structure.

Winter cereals
Winter cereals on the other hand – especially on homogeneous, rich soils – with a standard sowing density often develop thick and high stands early in the year, which are unattractive for most animal species. Winter rye and triticale reach a height of more than 40 cm by the beginning of May and a coverage ratio of well above 50 %; they reach their maximum height by the beginning of June.

Obligatory habitat
Most of the segetal flora in central Europe are strictly bound to arable crops as a habitat. Typical species found in winter cereals, such as Forking Larkspur or Fingered Speedwell, prefer to germinate in the autumn; they are not found at all in spring cereals or only in small quantities. The majority of the segetal species germinating in spring however can be found both in winter and in spring cereals.

Short-stemmed cereals
Yellow Wagtails and Corn Buntings settle particularly frequently in spring crops. With tall wild plants such as thistle or mugwort towering here and there above the crop, which serve as perches for resting and hunting, optimal nesting sites can be found in the middle of the field.

Abundance of insect fauna
Organic grain offers food and habitat for insects on a large-scale and thus, for example, also for farmland birds: The birds are dependent upon invertebrates as nourishment for nestlings.

Sparse, herb–rich crops
Brown Hares also have sufficient freedom of movement in mature crops and find suitable plant nourishment. Young farmland birds not yet capable of flight can also move around easily.

Crop densities of 250 to 350 ear-carrying stalks per m^2, vegetation heights of less than one metre and low yields of up to 3 t ha^{-1} provide an ideal habitat. Then there are sufficient wild plants with the corresponding insects to provide cover and food, and sufficient light and freedom of movement on the ground for Brown Hares, ground-breeding birds or migrating amphibians.

Significance for agriculture

Grain crops are cultivated on 50 to 80 % of the arable land on organic farms. The spectrum of crop species is diverse because winter and spring cereals as well as grain legumes are usually cultivated within five to eight-year crop rotations. Winter cereals dominate as a result of the higher stability of the yield. On light soils, winter rye is frequently cultivated on more than 50 % of the fields under cereals, alongside triticale, winter wheat, spelt and winter barley, according to site quality. Oats, wheat and barley, various grain legumes (incl. lupines, peas) and their mixtures are cultivated as spring crops. Grain legumes contribute to the supply of nitrogen like legume-grass leys.

Customary management comprises different operations depending upon the crop species cultivated: Stubble breaking of the previous crop, fertilizing, soil management and seedbed preparation, sowing of the main crop and catch crops, mechanical weed control and harvesting. Crop development and yields are subject to very big variations according to their position in the crop rotation, the soil quality, climate situation, crop species, sowing density and date and management intensity.

Systematically improving quality for wild animals and plants

Losses, above all of young animals and of segetal flora, can be brought about by operations such as harrowing, hoeing, ploughing or stubble breaking. Late ripening plants such as Field Nigella and Field Madder are dependent upon being able to complete fructification on the stubble after harvesting, early stubble breaking is therefore unfavourable. Ploughing near small water bodies can have fatal consequences for migrating European Tree Frogs and Fire-bellied Toads, which have to cross the field to reach their winter quarters. Customary soil management operations generally represent a threat for leverets which are not very mobile, and as a result of its extended reproductive season from March to September, there is a temporal overlap for the Brown Hare with the presence of leverets in all grain crops. Farmland bird broods on the other hand are only at risk in crops with very late harrowing dates or from soil management after early harvesting.

Targeted changes in farm management procedures and management times thus provide good opportunities to support many of the species presented in this manual. The large area of the farm taken up by grain crops makes nature conservation measures profitable, especially in crop species or at locations with great ecological potential. The recommended measures are explained in more detail in the profiles M 7 to M 14.

Inconspicuous and rare: The low-growing Field Nigella can be found on fields in north-east Germany primarily on eroded hilltops and at the edges of fields.

Conservation strategies

The conservation measures follow two strategies:

- The reduction of cropping operations or adaptation of management dates to the reproductive periods of wild animals and plants with the goal of minimizing direct losses among young animals (e.g. Brown Hares, farmland birds, amphibians) and to enable late blossoming segetal flora to reach seed maturity.
- The creation of favourable crop plant densities from a nature conservation viewpoint, in order to positively influence the site conditions for segetal flora and the habitat quality for the ground-dwelling fauna.

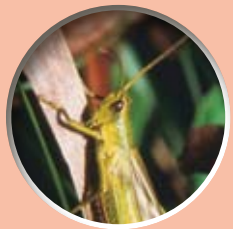
Landscape elements as a habitat

Landscape elements structure the landscape and offer numerous partial habitats for birds, hares, butterflies and other animals.

Diversity of the landscape elements
Hedges, bushes, copses, rows of trees, edges of forests, ditches, embankments, field margins, ruderal plots, fallow land, country lanes, clearance cairns, kettle holes, wet-spots, dry and neglected grassland on hilltops: There is a large variety of landscape elements in the agricultural landscape. They all form valuable, often indispensable partial habitats for the animals presented in this manual. Many of these biotopes serve farmland birds, Brown Hares, amphibians and insects as sites for reproduction, as sources of food, as protection against the wind and the sun to prevent drying out, as a hibernation site, or as a refuge area and protection, if the fields become unsuitable as a habitat (for example after the harvest or mowing). Saltatoria, butterflies and many other insects, whose larvae or eggs spend the winter in the ground, in the litter layer or in and on parts of plants, can for example survive the cold season in field margins or fallow land without damage. Many plant species are only found in landscape elements. This applies among other things to perennial herbaceous vegetation, dry grassland and field margin vegetation, aquatic plants, dwarf plant communities and naturally to wooded areas. This special plant life in turn attracts specific animals. A high proportion of different landscape elements therefore also always contributes to a rich biodiversity.

Blossom-rich habitats
Butterflies and wild bees also find nectar rich blossoms in field margins and other herbaceous landscape elements when the adjacent fields have been harvested.

Hedges and shrubs: Reproductive site for many animals
Hedgerow birds such as the Red-backed Shrike build their nests in dense bushy hedges and shrubs, sometimes also in strips of stinging nettles. The Black Hairstreak, along with numerous other insects, lives on woody structures in the open landscape.



No tillage, little or no use
Butterfly caterpillars and eggs of saltatoria survive the winter without damage in the soil, in the litter layer or inside plant stalks.

Connectivity of partial habitats
Tree Frogs frequent the water bodies in the spring; however they spend the summer and winter in hedges, groves or forests. They migrate most securely along hedges or wooded field margins.

The kettle holes in the agricultural landscape are an indispensable partial habitat for the rare Fire-bellied Toad and many other amphibian species, which frequent the water bodies every year in the spring for courtship and reproduction.

Typical for north-east Germany: The Kettle Holes

What is characteristic of the north-east German lowland are the large numbers of kettle holes which emerged during the Ice Age. Today there are approximately 170,000 of them in Brandenburg and Mecklenburg-Western Pomerania alone. Kettle holes are special microclimatic sites. They are connecting elements and extraordinarily important habitats for many species, also including endangered plant species, dragonflies, water beetles and amphibians.

Significance for agriculture

The different landscape elements have a multitude of different functions, also of benefit for agriculture. Thus kettle holes constitute a reservoir and a compensation space for the regional water balance. Hedges offer protection from wind or water erosion. The trees can be used as a supplier of fruit, forage, litter, compost or firewood. Field margins, dry grassland, fallow land, ditches or embankments can to some extent be used for haymaking and also help protect against erosion. An important effect with high economic relevance exists in the promotion of beneficial organisms for the biological control of pests (for example, hoverflies and ladybirds as aphid eaters; spiders, ground beetles and rove beetles as non-specialist predators). These beneficial organisms are dependent upon landscape elements to survive the winter. The colonisation of the fields during the growing season depends upon the availability of such overwintering biotopes.

Connectivity of biotopes

Migrating species and those that require different habitats for survival, profit greatly if their partial habitats are near each other and are moreover connected, for example by field margins and hedges. Also blossom strips or unmown legume-grass strips can constitute temporary connective elements. Many butterflies migrate in search of nectar preferably along forest edges or hedges, which give them protection from the wind. The Red-backed Shrike is reluctant to nest in isolated groves, whereas several couples often brood close to each other in spatially connected hedges or shrubs with field margins and fields rich in insects.

Take note of quantity and quality

The type and characteristics of landscape elements varies according to the natural environment and the farm itself. A minimum of at least 5% of the farm area should however be available, ideally even 10 to 15%. In addition to the number of landscape elements, a significant role is also played by their actual suitability as a habitat. For example, it is easy for predators such as the fox to systematically seek out the nests of farmland and hedgerow birds in very narrow hedges or field margins. Many animals and plants of the agricultural landscape require sparse or loosely standing and blossom-rich vegetation. Such structures may usually only be preserved in the longer-term on field margins, fallow land or dry grassland through suitable maintenance.

It is therefore possible to preserve or improve the quality of landscape elements through suitable maintenance, and favourable characteristics can be taken into consideration for new establishments. The recommended measures are explained in more detail in profiles M 4 to M 6 and M 13 to M 18.

Field margins, embankments and dry grassland with a high abundance of blossoms and herbs, are of particularly high value from a nature conservation viewpoint. They give shelter to a large variety of rare plants and insects and at the same time offer favourable partial habitats to the typical wildlife of the fields.

Conservation strategies

The conservation measures follow three strategies:

- The preservation and maintenance and/or supplementation of the existing landscape elements, with the goal of securing or improving their quality as a habitat for the wild flora and fauna in the long-term.
- The new establishment of temporary and/or permanent landscape elements with the goal of achieving a share of 5 to 15% of the farm area. The focus should lie on the wood-free landscape elements such as field margins and fallow land in order to preserve the open character of the north-east German farm areas.
- The optimisation of the arrangement and connection of existing and newly established landscape elements so that an association between the partial habitats is promoted.

Profiles of the measures

Do you have special interests or farm characteristics?
On the basis of specific research criteria you can allow yourself to be guided directly to the profiles which are of interest to you.
→ Page 7

The profiles of the measures describe in detail how measures for the protection of species are to be implemented, how to estimate costs and losses incurred during implementation and which advantages or risks arise for the farmer. In a similar way to the species profiles, references are given to the most favourable locations for the species. It is also made clear which species or species groups especially benefit from the measure. This makes it possible for the user, according to his interests and the situation of the farm, to target suitable fields and where appropriate to select practical combinations of measures.

The profiles of the measures are followed by brief descriptions of further measures, which have not been prepared as two-page profiles, but are worthy of mention due to their positive effects on many wild animal and plant species. Some of these measures are not specifically oriented towards organic farming, and detailed instructions are already available in other publications (for example, on planting hedges). Other measures were not explicitly investigated in the 'Nature Conservation Farm Brodowin' project, so that there is insufficient scientific evidence available concerning their ecological and economical effects in organic farming in north-east Germany (e.g. large-scale overwinter stubble). As the selection of the measures was carried out with a focus on the basic arable farming conditions prevalent in north-east Germany, the list can be extended to include other regions according to site and farm conditions.

Complete listing

Profiles of the measures

Legume-grass leys	**M 1**	Later 1st cut
	M 2	Later 2nd cut
	M 3	High cut
	M 4	Bird strips
	M 5	Butterfly strips
	M 6	Amphibian strips
Grain crops	**M 7**	No harrowing
	M 8	Drilling gaps
	M 9	Reduced sowing density
	M 10	Delayed stubble breaking
	M 11	Grubbing instead of ploughing
	M 12	Reduced use of fertilizers and liming
	M 13	Small-scale set-aside
	M 14	Blossom strips
Landscape elements	**M 15**	Field margins on rich soils
	M 16	Field margins on dry poor soils
	M 17	Wood maintenance and management
	M 18	Buffer strips around water bodies
Crop rotations	**M 19**	More spring crops
	M 20	Better distribution of crop species on smaller fields

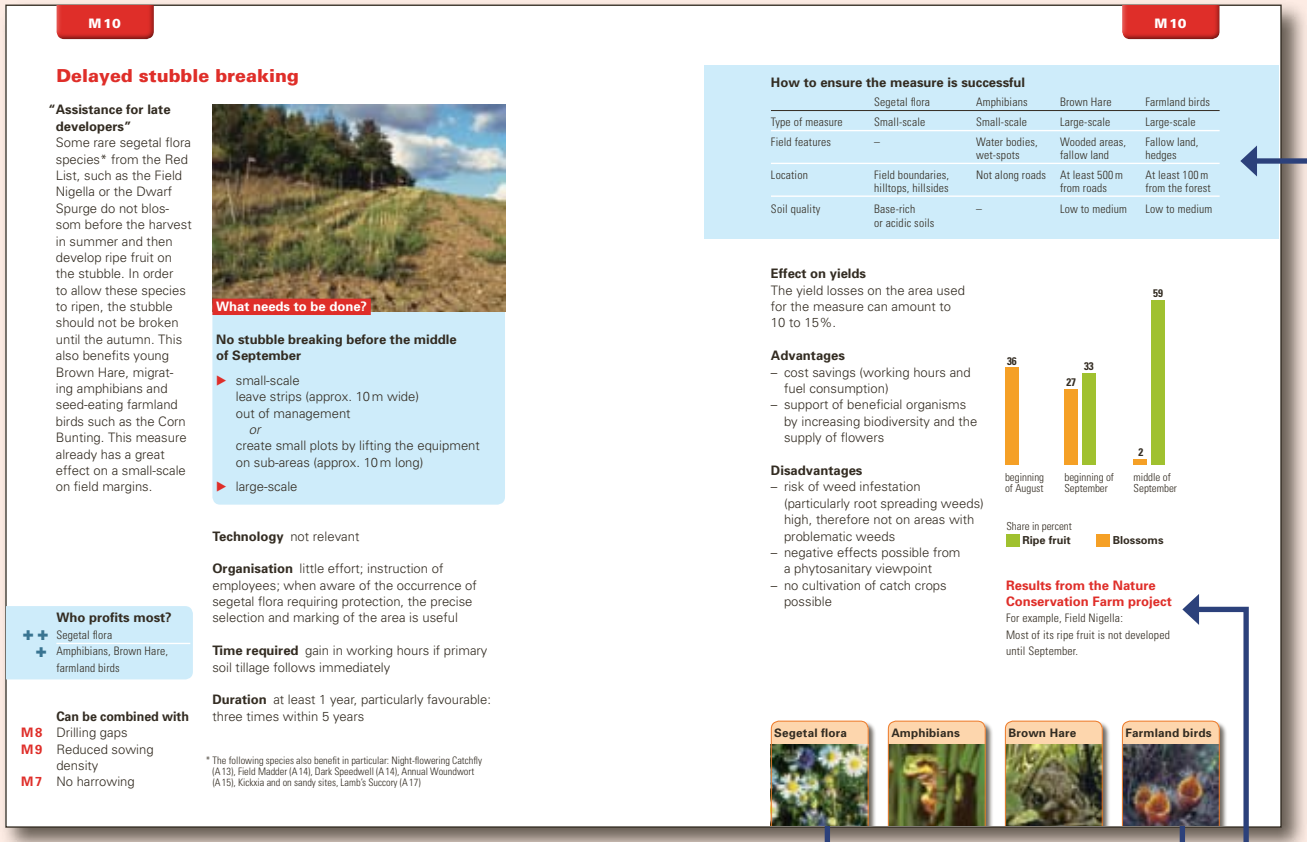
Other relevant measures

Grain crops	Overwinter stubble Leaving cereals over the winter on a small-scale Wet-spots in fields
Landscape elements	Narrow field margins Planting hedges

Explanation of the profile of a measure

“Who profits most”
✚ strong effect
✚ ✚ very strong effect
Indicates for which species or species groups strong or very strong positive effects are to be expected from the measure. No entry means that only slight positive effects are or could be present (so-called windfall gains).

“Can be combined with”
Through the combination with one or more of the indicated measures, the effectiveness can be significantly increased from a nature conservation viewpoint.



M 10

Delayed stubble breaking

“Assistance for late developers”
Some rare segetal flora species* from the Red List, such as the Field Nigella or the Dwarf Spurge do not blossom before the harvest in summer and then develop ripe fruit on the stubble. In order to allow these species to ripen, the stubble should not be broken until the autumn. This also benefits young Brown Hare, migrating amphibians and seed-eating farmland birds such as the Corn Bunting. This measure already has a great effect on a small-scale on field margins.

What needs to be done?

No stubble breaking before the middle of September

- small-scale
  leave strips (approx. 10 m wide) out of management
  or
  create small plots by lifting the equipment on sub-areas (approx. 10 m long)
- large-scale

Technology not relevant

Organisation little effort; instruction of employees; when aware of the occurrence of segetal flora requiring protection, the precise selection and marking of the area is useful

Time required gain in working hours if primary soil tillage follows immediately

Duration at least 1 year, particularly favourable: three times within 5 years

* The following species also benefit in particular: Night-flowering Catchfly (A 13), Field Madder (A 14), Dark Speedwell (A 14), Annual Woundwort (A 15), Kickxia and on sandy sites, Lamb's Succory (A 17)

Who profits most?
✚ ✚ Segetal flora
✚ Amphibians, Brown Hare, farmland birds

Can be combined with
M 8 Drilling gaps
M 9 Reduced sowing density
M 7 No harrowing

M 10

How to ensure the measure is successful

	Segetal flora	Amphibians	Brown Hare	Farmland birds
Type of measure	Small-scale	Small-scale	Large-scale	Large-scale
Field features	–	Water bodies, wet-spots	Wooded areas, fallow land	Fallow land, hedges
Location	Field boundaries, hilltops, hillsides	Not along roads	At least 500 m from roads	At least 100 m from the forest
Soil quality	Base-rich or acidic soils	–	Low to medium	Low to medium

Effect on yields
The yield losses on the area used for the measure can amount to 10 to 15%.

Advantages
– cost savings (working hours and fuel consumption)
– support of beneficial organisms by increasing biodiversity and the supply of flowers

Disadvantages
– risk of weed infestation (particularly root spreading weeds) high, therefore not on areas with problematic weeds
– negative effects possible from a phytosanitary viewpoint
– no cultivation of catch crops possible

Results from the Nature Conservation Farm project
For example, Field Nigella:
Most of its ripe fruit is not developed until September.

“Supported species and species groups”
Here are the species or species groups that profit particularly well from the measure.
Positive effects often also emerge for other, not explicitly listed, animal and plant species.

“Type of measure”
large-scale
= on at least 10 ha or 50 to 100% of a field
small-scale
= on strips (3 to 20 m) in the field, at the edge of a field or water border or
= on sub-areas on 1 to 10% of a field

“Field features”
The landscape elements indicated must be either on the field or in the immediate vicinity.

“Location”
The measure should be carried out with preference, depending upon the species to be supported, on the field areas indicated or at an appropriate distance from the forest or roads.

“Results from the Nature Conservation Farm project”
An example from the scientific results obtained in practice in Brodowin.

Later 1st cut

„First broods are the winners"
Farmland birds breed particularly well in legume-grass leys from the middle of April. Many young birds have left their nests by the end of May.
If the 1st cut is made by the end of May, it helps the Skylark in particular to reproduce successfully. The Yellow Wagtail benefits above all from a very late 1st cut.
The measure is easy to carry out on stockless farms. Fields with low soil rating indices should be selected on livestock farms in order to reduce fodder losses.

What needs to be done?

- **1st cut:** 1 week later than normal practice or 2 to 3 weeks later than usual
- 2nd cut: normal practice or delayed
- 3rd cut: normal practice or delayed

Mowing generally from within a field outwards or from one side to the other, so as to give the wild animals an escape route

Technology existing technology useable

Organisation little effort; instruction of employees required before the 1st cut

Time required in animal husbandry: medium to high, as separate harvesting of the 1st and subsequent cuts is necessary; low on stockless farms

Duration 1 year

Who profits most?

1st cut	Skylark	Yellow Wagtail
1 week later	+	
2 to 3 weeks later	+ +	+

Can be combined with
M 3 High cut

How to ensure the measure is successful

	Skylark	Yellow Wagtail
Type of measure	Large-scale	Large-scale
Field features*	–	Fallow land, hedges
Location	At least 100 m from the forest	At least 100 m from the forest
Soil quality	Low to medium	Medium

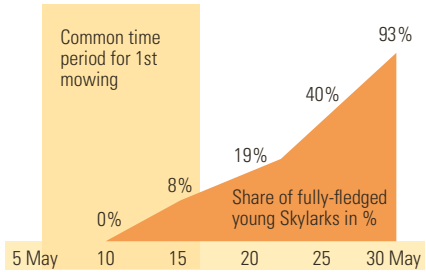
* Late cut should not be carried out near amphibian spawning areas, otherwise the 2nd mowing will fall during the migration period of the young amphibians.

Forage yield and quality
Delaying the 1st cut reduces the energy content by around 0.5 MJ NEL kg^{-1} DM per week, the crude fibre content increases by approx. 3%, the digestibility of the forage thus decreases greatly. After a delay of 2 to 3 weeks the fodder is no longer suitable for dairy cattle, resulting in losses of 15 to 25 GJ NEL ha^{-1}. A higher cut however would reduce the share of stalks and thereby the quality loss in the 1st cut. Subsequent cuts will have a somewhat lower quality (see M 3).

Application on the farm
- 1 week later: application with normal cut still possible, fodder for the young cattle
- 2 to 3 weeks later: harvest field separately, litter or horse hay

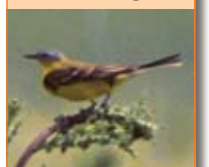
Advantages
- larger supply of blossoms for (beneficial) insects
- staggering of work peaks
- improved establishment of leguminous fodder crops in the 1st production year.

Disadvantages
- additional forage production/ purchase necessary
- if the 1st cut is very late, problems may arise with root spreading weeds (particularly where there is prior weed infestation)
- probably no 4th cut if the 2nd and 3rd cuts are delayed



Skylark

Yellow Wagtail



Results from the Nature Conservation Farm project
For example, the Skylark:
A large number of its chicks are not fully-fledged until after the 1st usual cutting date.

Later 2nd cut

"The 1st cut for the farmer, the 2nd cut for nature conservation"
The Skylark begins nest building again 2 to 3 weeks after the 1st legume-grass cut, the Corn Bunting after 3 to 4 weeks. It takes about 5 weeks for both species before the nestlings are fully fledged. Therefore the later the 2nd cut, the more chicks survive. The same applies to young Brown Hare leverets that are born in May and June. The normal good yield and quality of the 1st cut remains unaffected.
The measure is easy to carry out on stockless farms; fields with low soil rating indices should be selected on livestock farms in order to reduce fodder losses.

What needs to be done?

- 1st cut: normal practice
- **2nd cut:**
  7 or 8 weeks after the 1st cut or leaving out the 2nd cut altogether and then a maintenance cut from the middle of August
- 3rd cut: normal practice or delayed

Mowing generally from within a field outwards or from one side to the other, so as to give the wild animals an escape route.

Technology existing technology useable; on low-yield sites, the direct placing of one 6 m or 9 m swath can be advantageous.*

Organisation little effort; instruction of employees required before the 2nd cut

Time required in animal husbandry: medium as separate harvesting is necessary for the 2nd and where applicable 3rd cut; low on stockless farms

Duration 1 year

* This also benefits farmland birds as a small part of the field is covered with plant biomass and therefore fewer nests are untraceably covered.

Who profits most?

2nd cut:	Skylark	Corn Bunting	Brown Hare
7 weeks after 1st cut	+		+ +
8 weeks after 1st cut	+ +	+	+ +
no 2nd cut	+ +	+ +	+ +

M2

How to ensure the measure is successful

	Skylark	Corn Bunting	Brown Hare
Type of measure	Large-scale	Large-scale	Large-scale
Field features*	–	Fallow land, hedges	Wooded areas, fallow land
Location	At least 100 m from the forest	At least 100 m from the forest	At least 500 m from roads
Soil quality	Low to medium	Medium	Low to medium

* Late cut should not be carried out near amphibian spawning areas, otherwise the 2nd mowing will fall during the migration period of the young amphibians.

Forage yield and quality

With a delay of up to 8 weeks after the 1st cut, the energy content can drop below 5.2 MJ NEL kg^{-1} DM, the crude fibre content increases significantly, meaning that the forage is no longer suitable for the dairy cattle. The energy loss then amounts to up to 20 GJ NEL ha^{-1}.

Application on the farm

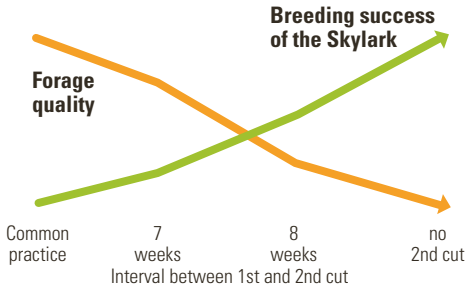
- 7 weeks after the 1st cut: application with customary cut still possible, fodder for the young cattle
- 8 weeks after the 1st cut and later: litter or horse hay

Advantages

- greater supply of blossoms for (beneficial) insects
- staggering of work peaks

Disadvantages

- additional forage production/ purchase necessary
- if the 1st cut is very late, problems may arise with root spreading weeds (particularly where there is prior weed infestation)
- one fewer cut may be possible if the 3rd cut is delayed



Results from the Nature Conservation Farm project

For example, the Skylark: The later the 2nd cut, the more young Skylarks survive. However the quality of the fodder drops considerably.

Skylark

Corn Bunting

Brown Hare

High cut

"Compromise for wild animals and livestock"

If the cutting height in legume-grass is increased, fewer nests of ground-breeding birds are endangered. Moreover the farmland birds can build new nests again in the higher vegetation sooner after mowing. With a standard cutting height, they do not begin nest building again until after 2 to 4 weeks. Leverets and amphibians retain their cover with a high cut, and the eggs of the Common Blue remain unharmed.

This measure can be easily implemented on stockless farms. Livestock farms must take yield losses into account. Due to the lower proportion of stalks the fodder quality is however better.

Can be combined with

M 10 Bird strips
M 11 Blossom strips

What needs to be done?

- **1st or 2nd cut:** 14 cm cutting height, use of runners on the mower (ground clearance of at least 8 cm required for the mower) to protect farmland birds and Brown Hare
- **2nd and 3rd cut:** cutting height of at least 10 cm to protect amphibians, grasshoppers and the Common Blue

  Mowing generally from within a field outwards or from one side to the other, so as to give the wild animals an escape route.

Technology mowers with adjustable cutting heights required*

Organisation little effort; instruction of employees required before the respective high cut

Time required medium due to the equipment conversion

Duration 1 year

* If growth heights are low (for example, as a result of a dry spring) the measure cannot be carried out as described. In this case mowing should additionally be delayed by one week.

Who profits most?

High cut	Farmland birds	Brown Hare	Amphibians	Common Blue/ Grasshoppers
1st cut	+	+		
2nd cut	+	+	+ +	+
3rd cut		+	+ +	+

M3

How to ensure the measure is successful

	Farmland birds	Brown Hare	Amphibians	Common Blue/ Grasshoppers
Type of measure	Large-scale	Large-scale	Small-scale	Small-scale
Field features*	Fallow land, hedges	Wooded areas, fallow land	Water bodies, wet spots	Field margins
Location	At least 100 m from the forest	At least 500 m from roads	Not along roads	South-facing field boundaries and slopes, hilltops
Soil quality	Low to medium	Low to medium	–	Low to medium

Forage yield and quality

With a cutting height of 14 cm for the 1st cut, the dry matter yield per year drops by around 0.5 to 1.0 t ha^{-1}, the energy yield drops by approx. 5 GJ NEL ha^{-1}. Fodder quality increases however as a result of the high cut (compared to a cutting height of 7 cm: approx. 0.3 MJ NEL kg^{-1} DM higher energy content, approx. 2 % less crude fibre content). Subsequent cuts will have a somewhat lower quality.

Application on the farm

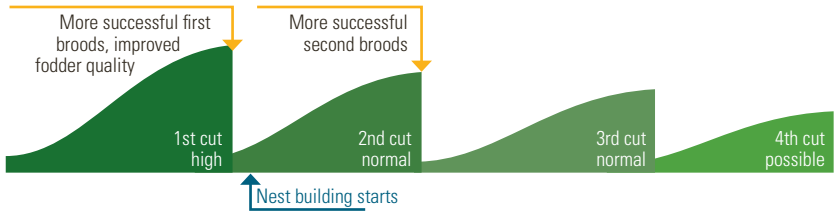
no restrictions

Advantages

- lower contamination during harvesting (above all in silage)
- somewhat better fodder quality
- the 2nd cut represents less of a risk for farmland birds, as they were able to start nest building again sooner after the 1st cut
- one additional cut may be possible

Disadvantages

- additional investment may be required to modify the cutting height
- additional forage production/purchase necessary



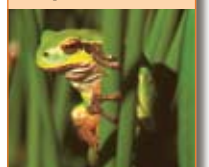
Results from the Nature Conservation Farm project

For example, the Skylark: Following the high cut, it can soon breed again in the higher vegetation and can raise its young without interference before the 2nd customary cut.

Farmland birds

Brown Hare

Amphibians



Common Blue

Bird strips

"Moderate mowing"
When unmown strips remain in the field during legume-grass mowing, farmland birds, Brown Hare and insects retain their sources of food and places for nesting, shelter and overwintering. What is important to the animals is that the strips are retained until the following year: The Whinchat for example, prefers to breed in such overwintering crops.
The measure is easy to implement. Apart from the strips the field can be farmed without restrictions.

What needs to be done?

- **Not mowing 10 m wide strips 100 m apart**
  The strips remain for one or two winters and are mown and/or mulched with the 3rd cut the following summer

- **There are three possible variants**
  1. Establishment of strips from August in the 1st production year until August of the following year (= overwintering)
     or
  2. Establishment of strips already in the autumn of the sowing year until August of the 1st production year (= overwintering)
     or
  3. Establishment of strips in the autumn of the sowing year until August of the 2nd production year (= perennial)

Technology adapt strip width to suit machine working width

Organisation medium effort; instruction of employees and marking of strips required

Time required low on stockless farms if growth is mulched; medium, if fields are separately mown/harvested

Duration 1 to 2 years

Who profits most?

++ Yellow Wagtail, Whinchat, Saltatoria

\+ Corn Bunting, Red-backed Shrike, Brown Hare, Butterflies

Can be combined with

M3 High cut
M1, 2 Later cut

M4

How to ensure the measure is successful

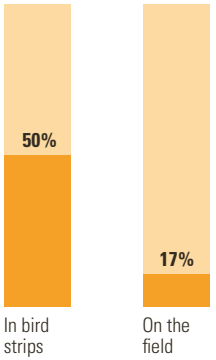
	Farmland birds	Red-backed Shrike	Brown Hare	Saltatoria/ Butterflies
Field features	Fallow land, hedges	Hedges, copses, field margins, fallow land	Wooded areas, fallow land	Field margins
Location	At least 100 m from the forest	–	At least 500 m from roads	South-facing field boundaries and slopes
Soil quality	Low to medium	–	Low to medium	Low to medium

Losses and application on the farm
With 10 % of the field given over to bird strips, energy losses of 4 to 5 GJ NEL ha^{-1} and year arise; application as litter or horse hay; seed production possible if weed infestation is low.

Advantages
- greater supply of blossoms for (beneficial) insects
- flexible selection between different measure variants

Disadvantages
- loss of production area
- additional forage production/ purchase necessary
- risk of weed infestation with root spreading weeds (particularly where there is prior weed infestation)

Share of farmland birds' nests with breeding success



Results from the Nature Conservation Farm project
For example, farmland birds:
Yellow Wagtails, Whinchats and Corn Buntings breed considerably more successfully in the bird strips than in legume-grass leys which are customarily managed.

Butterfly strips

"Seemingly little can be a lot!"
Clover and lucerne in blossom are an excellent source of nectar for many butterflies. Furthermore some species, such as the Common Blue, also lay their eggs on the plants. The eggs and larvae of many insects can survive the cold season on overwintering plants. Even small unmown areas at the edges of fields, particularly in sunny sites which are protected from the wind, help to meet these requirements.
The measure can easily be integrated into cultivation, and significant results can be achieved from only a small area.

What needs to be done?

- **Not mowing a 3 m strip at the edge of the field** (on approx. 1 % of the whole field)
- **Increase of the supply of flowers through the gradual enlargement of the strip**
  1st cut: a 1 m strip is not mown
  2nd cut: a further 1 m strip is left unmown beside the first
  3rd cut: a third 1 m strip is left unmown beside the others

  The strip is retained until the 3rd cut of the following year. It can however also be mowed and harvested in the autumn of the same year.

Technology existing technology useable

Organisation medium effort; instruction of employees and marking of strips required

Time required low on stockless farms if growth is mulched; low to medium if the area is mown/ harvested separately

Duration 1 to 2 years

Who profits most?
++ Butterflies
+ Saltatoria

Can be combined with
M3 High cut
M1, 2 Later cut

M5

How to ensure the measure is successful

	Butterflies	Saltatoria
Type of measure	Small-scale	Small-scale
Field features	Field margins, edges of woods	Field margins
Location	South-facing field boundaries and slopes	South-facing field boundaries and slopes
Soil quality	Low to medium	Low to medium

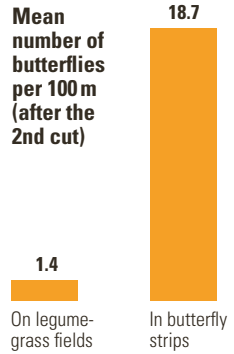
Losses and application on the farm
As a result of the low proportion of land used, losses are slight (< 0.5 GJ NEL ha^{-1} yr^{-1}); the growth can be added to the fodder during mowing or used as litter.

Advantages
– small land requirement
– flexible choice of duration of the measure according to crop developement

Disadvantage
– risk of weed infestation with root spreading weeds (particularly where there is prior weed infestation)

Results from the Nature Conservation Farm project

For example, butterflies: The butterflies find more nectar in the butterfly strips after mowing than in normally farmed legume-grass leys.



Butterflies

Saltatoria

M6

Amphibian strips

"Small but effective"
Extensively used buffer strips at the edges of small water bodies are important habitats for amphibians in the summer and winter. These animals can be specifically protected during the legume-grass phase by minor changes in the management of the areas near the banks of water bodies. Saltatoria and butterflies also benefit from these buffer strips. In addition, the potential contamination of the water body with soil and nutrients from the field is minimised.

What needs to be done?

- **Cultivation of a 20 m wide buffer strip around a water body in legume-grass leys**
  1 to 2 cuts before July, cutting height at least 10 cm, no 3rd cut, maintenance cut from October; removal of plant biomass to give the amphibians sufficient opportunities to move around

  or

  grazing (e.g. sheep, goats) at any time

Technology mowers with adjustable cutting heights required

Organisation medium effort; marking of the buffer strips and instruction of employees at each cutting date required

Time required medium to high due to equipment conversion (high cut); maintenance cut in the autumn and removal of plant biomass

Duration 1 to 2 years, depending upon the duration of the legume-grass cultivation

Who profits most?
++ Amphibians
+ Butterflies, Saltatoria

Can be combined with
M3 High cut – large-scale

How to ensure the measure is successful

	Amphibians	Butterflies/Saltatoria
Type of measure	Small-scale	Small-scale
Field features	Water bodies, wet-spots	Field margins, edges of woods
Location	Buffer strips around water bodies, not along roads	South-facing field boundaries and slopes
Soil quality	–	Low to medium

Forage yield and quality
Through the higher 1st and 2nd cuts as well as by forgoing the 3rd cut, a loss of approx. 15 to 20 GJ NEL ha^{-1} is incurred on the buffer strips. The fodder quality is somewhat better with the higher cut.

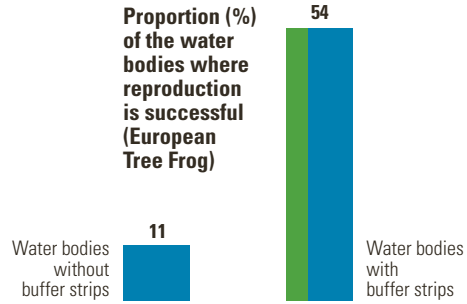
Application on the farm
- 1st and 2nd cut (before July) can be used without restrictions
- maintenance cut in October as litter or horse hay

Advantages
- lower contamination when harvesting fodder from a high cut
- reduction of the nutrient contamination of the water bodies
- due to the small proportion of land used, losses are localised

Disadvantages
- additional investment may be required to modify the cutting height
- if the 2nd cut can no longer be made in June because of the weather, the loss for livestock farms is considerably greater

Results from the Nature Conservation Farm project

For example, the European Tree Frog: It prefers water bodies with buffer strips for reproduction.



No harrowing

"More diversity without harrowing"
Not harrowing has a positive effect on many segetal flora species. The segetal flora serve various animal species as cover, food, perches or songposts as well as nesting plants; reasons why animals such as farmland birds and Brown Hare also benefit from no harrowing. The Corn Bunting and Yellow Wagtail do not start nest building until after the usual harrowing dates. Only the Skylark, which starts breeding as early as April, can suffer nest losses in some crop species (winter wheat, spring cereals) as a result of harrowing.

What needs to be done?

- **No pre- or postemergence harrowing**

  or

- **No postemergence harrowing (blind harrowing permitted)**

  small-scale
  as a strip: with a width of approx. 10 m
  or
  as a small plot: lift the harrows 2 to 3 times per hectare for a length of approx. 10 m

  large-scale
  on the whole field or on at least 10 ha

Technology not relevant

Organisation little effort; instruction of employees and marking of field areas for small-scale implementation required

Time required gain in working hours with large-scale implementation

Duration 1 year

Who profits most?

No harrowing	Segetal flora	Farmland birds	Brown Hare
… in postemergence	+	+	+
… in pre- and postemergence	+ +	+ +	+ +

M 7

How to ensure the measure is successful

	Segetal flora	Farmland birds	Brown Hare
Type of measure	Small or large-scale	Large-scale	Large-scale
Field features	–	Fallow land, hedges	Wooded areas, fallow land
Location	Field boundaries, hilltops, hillsides	At least 100 m from the forest	At least 500 m from roads
Soil quality	–	Low to medium	Low to medium

Effect on yields

Where there is no harrowing at all, yield losses of 10 to 20 % can be expected on the area used for the measure; winter rye, triticale and oats are the most tolerant, grain legumes on the other hand are particularly sensitive.

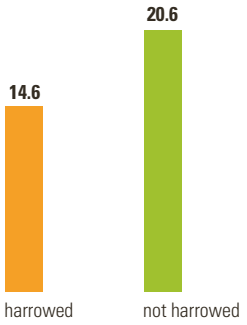
Advantages

- cost savings (working hours and fuel consumption)
- support of beneficial organisms by increasing biodiversity and the supply of flowers
- flexibility in the selection of the scope of the measure according to conservation goal and agricultural risks

Disadvantage

- the risk of weed infestation is high, therefore not to be used on areas with problematic weeds

Number of wild plants per m² in spring wheat



Results from the Nature Conservation Farm project

For example, Segetal flora:
Up to 30 % more wild plants grow on unharrowed fields than on harrowed fields.

Segetal flora

Farmland birds

Brown Hare

M8

Drilling gaps

"The courage to leave gaps"
In crops with unsown sub-areas, segetal flora – including vulnerable species – have more light upon which to thrive. Farmland birds and Brown Hare can reproduce better; the food supply is more abundant. Drilling gaps provide the prerequisite for this and even on a small-scale have very positive effects at the same time as minor, easily calculated yield losses.

What needs to be done?

Creation of drilling gaps during sowing

- small or large-scale
  as strips: leave a gap of 30 to 50 cm between the rows acc. to drill width (staggered driving)
  or
  closing of 2 to 3 drill coulters according to the distance between drill rows
- small-scale
  as a small plot: lift the seed drill for a distance of approx. 10 m at 2 to 3 places per hectare

No mechanical weed control in the spaces between the rows. The measure is not suitable for fields with underseed.

Technology existing technology useable

Organisation medium effort; instruction of employees and marking of field areas for small-scale implementation required

Time required low to medium according to available technology and measure variant

Duration 1 year

Who profits most?

++ Segetal flora
\+ Farmland birds, Brown Hare

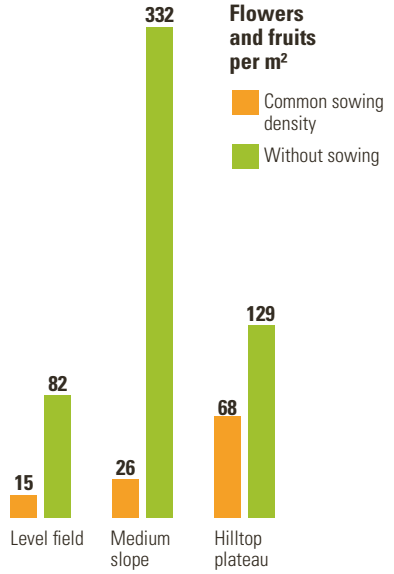
How to ensure the measure is successful

	Segetal flora	Farmland birds	Brown Hare
Type of measure	Small or large-scale	Large-scale	Large-scale
Field features	–	Fallow land, hedges	Wooded areas, fallow land
Location	Field boundaries, hilltops, hillsides	At least 100 m from the forest	At least 500 m from roads
Soil quality	–	Low to medium	Low to medium

Effect on yields
The yield losses on the area used for the measure can amount to 10 to 15 %.

Advantages
– support of beneficial organisms by increasing biodiversity and the supply of flowers
– flexibility in the selection of the scope of the measure according to conservation goal and agricultural risks

Disadvantage
– the risk of weed infestation is high, therefore not to be used on fields with problematic weeds



Results from the Nature Conservation Farm project
For example, Forking Larkspur:
The plant develops more fruits and flowers in gaps between rows than with the customary sowing density

Segetal flora

Farmland birds

Brown Hare

Reduced sowing density

"Light brings diversity into the dark"
Many wild animals and plants find favourable living conditions in 'sparse' cereal stands. Segetal flora species have more light and less competition. The more diverse vegetation structure attracts the Brown Hare and farmland birds as the food supply is also greater.
Even on a small-scale, biodiversity and the supply of blossoms can be significantly improved and seed costs saved by reducing the seed quantity.

Who profits most?

+	Farmland birds
+ +	Brown Hare
+ +	Segetal flora

Can be combined with
M 14 Blossom strips

What needs to be done?

Reduction of the seed quantity by 30 to 50% in order to achieve lower crop densities

- small-scale
  as a strip: on 2 to 3 sowing widths
  or
  as a small plot: for a distance of approx. 10 m at 2 to 3 places per hectare
- large-scale
  on the whole field
  or on at least 10 ha

No mechanical weed control. The measure is not suitable for fields with underseed. The effect is especially apparent with late seedings through less tillering.

Technology existing technology useable; when establishing small plots: pneumatic seed drill necessary

Organisation medium effort; instruction of employees and marking of field areas for small-scale implementation required

Time required low to medium according to available technology and measure variant

Duration 1 year

M 9

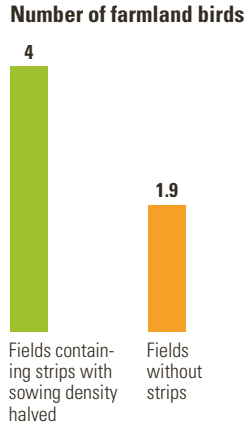
How to ensure the measure is successful

	Farmland birds	Brown Hare	Segetal flora
Type of measure	Large-scale	Large-scale	Small-scale
Field features	Fallow land, hedges	Wooded areas, fallow land	–
Location	At least 100 m from the forest	At least 500 m from roads	Field boundaries, hilltops, hillsides
Soil quality	Low to medium	Low to medium	–

Effect on yields
By reducing seed quantity by 50%, yield losses of 20 to 40% can be expected on the area used for the measure. It must be taken into consideration that early sown winter cereals in particular, with a good N-supply from preceding crops, can compensate for lower seed quantities through increased tillering.

Advantages
– support of beneficial organisms by increasing biodiversity and the supply of flowers
– flexibility in the selection of the scope of the measure according to conservation goal and agricultural risks

Disadvantage
– the risk of weed infestation is high, therefore not to be used on areas with problematic weeds



Results from the Nature Conservation Farm project
For example farmland birds: More species settle on fields where the sowing density is halved than on those with standard sowing densities.

Farmland birds

Brown Hare

Segetal flora

M 10

Delayed stubble breaking

"Assistance for late developers"
Some rare segetal flora species* from the Red List, such as the Field Nigella or the Dwarf Spurge do not blossom before the harvest in summer and then develop ripe fruit on the stubble. In order to allow these species to ripen, the stubble should not be broken until the autumn. This also benefits young Brown Hare, migrating amphibians and seed-eating farmland birds such as the Corn Bunting. This measure already has a great effect on a small-scale on field margins.

What needs to be done?

No stubble breaking before the middle of September

- small-scale
  leave strips (approx. 10 m wide) out of management
  or
  create small plots by lifting the equipment on sub-areas (approx. 10 m long)
- large-scale

Technology not relevant

Organisation little effort; instruction of employees; when aware of the occurrence of segetal flora requiring protection, the precise selection and marking of the area is useful

Time required gain in working hours if primary soil tillage follows immediately

Duration at least 1 year, particularly favourable: three times within 5 years

Who profits most?
++ Segetal flora
\+ Amphibians, Brown Hare, farmland birds

Can be combined with
M 8 Drilling gaps
M 9 Reduced sowing density
M 7 No harrowing

* The following species also benefit in particular: Night-flowering Catchfly (A 13), Field Madder (A 14), Dark Speedwell (A 14), Annual Woundwort (A 15), Kickxia and on sandy sites, Lamb's Succory (A 17)

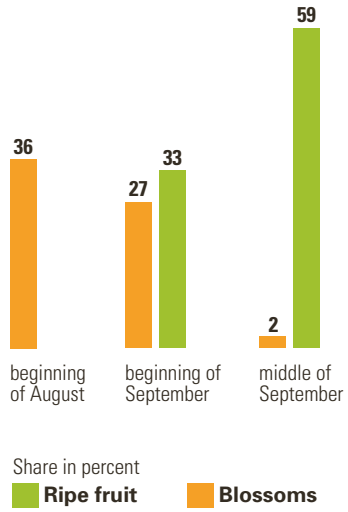
How to ensure the measure is successful

	Segetal flora	Amphibians	Brown Hare	Farmland birds
Type of measure	Small-scale	Small-scale	Large-scale	Large-scale
Field features	–	Water bodies, wet-spots	Wooded areas, fallow land	Fallow land, hedges
Location	Field boundaries, hilltops, hillsides	Not along roads	At least 500 m from roads	At least 100 m from the forest
Soil quality	Base-rich or acidic soils	–	Low to medium	Low to medium

Effect on yields
The yield losses on the area used for the measure can amount to 10 to 15 %.

Advantages
– cost savings (working hours and fuel consumption)
– support of beneficial organisms by increasing biodiversity and the supply of flowers

Disadvantages
– risk of weed infestation (particularly root spreading weeds) high, therefore not on areas with problematic weeds
– negative effects possible from a phytosanitary viewpoint
– no cultivation of catch crops possible



Results from the Nature Conservation Farm project
For example, Field Nigella:
Most of its ripe fruit is not developed until September.


Segetal flora


Amphibians


Brown Hare


Farmland birds

M11

Grubbing instead of ploughing

"Introduction to non-inverting tillage"
In particular the Common Spadefoot Toad, but also the European Tree Frog, the Fire-bellied Toad and many other amphibians benefit if the area around water bodies are not ploughed in the spring and late summer. If tillage operations are not carried out upon the entire field, more wild plant flora often develop. Farmland birds and Brown Hare find the living conditions on such fields more favourable. One ploughing operation less within the crop rotation already brings benefits for the animals and at the same time saves energy and costs.

What needs to be done?

Forgo ploughing once more than is customary within the scope of the crop rotation, and grub twice instead

- small-scale
  as a strip around water bodies (20 m wide)
- large-scale

Technology existing technology useable

Organisation little effort; instruction of employees required. The marking out of the area required for the measure is necessary for small-scale implementation.

Time required gain in working hours with large-scale implementation

Duration 1 year within the scope of the crop rotation

Who profits most?

++ Amphibians
+ Farmland birds, Brown Hare

How to ensure the measure is successful

	Amphibians	Farmland birds	Brown Hare
Type of measure	Small-scale	Large-scale	Large-scale
Field features	Water bodies, wet-spots	Fallow land, hedges	Wooded areas, fallow land
Location	Not along roads	At least 100 m from the forest	At least 500 m from roads
Soil quality	–	Low to medium	Low to medium

Effect on yields
Yield losses can amount to 10 to 15 % in the year the measure is implemented. Losses in yields may also be expected in subsequent years.

Advantages
– cost savings (working hours and fuel consumption)
– support of beneficial organisms by increasing biodiversity and the supply of flowers

Disadvantages
– increased risk of root spreading weeds especially with prior weed infestation
– negative effects possible from a phytosanitary viewpoint

Results from the Nature Conservation Farm project
For example, the Common Spadefoot Toad: The animals live on the field from March to October and are then endangered by the tillage operations.

Amphibians

Farmland birds

Brown Hare

Reduced use of fertilizers and liming

"Protection of Lamb's Succory communities"
Several very rare segetal flora species such as the endangered Lamb's Succory (A 17) are only found on extensively used acidic sandy soils which are low in nutrients. Lamb's Succory prefers a pH-value below 5, a very critical boundary for crop plants. A main part of the worldwide population of Lamb's Succory occurs in north-east Germany, highlighting the importance of protecting this species. The preservation of Lamb's Succory communities on small areas can be achieved by reducing the use of fertilizers and liming.

What needs to be done?

- **Reduce use of fertilizers and liming**
  Standard site maintenance application every 5 to 10 years; no mechanical weed control

  Carried out on sites of at least 0.1 ha with (potential) occurrences of Lamb's Succory

Specialist advice should be taken to aid the selection of the site and the specific management measures.

Technology not relevant

Organisation little effort; instruction of employees required; clear marking of areas designated for the measure necessary

Time required little

Duration long-term

M 12

Effect on yields
The Lamb's Succory community only occurs on marginal sites where intensification usually brings few economic advantages. Even here however, the preservation of this segetal plant community is only possible if the measure is carried out on a permanent basis. Annual yield losses of up to 25 % are to be expected on the area used for the measure.

How to ensure the measure is successful

	Lamb's Succory
Type of measure	Small-scale
Field features	–
Location	–
Soil quality	Acidic sandy soils

Advantages
- if the existence of the Lamb's Succory community is known, a high rate of success can be achieved on very small sub-areas of a field
- losses can be limited locally

Disadvantages
- potential gradual soil acidification
- at field boundaries potential conflict of objectives with the establishment of permanent field margins (see M 16 and p. 133)

Results from the Nature Conservation Farm project

For example, Lamb's Succory:
It is found at sites with very low pH values and a low phosphorus and potassium content.

Soil parameters	Range
pH value	4.0 to 4.5
Phosphorus (mg/100g)	3.0 to 5.3
Potassium (mg/100g)	3.5 to 7.1

More extensive studies of the Lamb's Succory community in Mecklenburg-Western Pomerania (Litterski et al. 2005) also show a preference for soils with pH < 5 as well as potassium (K) deficiencies.

Lamb's succory

M 13

Small-scale set-aside

"Short-term – small-scale – successful"
Many pioneer species are very happy on set-aside areas. They benefit from a high share of soil without vegetation. The Common Field Grasshopper lays its eggs in the sun-warmed earth, wild bees burrow in it. Among butterflies, the Queen of Spain Fritillary, which readily lays its eggs on Field Pansies on the stubble, benefits especially. The Brown Hare benefits in winter from the structures providing cover, and the Whinchat has undisturbed nesting sites with perches and good nest cover in the spring.

What needs to be done?

- **One or two year set-aside of sub-areas** at the edges of fields or within the field on 0.05–0.1 ha

  no tilling and no soil management in the autumn, no further cultivation until threshing in the following year and/or the year thereafter

Technology not relevant

Organisation little effort; clear marking of areas designated for the measure and instruction of employees necessary

Time required for a one-year implementation little; the time requirement increases for two-year set-asides due to the difficulties arising from omitting soil management

Duration
1 to 2 years

Who profits most?
++ Queen of Spain Fritillary, Whinchat
+ Saltatoria, Brown Hare, Butterflies

How to ensure the measure is successful

	Queen of Spain Fritillary	Whinchat	Saltatoria	Brown Hare
Field features	–	Fallow land	Field margins	Wooded areas, fallow land
Location	Southerly exposed wind-sheltered field areas	At least 100 m from the forest	South-facing field boundaries and slopes	At least 500 m from roads
Soil quality	Low to medium	Low to medium	Low to medium	Low to medium

Losses
The yield losses on the area used for the measure match the respective gross margin loss of the cultivated crop.

Advantages
- cost savings (working hours and fuel consumption)
- very low land requirement
- support of beneficial organisms by increasing biodiversity and the supply of flowers
- time savings in cultivation, when field edges that are difficult to cultivate are selected ('field straightening')

Disadvantages
- the risk of weed infestation is high, therefore not to be used on areas with problematic weeds
- if used within the field: complications during cultivation

Results from the Nature Conservation Farm project
For example, the Whinchat: It finds undisturbed breeding sites in the set-asides.

Queen of Spain Fritillary

Whinchat

Saltatoria

Brown Hare

Blossom strips

"Attractive for man and animals"
Butterflies, bees and other insects find food and refuge areas in blossom strips. Insect hunters such as the Red-backed Shrike benefit from this. The strips provide more attractive and safer nesting sites for the Whinchat and the Yellow Wagtail in the second year. They offer overwintering areas for many animals and not least: Blossom strips are a real feast for the eyes for those looking for recreation.

What needs to be done?

▶ **Establishment**
Sowing of annual and perennial wild plant and crop species* on at least 10 m wide strips in cereals or grain legumes

The strips remain until the autumn or until the autumn of the following year (also in legume-grass leys) and are then mown or mulched
Important: Vegetation density up to max. 70 % with several distinct plant layers

▶ **There are two possible variants**
1. Subdivision of large arable fields with several strips spaced 100 m apart
2. Strips at the edges of fields or in corners that are difficult to reach

* in the appendix: Sowing mixtures and sources of supply

Technology adapt strip width to suit machine working width; sowing with seedbed combination, drilling machine, fertilizer spreader or by hand; when drilling directly into standing crops a weakening of the crop, for example through scoring, is unavoidable

Time required low to medium depending upon the location of the strips

Organisation medium effort; instruction of employees and marking of strips required

Duration 1 to 2 years

Who profits most?
++ Whinchat*, Yellow Wagtail*
+ Corn Bunting*, Red-backed Shrike, Butterflies

* two-year implementation required

Can be combined with
M1,2 Later cut
M8 Drilling gaps
M9 Reduced sowing density

M 14

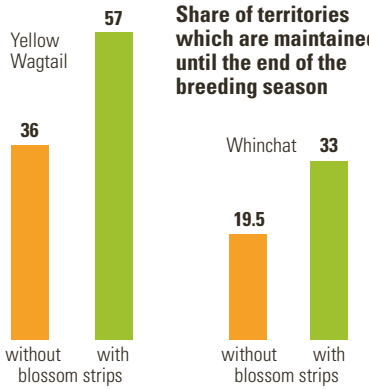
How to ensure the measure is successful

	Farmland birds	Red-backed Shrike	Butterflies
Field features	Fallow land, hedges	Hedges, copses, field margins, fallow land	Field margins, edges of woods
Location	At least 100 m from the forest	At the edges of hedges and coppices, not along roads	South-facing field boundaries and slopes, hilltops
Soil quality	Low to medium	–	Low to medium

Losses and expenditure
The yield losses on the blossom strips match the respective gross margin loss of the cultivated crop. Seeds must be purchased. In addition costs are incurred for mowing and harvesting when the measure is completed.

Advantages
- enrichment of the countryside
- low area requirement
- support of beneficial organisms by increasing biodiversity and the supply of flowers
- time savings when field edges that are difficult to cultivate are selected ('field straightening')
- buffer effect (e.g. reduction of nutrient contamination of adjacent water bodies)
- possible connectivity between biotopes

Disadvantages
- loss of production area
- risk of weed infestation, therefore targeted field selection required



Results from the Nature Conservation Farm project
For example, the Yellow Wagtail and Whinchat: More breeding pairs find suitable habitats until the end of the breeding season on fields with blossom strips.

Farmland birds

Red-backed Shrike

Butterflies

Field margins on rich soils

"Biodiversity on field edges"
Many species, including butterflies, saltatoria and also the Red-backed Shrike find ideal living conditions in field margins rich in flowers. They offer food, cover and refuge areas from soil management and harvesting on the adjacent fields all year round, and form connecting paths between biotopes. Even with only a small area the landscape becomes more attractive. Field margins on rich soils can be mown and used as fodder.

Who profits most?
++ Butterflies, Saltatoria
+ Red-backed Shrike

Can be combined with
M 3 High cut

What needs to be done?

- **Establishment**
  Sowing of a grass and herb mixture* on a 3 to 10 m strip along the field margin; seeding in the spring or autumn into a fine crumbled seedbed (SRI > 30) and rolling; maintenance cut in the first year in order to repress spontaneously appearing competitive plants

- **Use**
  One or two cuts ('linear meadow');
  1st cut in May to weaken the grasses, for example during the 1st cut in legume-grass leys; subsequent cut with the customary 3rd cut or mowing/mulching in autumn

Existing field margins can be improved and costs saved through slot-seeding. The meadow flowers should be able to disseminate abundantly every 2 to 3 years. Broad field margins can be driven upon every so often, however may not be used as headland.

* in the appendix: Sowing mixtures and sources of supply

Technology adapt margin width to suit machine working width; sowing by machine or by hand

Organisation medium effort; instruction of employees and marking of field margins required; location near the farm is favourable if separate mowing is required; several field margins in a "habitat network system" are easier to manage than scattered single field margins

Time required medium to high depending upon location and use

Duration long-term

M 15

How to ensure the measure is successful

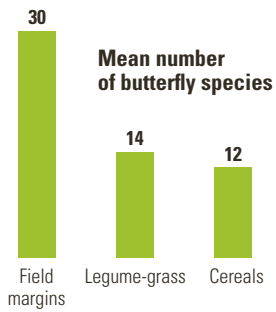
	Butterflies/Saltatoria	Red-backed Shrike
Type of measure	Small-scale	Small-scale
Field features	Edges of woods	Hedges, copses
Location	Southerly exposed field boundaries	At the edges of hedges and coppices, not along roads
Soil quality	Medium	–

Losses and expenditure
Due to the loss of production on the field margins, medium gross margin losses are to be estimated depending upon the crop rotation. Costs for seeds purchase as well as for mowing and harvesting are to be calculated.

Application on the farm
- 1st cut (before July) can be applied without restrictions
- subsequent cut in August as litter or horse hay

Advantages
- enrichment of the countryside
- small area required
- support of beneficial organisms by increasing the supply of flowers and the biodiversity
- buffer effect (e.g. reduction of nutrient contamination of adjacent water bodies)
- possible connectivity between biotopes

Disadvantages
- loss of production area
- risk of weed infestation, therefore targeted area selection required and/or more frequent mowing or mulching
- outside of the legume-grass phase, the area must be driven to separately in order to be used



Results from the Nature Conservation Farm project
For example, butterflies: On field margins with rich soils, a much greater variety of butterfly species can be found than in legume-grass leys and cereal fields.

Butterflies

Saltatoria

Red-backed Shrike

Field margins on dry poor soils

"Very little effort for a lot of species"
For grasshoppers and many other insects such as the Brown Argus, field margins on dry poor soils provide a particularly suitable habitat, because a blossom-rich vegetation soon establishes itself at these places without soil management, requiring only little use and nevertheless remaining sparse and low. The Red-backed Shrike finds a suitably abundant supply of insects as food there, and Woodlarks or Tree Pipits are glad to use margins such as these as protected nesting habitats.

What needs to be done?

- **Establishment**
  Take a strip with a width of between 3 and 20 m at the edge of the field (SRI < 30) out of arable use after the soil management or the legume-grass phase (without ploughing); no sowing required

- **Maintenance**
  According to growth, mow or mulch once per year or every few years in the autumn, for example with the last legume-grass cut

  Broad field margins can be driven upon every so often, however should not be used as headland.

Technology adapt field margin width to suit mowing machinery

Organisation little effort; instruction of employees and marking of field margins required; location near the farm is favourable if separate mowing is required; several field margins in a "habitat network system" are easier to maintain than scattered single field margins

Time required low to medium depending upon the location of the strips and the maintenance requirements

Duration long-term

Who profits most?
++ Butterflies, Saltatoria
+ Red-backed Shrike

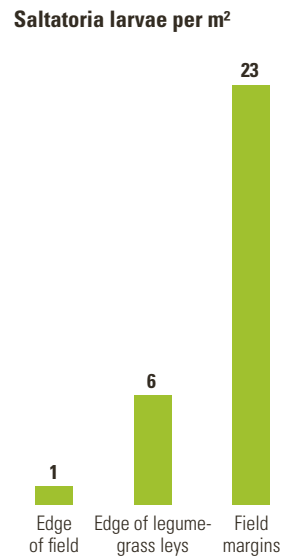
How to ensure the measure is successful

	Butterflies/Saltatoria	Red-backed Shrike
Type of measure	Small-scale	Small-scale
Field features	Edges of woods	Hedges, copses
Location	South-facing , wind-sheltered field boundaries and slopes	At the edges of hedges and coppices, not along roads
Soil quality	Low	–

Losses and expenditure
Due to the loss of production on the field margins, medium gross margin losses are to be estimated depending upon the crop rotation. Costs for mowing and harvesting are to be calculated.

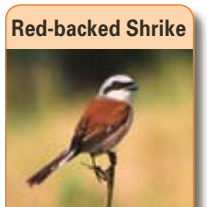
Advantages
- low to very low land requirement
- with adjacent legume-grass leys, small quantities can be added to the forage
- enrichment of the countryside
- support of beneficial organisms by increasing the supply of flowers and the biodiversity
- connectivity between biotopes possible

Disadvantages
- growth is generally not usable
- expansion of undesirable plant species and/or wooded areas possible



Results from the Nature Conservation Farm project

For example, saltatoria: The mostly sparse and low vegetation in field margins on poor soils provides saltatoria with excellent reproductive conditions as the ground is easily warmed.



Wood maintenance and management

"Benefits from cutting back"
Hedges and copses fulfil important functions as a habitat for many animals and for the reduction of erosion. In the past, cutting back was traditionally integrated into land management (for example, as firewood, animal food). Trees and bushes require cutting back at the edges of fields so as not to impede cultivation. A dense wooded belt around water bodies decreases the quality of the habitat for amphibians as there is too much shadow. Older hedges tend to thin out inside and are then unsuitable as a breeding habitat for the Red-backed Shrike and Barred Warbler.

What needs to be done?

- **Cutting back**
  along lakes and kettle holes, especially at the southern sides
  along hedges: cutting back 50 to 100 m sections of the woody structures to a height of approx. 70 cm above the ground (every 15 to 20 years)
- **Processing and use of habitat care residues**
  gathering of wood chippings (size 40 to 60 mm)
  composting shredded material with farmyard manure (max. 15 vol. % share of the farmyard manure) or use as litter or source of energy

Technology when adding shredded material to farmyard manure composting, a compost turner is required for a good mix (= multiple turning of the manure heap)

Organisation medium to high effort; instruction of employees required

Time required medium to high for cutting back according to degree of mechanization; medium for composting

Duration once every 15 to 20 years depending on type of woody structure and maintenance goal

Who profits most?

Cutting back	Amphibians	Hedgerow birds
Around water bodies	+ +	
Along hedges		+ +

M17

How to ensure the measure is successful

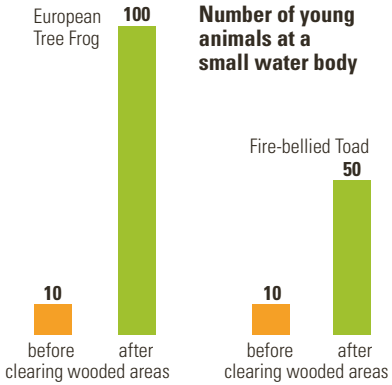
	Amphibians	Hedgerow birds
Type of measure	Small-scale	Small-scale
Field features	Water bodies, wet-spots	Hedges, copses, field margins, fallow land
Location	Not along roads	Not along roads
Soil quality	–	–

Expenditure
Costs for semi-automated procedures ("small private forest").
16.00 EUR/stère at 10 cm DBH to 14.50 EUR/stère at 15 cm DBH (wider ranges are not covered in this predominantly manual procedure).
For fully-automated procedures ("harvester") : reduced costs for diameters of 15 cm DBH to 13.80 EUR/stère or 9.80 EUR/stère for 20 cm DBH.

Application on the farm
- as firewood (diameter class 1 up to 3.2, source: www.wald-online-bw.de; standard lengths for wood fires: 25, 30, 50 cm)
- in livestock farms: where there is a lack of straw, as litter or as a structural support for composting (admixture of max. 15 % wood chippings in order to avoid a nitrogen barrier) and use in vegetables or maize

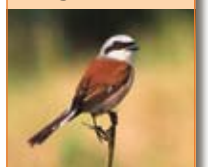
Advantages
Cutting back
- can be carried out in winter at times when workload is light
- firewood can additionally be sold or given to farm workers

Composting
- good for the humus balance in the long-term



Amphibians

Hedgerow birds



Results from the Nature Conservation Farm project

For example, the European Tree Frog and Fire-bellied Toad: After clearing woody structures from the banks of water bodies, the reproduction rates increase significantly.

Buffer strips around water bodies

"Evergreen banks"
Amphibians benefit from permanent, grassland-like buffer strips around kettle holes and other small water bodies. They provide a considerable expansion and improvement of the habitat for the Fire-bellied Toad and European Tree Frog in summer and winter, particularly if management is ideally adapted to the needs of the animals. Saltatoria and butterflies also benefit from this. The contamination of the water body with soil and nutrients from the field is reduced and thereby an effective contribution made to the protection of biotopes.

Who profits most?
++ Fire-bellied Toad, Butterflies, Saltatoria
\+ European Tree Frog, Common Spadefoot Toad

Can be combined with
M 3 High cut
M 15 Field margins – rich soils
M 14 Blossom strips

What needs to be done?

- **Sowing of a 20 m wide strip of grassland and subsequent management as a buffer strip***

  1 to 2 cuts before July, cutting height at least 10 cm, no 3rd cut, maintenance cut from October; removal of plant biomass to give the amphibians sufficient opportunities to move about

  or

  grazing (e.g. sheep, goats) at any time

* Sporadic inundation areas ("wet-spots") develop in the spring near some of the kettle holes. When these dry out in the summer, the soil without vegetation provides an ideal habitat for some rare plant specialists. These areas should therefore not be transformed into permanent grassland.

Technology mowers with adjustable cutting heights required

Organisation medium effort; marking of the buffer strips and instruction of employees at each cutting date

Time required medium to high due to equipment conversion (high cut) as well as maintenance cut in the autumn and removal of plant biomass

Duration long-term

M 18

How to ensure the measure is successful

	Amphibians	Butterflies/Saltatoría
Type of measure	Small-scale	Small-scale
Field features	Water bodies, wet-spots	Field margins, edges of woods
Location	Not along roads	South-facing field boundaries and slopes
Soil quality	–	Low to medium

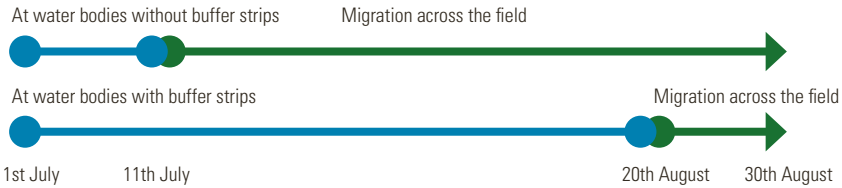
Forage yield and quality
Through the higher 1st and 2nd cuts as well as by forgoing the 3rd cut, a loss of approx. 20 GJ NEL ha^{-1} is incurred on the buffer strips. The fodder quality is somewhat better with the higher cut.

Application on the farm
– no restrictions on the 1st and 2nd cut before the end of June
– maintenance cut in October as litter or horse hay

Advantages
– lower contamination when harvesting fodder from a high cut
– due to the small proportion of land used, losses are localised
– reduction of the nutrient contamination of the water bodies
– possible connectivity between biotopes

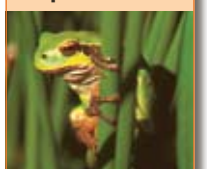
Disadvantages
– additional investment may be required to modify the cutting height
– if the 2nd cut can no longer be carried out in June because of the weather, the loss for livestock farms is considerably greater

Location of young amphibians



Results from the Nature Conservation Farm project For example, the Fire-bellied Toad: If there are buffer strips available around a water body, the toadlets remain longer at the water body. The danger arising from agricultural cultivation on the field is therefore strongly reduced.

Amphibians



Butterflies

Saltatoria

M 19

More spring crops

"Keeping an eye on the crop rotation"
Farmland birds and Brown Hare avoid high and dense crops as are often found early in the year in winter cereals. Spring cereals and grain legumes on the other hand, which are not sown until the spring, are still relatively low and sparse in May; the animals can therefore use these stands for a longer period of time to raise their young. Every increase in the share of spring cereals and grain legumes in the crop rotation improves the living and reproductive conditions for the Skylark & Co.

What needs to be done?

- **Increase the share of spring cereals and grain legumes in the crop rotation**
  favourable: 10 to 30 %

Technology not relevant

Organisation medium effort due to changes in the crop rotation planning and structuring

Time required
low to medium depending upon the necessity of the changes to the crop rotation

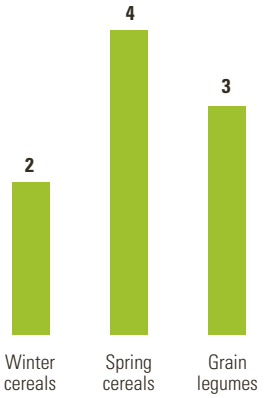
Duration long-term

Losses
The yield risk for spring cereals is higher than for winter cereals. A 20 % lower yield can be expected.

Advantages
- no change in production methods for individual crop species
- some spring wheat species achieve higher quality levels than winter wheat
- good opportunity to increase crop diversity

Disadvantages
- uncertainty in the establishment of crops due to a dry spring or overly damp conditions while sowing
- observe weed infestation problems with summer annual arable flora – risk of nutrient leaching (can be reduced by cultivating catch-crops)

Average number of breeding farmland bird species



Results from the Nature Conservation Farm project
For example, farmland birds: More species breed in spring cereals and grain legumes than in winter cereals.

Who profits most?
++ Farmland birds, Brown Hare

Farmland birds

Brown Hare

M20

Better distribution of crop species on smaller fields

"Variety is good"
Demands made on their habitat by farmland birds, Brown Hare and amphibians could be better fulfilled, if crop species with different growth patterns were cultivated next to each other. The animals would then always be able to find suitable locations (for example, low vegetation) within easy reach. As agricultural cultivation takes place at different times depending on the crop, alternative sites are additionally available during soil management or harvesting. Fields with a maximum size of 20 to 30 ha are advantageous, so that the distances between the crop species can be overcome.

What needs to be done?

- **Cultivation of adjacent fields with crops that have different vegetation patterns and cultivation times**
  - winter cereals/spring crops
  - winter cereals/legume-grass
  - spring crops/legume-grass
- **Division of fields larger than 30 ha**
  cultivation of two crop species

Technology not relevant

Organisation medium effort, especially in crop rotation planning

Time required low to medium depending upon the layout of the fields and their distance from the farm; if, for example, the next field but one in contiguous farms is cultivated with the same crop species, the additional time required is slight

Duration long-term

Who profits most?

++ Farmland birds, Brown Hare

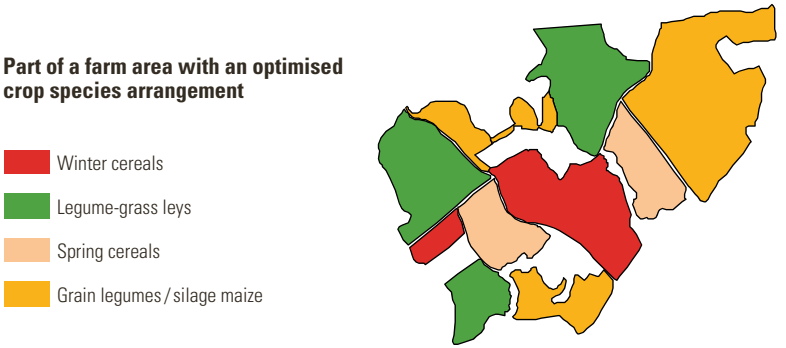
\+ Hedgerow birds, amphibians

Expenditure
Hardly any negative economic effects result from the desired maximum field size of 30 ha.

Advantage
– no change to production methods for the individual crop species

Disadvantage
– there is a higher logistical expense on fields that are a long distance from the farm

Part of a farm area with an optimised crop species arrangement



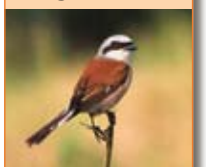
Results from the Nature Conservation Farm project

Adjacent fields with different crop species offer farmland birds and hares good opportunities for evasion and protection.

Farmland birds

Brown Hare

Hedgerow birds



Amphibians

Other relevant measures

Overwinter stubble

Stubble field in the autumn

Overwinter stubble fields offer cover and food to almost all of the animals presented in the species profiles in the late summer and autumn and to the overwintering species during the winter months. Non-competitive and late-flowering segetal flora species also benefit. This measure can be advantageous in terms of labour costs. However yield losses of 10 to 20 % may be expected in the following year. Negative effects such as problematic weeds in subsequent years as well as phytosanitary aspects are to be taken into consideration. The measure can be carried out on a large or small-scale, for example, on 3 m wide strips at the edges of fields, around water bodies or at wet-spots in fields.

Leaving cereals to stand over the winter on a small area

Cereals left unharvested on small sub-areas of a field provide overwintering seed-eating birds as well as Brown Hares and European Hamsters with food in the cold season. Insects and late-flowering segetal flora species also benefit. Narrow strips along the field margins (1 to 3 m) or at places that are difficult to harvest are not threshed and are reintegrated into cultivation the following spring. Even small cereal areas like this are valuable while at the same time requiring little effort on the part of the farm.

Wet-spots in fields

Temporary wet-spot in a field

Small-scale wet-spots, for example in hollows on waterlogged soils or in the inundation areas of kettle holes present a problem for cultivation. Arable cultivation is at the same time however, the prerequisite for typical animal and plant communities to develop. Some of these species are highly endangered and dependent upon open, sparsely vegetated pioneer sites. These areas offer opportunities for survival, in particular for the very rare segetal flora of the "dwarf plant communities". Amphibians and the Lapwing also use wet-spots such as these as a food and breeding habitat. Drainage or filling must be forgone in order to preserve them. At the same time several species require appropriate arable use (for example delayed stubble breaking, reduced use of fertilizers).

Narrow field margins

Small, unused areas beside fields and along paths or wooded areas appear to be neglected. Yet that is precisely what hedgerow birds such as the Red-backed Shrike and the Barred Warbler (A 4) prefer, because they find a lot of food or build their nests in these herb borders. The Upland Field Grasshopper (A 11) also loves field margins like this. At the edge of the field, a strip of 0.3 to 1 m is left out of the soil cultivation and not sown. In the periphery of wooded areas, particularly near blackthorn hedges, these field margins must be ploughed or mown every 3 to 5 years (e.g. with the last legume-grass cut) so that the wooded areas do not spread out into the field margins. The non-cultivation of 'unproductive' sites saves working time. The measure should be carried out at least biennially or permanently.

Narrow field margins beside a field and path

Planting hedges

The planting of new hedges and woody structures is frequently carried out to divide large fields and to reduce wind erosion. At the same time it is also connected with an improvement of the structural diversity of the arable land and the quality of the habitat for many wild animals (for example Brown Hare, Partridge, hedgerow birds and insects). These in turn make valuable contributions to biological control. Hedges can also serve economic purposes if fruit trees with fruit for sale are integrated into the hedges. Due to the multitude of available instructions on the planting of hedges, we would like in particular to refer here to the leaflet 'Hecken – planen, pflanzen, pflegen' published by the Nature Conservation Advisory Service of Lower Saxony et al. (www.oeko-komp.de).

Profiles of the species

Do you have special interests or farm characteristics?
On the basis of specific research criteria you can allow yourself to be guided directly to the profiles which are of interest to you.
→ page 7

The profiles of the species provide information on habitat requirements, biology and threats, whereby both the advantages and potential conflicts of organic agriculture are explained. From this a list of measures suitable for each species can be developed along with their main effects. Information is additionally provided on the relevant crops, time periods and advantageous field and site conditions, because the measure is most successful at particularly suitable locations.

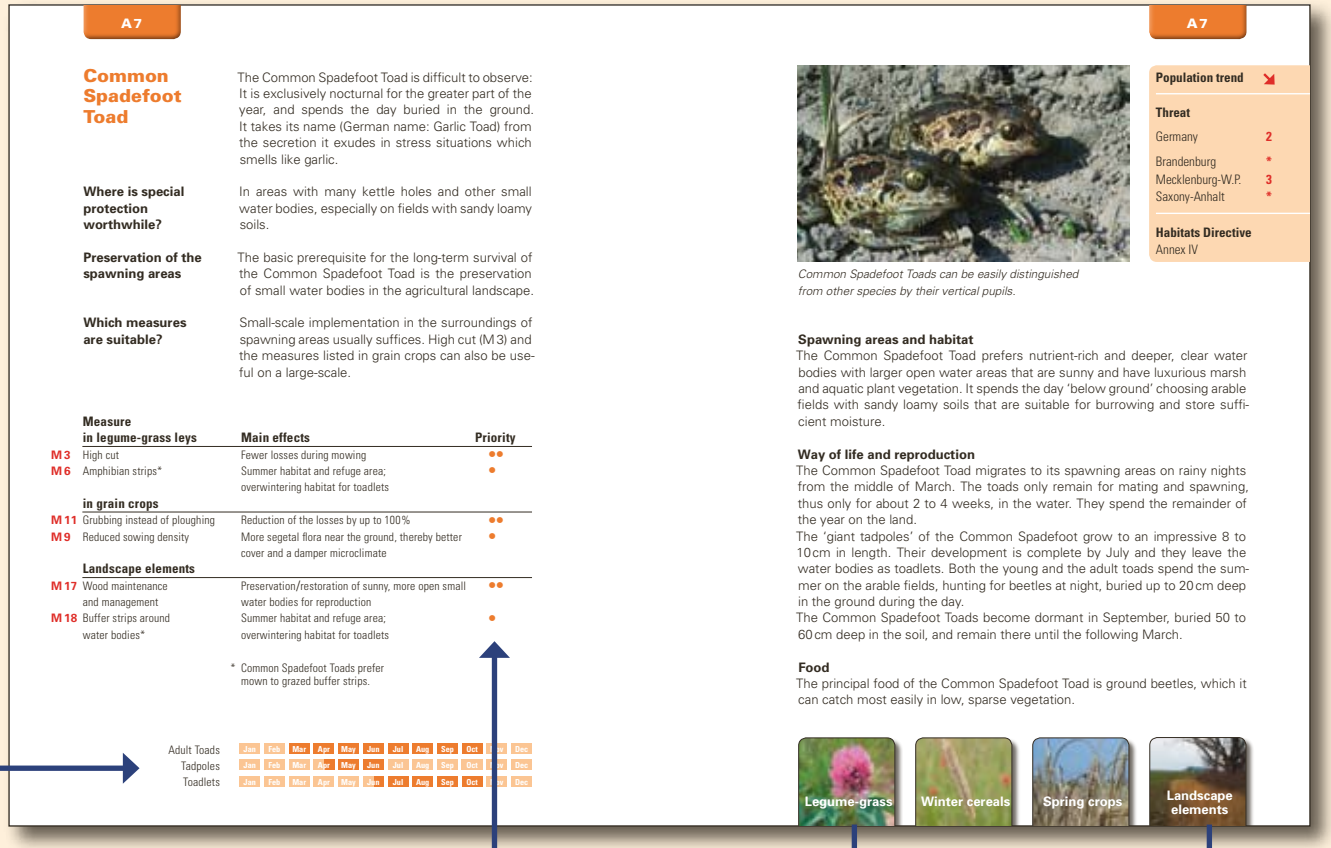
Following on from the profiles of the species are short descriptions of other typical and in part very rare animals and plants of the agricultural landscape. Profiles were not prepared for these species. They are predominantly species, which are only rarely found in north-east Germany, or for which more far-reaching measures are required than those which are described in this manual.

Complete listing

Profiles of the species

Other relevant species

Explanation of the profile of a species



A7

Common Spadefoot Toad

The Common Spadefoot Toad is difficult to observe: It is exclusively nocturnal for the greater part of the year, and spends the day buried in the ground. It takes its name (German name: Garlic Toad) from the secretion it exudes in stress situations which smells like garlic.

Where is special protection worthwhile?
In areas with many kettle holes and other small water bodies, especially on fields with sandy loamy soils.

Preservation of the spawning areas
The basic prerequisite for the long-term survival of the Common Spadefoot Toad is the preservation of small water bodies in the agricultural landscape.

Which measures are suitable?
Small-scale implementation in the surroundings of spawning areas usually suffices. High cut (M 3) and the measures listed in grain crops can also be useful on a large-scale.

Measure		Main effects	Priority
in legume-grass leys			
M 3	High cut	Fewer losses during mowing	●●
M 6	Amphibian strips*	Summer habitat and refuge area; overwintering habitat for toadlets	●
in grain crops			
M 11	Grubbing instead of ploughing	Reduction of the losses by up to 100%	●●
M 9	Reduced sowing density	More segetal flora near the ground, thereby better cover and a damper microclimate	●
Landscape elements			
M 17	Wood maintenance and management	Preservation/restoration of sunny, more open small water bodies for reproduction	●●
M 18	Buffer strips around water bodies*	Summer habitat and refuge area; overwintering habitat for toadlets	●

* Common Spadefoot Toads prefer mown to grazed buffer strips.

Adult Toads Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tadpoles Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Toadlets Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

A7

Common Spadefoot Toads can be easily distinguished from other species by their vertical pupils.

Population trend ↘

Threat

Germany	2
Brandenburg	*
Mecklenburg-W.P.	3
Saxony-Anhalt	*

Habitats Directive
Annex IV

Spawning areas and habitat
The Common Spadefoot Toad prefers nutrient-rich and deeper, clear water bodies with larger open water areas that are sunny and have luxurious marsh and aquatic plant vegetation. It spends the day 'below ground' choosing arable fields with sandy loamy soils that are suitable for burrowing and store sufficient moisture.

Way of life and reproduction
The Common Spadefoot Toad migrates to its spawning areas on rainy nights from the middle of March. The toads only remain for mating and spawning, thus only for about 2 to 4 weeks, in the water. They spend the remainder of the year on the land.
The 'giant tadpoles' of the Common Spadefoot grow to an impressive 8 to 10 cm in length. Their development is complete by July and they leave the water bodies as toadlets. Both the young and the adult toads spend the summer on the arable fields, hunting for beetles at night, buried up to 20 cm deep in the ground during the day.
The Common Spadefoot Toads become dormant in September, buried 50 to 60 cm deep in the soil, and remain there until the following March.

Food
The principal food of the Common Spadefoot Toad is ground beetles, which it can catch most easily in low, sparse vegetation.

Legume-grass | Winter cereals | Spring crops | Landscape elements

The figures relate to the first mentioned species.

"Population trend"
→ constant
↘ decreasing
↗ increasing

"Threat
1 = critically endangered
2 = endangered
3 = vulnerable
NT = near threatened
* = least concern
n. s. = not specified
Information from the Red Lists of Germany and the states of Brandenburg, Mecklenburg-Western Pomerania and Saxony-Anhalt (if same level of threat in the three states: North-east Germany).

"Habitats Directive/ Birds Directive"
Species which are listed in one of the annexes of the EU Habitats Directive and/ or the Birds Directive enjoy particularly rigorous protection.

"Relevant times"
Indicates in which months the species is on the farm, and in which months reproduction takes place, and therefore increased sensitivity is required during farming operations.

"Priority (from a nature preservation viewpoint)"
● high
●● very high
All of the measures listed have proven effective for the species. The priority additionally indicates which of the measures has the comparatively greatest nature conservation effect and should therefore be given priority concerning implementation.

"Habitat types"
– Legume-grass
– Winter cereals
– Spring crops
– Landscape elements
The habitat types in which the animal or plant species prefers to live and/or which it requires as a partial habitat are indicated. Priority should be given to implementing the measures in these habitats.

Skylark

If habitat, food supply and weather are right and moreover predators are not prevalent, Skylarks will rear several new generations from the spring to the summer. In this way they are in a position to make up for 'bad years' and to keep their population stable in the long-term. You as a farmer can systematically improve the quality of the field as a habitat – and thereby assist the Skylark's survival strategy.

Where is special protection worthwhile?

In all crops. Skylarks prefer low-yield soils and open areas that are at least 100 m from the forest. Small fallow areas alongside or in the fields are favourable.

Which measures are suitable?

The following measures must be taken across the entire field, yet on a minimum of 10 ha.

	Measure	Main effects	Priority
	in legume-grass leys		
M 2	No 2nd cut	More than twice as many young birds fledge	●●
M 2	Later 2nd cut	30 to 60 % more young birds fledge	●●
M 1	Later 1st cut	40 to 90 % more young birds fledge	●●
M 3	High cut	Fewer nests destroyed; suitable conditions for nest-building one week after a cut	●
	in grain crops		
M 8	Drilling gaps	More segetal flora; less dense crop stands, therefore longer breeding time and greater breeding success	●●
M 9	Reduced sowing density		●
M 11	Grubbing instead of ploughing		●
M 7	No harrowing*	No nest losses due to harrowing; more food and segetal flora as nest cover	●
M 10	Delayed stubble breaking	More seeds as food in summer and autumn	●

* in winter wheat and in spring crops

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult birds	■	■	■	■	■	■	■	■	■			
Eggs / young birds				■	■	■	■	■				

Male and female Skylarks are hard to tell apart.

Population trend

West Germany since the 1960s	↘
East Germany since the mid-1990s	↘

Threat

Germany	3
Brandenburg	V
Mecklenburg-W.P.	*
Saxony-Anhalt	NT

Breeding

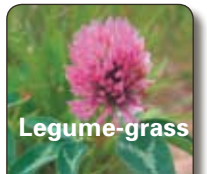
Breeding begins in April in legume-grass and in winter cereals; not until May in spring crops, in June in maize.
It takes 38 days from nest-building until the first fledglings appear. Up to 3 successive broods are possible each with a clutch of 3 to 5 eggs. Often only one to at most two broods are successful in cereals and maize.

Nest and nesting site

In the interior of the field in self-dug hollows in the ground, the edge of the nest level with the surface. Favourable sites display vegetation heights of between 20 and 60 cm and a coverage ratio of 30 to 70 %. Dicotyledonous plants such as Creeping Thistle or Mugwort are preferred nest cover.

Food

The nestlings are fed with insects and spiders. The adult birds eat a lot of plant-based food especially in the winter and spring. The Skylarks find their food on the ground, preferably at places with sparse crop cover and a lot of segetal flora, but also in low or mown vegetation.



Corn Bunting
Yellow Wagtail

The populations of Corn Buntings in East Germany increased considerably after 1990 – thanks to many set-aside fields. Now that the set-aside has been lifted, populations are stagnating in many places. There are still increases in areas where there is organic or extensive land use. In the western federal states, the species has however continued to steadily disappear from the landscape until today. The more widespread Yellow Wagtail also profits from the measures for the benefit of the Corn Bunting.

Where is special protection worthwhile?

In legume-grass, spring crops and short-stemmed cereal varieties. The Corn Bunting and Yellow Wagtail prefer open and semi-open fields, which are at least 100 m from the forest, and medium to good soils. Fallow land and low wooded areas beside or in the fields are convenient.

Which measures are suitable?

The following measures must be taken across the entire field, yet on a minimum of 10 ha. What is especially effective is the combination of bird or blossom strips (M 4, M 14) with a late or high cut in legume-grass (M 2, M 3).

	Measure in legume-grass leys	Main effects	Priority
M 2	No 2nd cut	Two-thirds fewer broods caught up in the mowing	●●
M 2	Later 2nd cut	One-third fewer broods caught up in the mowing	●
M 3	High cut	Fewer nests destroyed; suitable conditions for nest-building one week after a cut	●
M 4	Bird strips	Nest cover; perches; fewer nests destroyed; seeds as food in the winter	●
	in grain crops		
M 8	Drilling gaps	More dicotyledonous nesting plants and perches	●●
M 9	Reduced sowing density		●
M 10	Delayed stubble breaking	More seeds as food in summer and autumn	●
M 14	Blossom strips	Nest cover; perches; seeds as food in the winter	●

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs / young birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Male Corn Buntings like to sing from high places.

The Yellow Wagtail often settles in the same habitat as the Corn Bunting.

Population trend

Since the 1960s	↘
East Germany	
since the 1990s	↗
since the mid-1990s	→

Threat

Germany	3
Brandenburg	2
Mecklenburg-W.P.	*
Saxony-Anhalt	3

Breeding

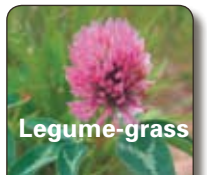
Corn Buntings like to breed in groups. The male birds mate with two females if conditions are good, which then often breed close to one another. Breeding begins in legume-grass leys, winter wheat and in fallow land from mid-May, not until June in spring crops and most winter cereals. It takes 36 days from nest-building until the first fledglings appear. Usually only one, rarely also 2 broods with clutches of 4 to 6 eggs apiece are possible. Breeding success is very high in spring crops.

Nest and nesting site

The Yellow Wagtail, which has similar habitat requirements, is regularly also found where the Corn Bunting settles. Both species find their ideal nesting sites in the middle of the field, far away from the wooded areas, beneath tall-growing plants providing good cover such as Mugwort or Thistle. The Corn Bunting locates its nest on the ground, the sides of the nests reaching a height of about 8 cm. Yellow Wagtails on the other hand use existing hollows in the ground for their nests or make them themselves.

Food

(Large) insects and spiders for the nestlings, otherwise seeds from cereals and grasses.



Whinchat

It is true that the Whinchat is considered a character species of extensively used meadows and pastures. In the meantime an important part of the populations in north-east Germany also breed in agricultural areas where there is little grassland. The East German federal states, and among them Mecklenburg-Western Pomerania and Saxony-Anhalt in particular, currently have the greatest breeding density of the species in Germany. Special attention is therefore also deserved there for the protection of this graceful bird.

Where is special protection worthwhile?

Above all in legume-grass leys. At the same time Whinchats prefer open fields without a bordering forest and poor to medium soils. Fallow land and ditches rich in vegetation alongside or in the fields are convenient. They are also settled regardless of the neighbouring crop species.

Conservation of fallow and waste land

Outside of legume-grass leys, Whinchats settle almost exclusively in small fallow patches, wet-spots and ruderal areas in the arable land. The preservation of such cultivation-free sites, at which the bird can breed regularly and without being disturbed, is an important prerequisite for its long-term survival.

Measure		Main effects	Priority
in legume-grass leys			
M 4	Bird strips*	Fewer territories given up following the 1st mowing; refuge area, nest cover and perches; fewer nests destroyed	●●
M 3	High cut	Fewer nests destroyed; suitable conditions for nest-building after a cut one week earlier	●
in grain crops			
M 13	Small-scale set-aside	Creation of undisturbed nesting sites with perches and good nest cover	●●
M 14	Blossom strips*		●●

* especially effective in combination with a late cut in legume-grass (M 2)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs / young birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

The male Whinchat (left) displays its orange to reddish-brown throat and breast colouring while the females' colours are less rich in contrast.

Population trend

Since the 1960s	↘
East Germany since the 1990s	→

Threat

Germany	3
Brandenburg	3
Mecklenburg-W.P.	*
Saxony-Anhalt	3

Way of life and breeding

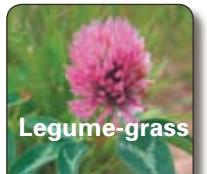
Several couples often establish themselves close together at favourable sites. Suitable perches are absolutely essential, for example high shrubs, paddock fences or small bushes. The Whinchat returns to the breeding area in April, breeding begins in the middle of May. From nest-building until the first fledglings appear takes 43 days. A clutch of 5 to 7 eggs is typical, subsequent clutches are rare. The families fly around together for a few more weeks after the young birds are fledged. The autumn migration to the African savannahs begins at the end of July and draws to a close in October.

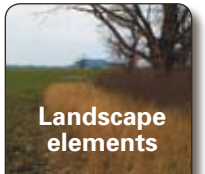
Nesting sites

The Whinchat finds its ideal nesting site in the field beneath dicotyledonous plants offering good cover, as well as in the dense felt of old grass. The nest is established where possible as a semi-hollow in the ground to provide the best protection for the shiny blue-green eggs. The top edge of the nest is usually level with the ground surface.

Food

Large insects and spiders, in the autumn also berries.





Red-backed Shrike

Barred Warbler

As the Red-backed Shrike readily resides in thorn bushes and moreover is accustomed to occasionally spear its prey on thorns, it is also referred to in Germany in the vernacular as "thorn turner" or "thorn hacker". The rarer Barred Warbler settles exclusively in close proximity to the Red-backed Shrike. Therefore measures to protect the Red-backed Shrike also aid the population of the Barred Warbler.

Where is special protection worthwhile?

On fields with hedges and other woody structures in which the Red-backed Shrike (and Barred Warbler) breed. Woody structures along heavily travelled paths or roads are not suitable.

Which measures are suitable?

Basically the Red-backed Shrike benefits from all agricultural measures in grain crops which promote a wealth of insects and the accessibility of food.

	Measure	Main effects	Priority
	in legume-grass leys		
M 4	Bird strips	Establishment of food habitats rich in insects	●
	in grain crops		
M 13	Small-scale set-aside	Establishment of food habitats rich in insects	●
M 14	Blossom strips		●
	Landscape elements		
M 17	Wood maintenance and management	Long-term preservation of the nesting sites	●●
M 15	Field margins on rich soils	Establishment of food habitats rich in insects	●
M 16	Field margins on dry poor soils		●
M 18	Buffer strips around water bodies		●

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult birds												
Eggs / young birds												

Male Red-backed Shrikes are unmistakable due to their black "bandit's mask".

The Barred Warbler almost always settles in close proximity to the Red-backed Shrike.

Population trend ↘

Threat

Germany	*
Brandenburg	*
Mecklenburg-W.P.	3
Saxony-Anhalt	*

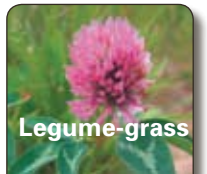
Birds Directive
Annex 1

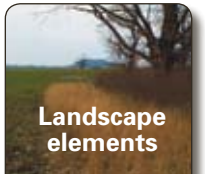
Way of life, nesting sites and breeding

The Red-backed Shrike prefers low bushy hedges and briars with widths of 7 meters and more for nest building. It does not settle in hedges of trees and forest-like groves. The Barred Warbler additionally requires single outstanding structures above the shrubs from the tip of which it likes to launch into its song flights. Both species lay their nests within the woody structure, often close together. Breeding begins towards the end of May. A clutch of 5 eggs is typical, most of the young birds fledge in June and July. While the Barred Warbler also seeks food in the breeding woods, the Red-backed Shrike hunts its prey exclusively in the surrounding open country.

Food

In the past it was thought that the Red-backed Shrike had to consume nine birds a day, otherwise it would die [hence it's German name: the Nine-Killer]. In actual fact, it feeds mainly on large insects, but also hornets and occasionally small vertebrates (mainly mice).





Brown Hare

The Brown Hare finds the living conditions on organic farms good if there are enough protective bushes, forests or fallow land nearby. Legume-grass is among the Brown Hare's preferred arable crops. Suitable measures help it to raise sufficient leverets there very effectively. Loosely standing cereals, interspersed with segetal flora, provide the hare with sufficient high-quality food and freedom of movement.

Where is special protection worthwhile?

In all crops, but most of all in legume-grass leys and in mixtures. The fields should be at least 500 m from well-travelled roads. Fields with extensive landscape elements such as copses or forest are particularly favourable.

Which measures are suitable?

The following measures must be taken across the entire field, yet on a minimum of 10 ha. Basically the Brown Hare benefits from all agricultural measures implemented in grain crops which add to the diversity of the plants and the freedom of movement at ground level.

	Measure	Main effects	Priority
	in legume-grass leys		
M 2	No 2nd cut	Undisturbed rearing of leverets in the most important reproduction period	●●
M 2	Later 2nd cut	Fewer losses of leverets during the most important reproduction period	●●
M 3	High cut	Fewer losses of leverets during mowing	●
	in grain crops		
M 8	Drilling gaps*	Diverse range of food and covering vegetation	●●
M 9	Reduced sowing density*	Good freedom of movement in the crops	●●
M 7	No harrowing	Undisturbed rearing of leverets until the harvest	●
M 10	Delayed stubble breaking	Fewer losses of leverets after harvesting; preservation of food supply and cover	●

* especially effective in combination with delayed stubble breaking (M 10)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult hares	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Leverets	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A5

Brown Hares are more active in the daytime during the reproductive season in the spring.

Population trend

Since the 1960s ↘

East Germany since the mid-1990s →

Threat

Germany	3
Brandenburg	2
Mecklenburg-W.P.	3
Saxony-Anhalt	2

Way of life

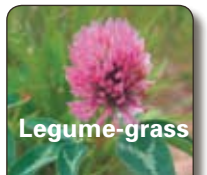
Brown Hares are predominantly nocturnal, not territorial and fundamentally loners, whereby the individuals know each other well and live alongside one another as a loose group. Their home ranges over the whole year can comprise an area of between 50 and 70 hectares. Brown Hares usually spend the day resting in a shallow hollow which they dig themselves. In the spring and summer this is usually on the field, in the autumn and winter, especially when the snow is high and there is a sharp east wind, also in the forest, reeds etc.

Reproduction

The female hares prefer fields with good vegetation cover as a birthplace for their young. Forests and groves are also selected in early spring. The reproduction period is from February to October. Up to 4 successive litters are possible with 2 to 6 leverets per litter. The leverets with the best chances of survival are born in the months of May, June and July. During their first 4 weeks, the leverets remain motionless when in danger. The young hares are suckled during this time. They are fully grown after 8 months.

Food

The Brown Hare has a low protein diet. They eat many different crops and wild plants; wild herbs make up approximately half of their food intake. The suckling does' milk quality depends strongly on the availability of plants with high fat content.



Fire-bellied Toad

European Tree Frog

The Fire-bellied Toad is one of the most vulnerable amphibian species in Germany. It often shares its spawning areas with the European Tree Frog which is also at risk. Toad watersites are generally distinguished however by a wide variety of amphibians. This is one reason why conservation measures for the Fire-bellied Toad also benefit many other species, in particular also the European Tree Frog.

Where is special protection worthwhile?

In areas with a large number of kettle holes.

Preservation of the spawning areas

The basic prerequisite for the long-term survival of the Fire-bellied Toad is the preservation of kettle holes and wet-spots in fields.

Which measures are suitable?

Small-scale implementation in the area surrounding toad watersites usually suffices. High cut (M3) and the measures listed in grain crops can also be useful on a large-scale.

	Measure	Main effects	Priority
	in legume-grass leys		
M 3	High cut	Fewer losses during mowing	●●
M 6	Amphibian strips*	More reproduction; summer and overwintering habitat; refuge area	●●
	in grain crops		
M 11	Grubbing instead of ploughing	Reduction of the losses by up to 100%	●●
M 9	Reduced sowing density	More vegetation near the ground, thereby better cover and a damper microclimate	●
M 10	Delayed stubble breaking	Undisturbed migration to the winter quarters	●
	Landscape elements		
M 17	Wood maintenance and management	More sunlight penetration, resulting in accelerated development of tadpoles and a higher survival rate	●●
M 18	Buffer strips around water bodies*	More reproduction; summer and overwintering habitat; refuge area	●●

* Fire-bellied Toads prefer grazed to mown buffer strips.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult toads	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawn/Tadpoles	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Toadlets	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A6

Male Fire-bellied Toads defend 1 to 2 m² stretches of water.

European Tree Frogs are excellent climbers thanks to the suckers on their toes.

Population trend ↘

Threat

Germany	1
North-east Germany	2

Habitats Directive
Annex II, IV

Toad watersites

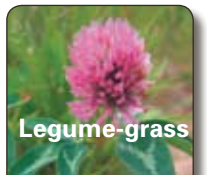
The Fire-bellied Toad's typical spawning areas are sunny, shallow water bodies with abundant underwater vegetation in the open landscape. Such water bodies warm up quickly, and drying up occasionally in summer keeps down the population of fish and other tadpole hunters in subsequent years.

Way of life and reproduction

The Fire-bellied Toads migrate, mainly at night, to their spawning areas from the middle of April. While doing so they use traditional migration corridors, regardless of the cultivated crops in that area. From spawning to the development of toadlets takes up to 12 weeks. The toadlets are diurnal and disperse undirected from the spawning area from the end of June.
For their summer stay on the land, Fire-bellied Toads often choose to stay in the immediate environment of the water body. They prefer open vegetation and meadow structures, preferably with burrows or stones providing shadow. European Tree Frogs on the other hand spend the summer mainly on woody structures, with a predeliction for hedges and young trees.
In September and October winter quarters are sought, which can be up to 1km away.

Food

Diptera and their aquatic larvae as well as beetles, spiders and other invertebrates.



Common Spadefoot Toad

The Common Spadefoot Toad is difficult to observe: It is exclusively nocturnal for the greater part of the year, and spends the day buried in the ground. It takes its name (German name: Garlic Toad) from the secretion it exudes in stress situations which smells like garlic.

Where is special protection worthwhile?

In areas with many kettle holes and other small water bodies, especially on fields with sandy loamy soils.

Preservation of the spawning areas

The basic prerequisite for the long-term survival of the Common Spadefoot Toad is the preservation of small water bodies in the agricultural landscape.

Which measures are suitable?

Small-scale implementation in the surroundings of spawning areas usually suffices. High cut (M 3) and the measures listed in grain crops can also be useful on a large-scale.

	Measure	Main effects	Priority
	in legume-grass leys		
M 3	High cut	Fewer losses during mowing	●●
M 6	Amphibian strips*	Summer habitat and refuge area; overwintering habitat for toadlets	●
	in grain crops		
M 11	Grubbing instead of ploughing	Reduction of the losses by up to 100 %	●●
M 9	Reduced sowing density	More segetal flora near the ground, thereby better cover and a damper microclimate	●
	Landscape elements		
M 17	Wood maintenance and management	Preservation/restoration of sunny, more open small water bodies for reproduction	●●
M 18	Buffer strips around water bodies*	Summer habitat and refuge area; overwintering habitat for toadlets	●

* Common Spadefoot Toads prefer mown to grazed buffer strips.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Toads												
Tadpoles												
Toadlets												

Common Spadefoot Toads can be easily distinguished from other species by their vertical pupils.

Population trend ↘

Threat

Germany	2
Brandenburg	*
Mecklenburg-W.P.	3
Saxony-Anhalt	*

Habitats Directive
Annex IV

Spawning areas and habitat

The Common Spadefoot Toad prefers nutrient-rich and deeper, clear water bodies with larger open water areas that are sunny and have luxurious marsh and aquatic plant vegetation. It spends the day 'below ground' choosing arable fields with sandy loamy soils that are suitable for burrowing and store sufficient moisture.

Way of life and reproduction

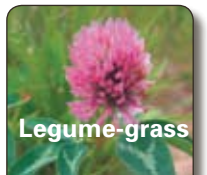
The Common Spadefoot Toad migrates to its spawning areas on rainy nights from the middle of March. The toads only remain for mating and spawning, thus only for about 2 to 4 weeks, in the water. They spend the remainder of the year on the land.

The 'giant tadpoles' of the Common Spadefoot grow to an impressive 8 to 10 cm in length. Their development is complete by July and they leave the water bodies as toadlets. Both the young and the adult toads spend the summer on the arable fields, hunting for beetles at night, buried up to 20 cm deep in the ground during the day.

The Common Spadefoot Toads become dormant in September, buried 50 to 60 cm deep in the soil, and remain there until the following March.

Food

The principal food of the Common Spadefoot Toad is ground beetles, which it can catch most easily in low, sparse vegetation.



Queen of Spain Fritillary

The Queen of Spain Fritillary was originally at home in barren steppes and is typical of the open arable landscape in Central Europe. It is an excellent flyer and also undertakes long migrations. When searching for nectar-rich blossoms it can be found everywhere, but for reproducing it is found exclusively on sparsely grown areas with open patches. There it lays its eggs on or in the vicinity of Violets, the future food plants of its caterpillars. Stubble fields or young fallow land with large numbers of Field Pansies are an ideal habitat for the Queen of Spain Fritillary. The field margins in organic agriculture also provide good reproduction conditions.
The "bottleneck" for the population is probably the survival of the overwintering caterpillars on the ground. Conservation measures should therefore also take the wintertime into consideration.

Where is special protection worthwhile?

In all crops. In the search for nectar, all blossom-rich habitats are important, thus legume-grass leys, field margins, fallow land, grassland and also stubble fields. As a reproduction habitat, stubble fields, recent set-asides, field margins and sparse low-vegetated areas in legume-grass leys serve best.

	Measure	Main effects	Priority
	in legume-grass leys		
M 5	Butterfly strips	Preservation of nectar sources after mowing	●●
	in grain crops		
M 13	Small-scale set-aside	Undisturbed reproduction and overwintering	●●

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs					■	■	■	■	■			
Caterpillars	■	■	■	■	■	■	■	■	■	■	■	■
Butterflies					■	■	■	■	■			

A8

The Queen of Spain Fritillary can be recognized by the large silver spots on the underside of its wings.

Population trend ↘

Threat	
Germany	*
North-east Germany	*

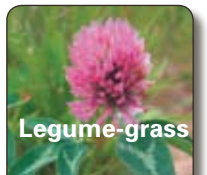
Behaviour and flower visits

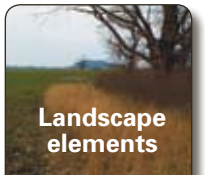
The Queen of Spain Fritillary likes to bask on sun-warmed earth free of vegetation, for example on country lanes. Red clover and lucerne are very popular nectar plants in legume-grass leys; on cereals and stubble fields, the butterflies suck on Camomile and Field Pansies for example. In field margins, grassland and dry grassland, the blossoms of many more plant species are visited such as the Dwarf Everlast, Oregano or Centaurea species.

Reproduction

The butterfly lays its eggs on arable fields on or in the vicinity of Field Pansies, and where available, also on the Wild Pansy. It lays on both adult violets and young cotyledons. On poorer soils, the Field Pansy also grows in legume-grass leys (in the sowing and the 1st production year) so that the Queen of Spain Fritillary can also reproduce here.
The species usually overwinters as a caterpillar in the litter layer on the ground. The butterflies then hatch in north-east Germany from the end of April and fly in several generations until the autumn. The butterfly's abundance reaches a peak in midsummer.

The upper sides of the butterfly's wings are brown with dark spots.





Common Blue

The Common Blue is one of our most common lycaenids. It has however largely disappeared from areas with intensive agricultural use. In organic agriculture it still usually finds favourable living conditions.
You as a farmer can, with simple measures, make a significant contribution to help this pretty butterfly feel at home here and be able to reproduce sufficiently.

Where is special protection worthwhile?

In perennial legume-grass leys during the 1st production year, especially in gappy stands with White clover, less in pure and dense stands of Red clover. In addition at field margins. The butterfly prefers sites with medium soil quality, south-facing slopes and borders of hedges exposed to sunshine.

	Measure in legume-grass leys	Main effects	Priority
M 5	Butterfly strips*	Preservation of nectar sources and deposited eggs after mowing	●●
M 3	High cut*	Conservation of deposited eggs	●
	Landscape elements		
M 15	Field margins on rich soils	Habitat and undisturbed reproduction	●●

* preferably in the 1st production year

The butterflies sometimes also gather on moist ruts on the fields

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs						■	■	■	■			
Caterpillars	■	■	■	■	■	■	■	■	■	■	■	■
Butterflies					■	■	■	■	■			

A9

The arrangement of spots on the underside of the wings is characteristic for the individual lycaenid species (left). Eggs are laid both on blossoms and leaves.

Population trend
local ↘

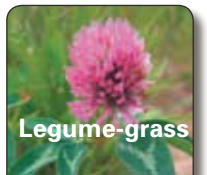
Threat
Germany *
North-east Germany *

Way of life

The Common Blue is a real all-rounder. It can be found in all habitats from damp grassland to dry grassland in which suitable food plants for the caterpillars can be found, and where the vegetation is not too dense.
It lays its eggs however exclusively on the leaves and flowers of leguminosae, in legume-grass leys on White clover, Lucerne, Red clover and Black medic. In other habitats for example, the Bird's-foot Trefoil (Lotus corniculatus) is very popular. The butterflies are not however choosy about which blossoms to visit: In addition to oviposition plants, they also fly for example to Centaurea, Oregano or Thyme as a source of nectar.

Life cycle

There are normally two generations of Common Blue per year in north-east Germany (flying in May/June and in August/September). The summer generation is much more numerous and peaks in August. The caterpillars of this second generation overwinter in the litter layer on the ground. Successful reproduction is therefore only possible in places where there is no soil tillage from August to May when the new butterflies hatch. Conservation measures in legume-grass leys should therefore preferably be carried out in perennial cultivation and in the first production year. If there is reploughing, the caterpillars of the summer generation are lost.



Grasshoppers

A number of species of saltatoria, which externally appear quite similar at first sight, are designated as grasshoppers. With a little practice however, they can be easily distinguished by their song. The following are widespread in the agricultural landscape in north-east Germany: Lesser Field Grasshopper, Common Field Grasshopper, Bow-winged Grasshopper, Upland Field Grasshopper (A 11), Meadow Grasshopper, Steppe Grasshopper and Lesser Marsh Grasshopper.
Grasshoppers live mainly in grassland, on field margins and set-asides as well as in legume-grass leys. From there however, some species also migrate every year into the cereals and after harvesting onto the stubble.

Where is special protection worthwhile?

In perennial legume-grass leys and on field margins. Grasshoppers prefer poor to medium soils as well as south-facing slopes and hilltops.

Measure in legume-grass leys		Main effects	Priority
M 4	Bird strips*	Refuge area after mowing	●●
M 5	Butterfly strips*		●●
M 3	High cut	Protection of the grasshopper and its larvae and eggs	●

Landscape elements			
M 15	Field margins on rich soils	Habitat, undisturbed reproduction and refuge area; biotope connectivity	●●
M 16	Field margins on dry poor soils		●●
M 18	Buffer strips around water bodies		●

* only in the 1st production year

Grasshoppers go through a series of larval stages or instars between moults before reaching maturity.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Larvae	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasshoppers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A 10

The Lesser Field Grasshopper is one of the most common grasshoppers in dry country in north-east Germany.

Population trend
Some species ↘

Threat

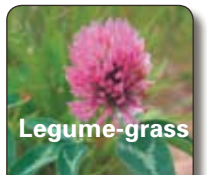
Germany	*/NT
Brandenburg	*
Mecklenburg-W.P.	*/3
Saxony-Anhalt	*

Way of life and abundance

The individual grasshopper species have different requirements concerning the density and height of vegetation as well as the dampness of the habitat. Many feel especially comfortable in dry sparsely covered locations with a lot of sunlight, others in turn, such as the Water-meadow Grasshopper, are regular wetland specialists.
The density of individuals in high quality habitats is between 1 and 10 grasshoppers per square metre.
The Lesser Field Grasshopper and the Steppe Grasshopper are declining in the west and south of Germany and are on the Red List in many states there. The Steppe Grasshopper is also threatened in Mecklenburg-Western Pomerania.

Reproduction

Most grasshopper species lay their eggs in the ground; the Steppe Grasshopper and Lesser Marsh Grasshopper however lay their eggs at the base of grasses. The sensitivity of the eggs to dehydration is species-specific. It determines which habitats the grasshoppers can settle in. Species which are found in dry warm habitats with short vegetation, accordingly have good dehydration protection.
Whereas the adult animals die in the autumn, the eggs laid in the summer overwinter in or on the ground. Successful reproduction is therefore only possible in places where there has been no soil tillage during the egg and larva phase.



Upland Field Grasshopper

The small Upland Field Grasshopper is one of the few saltatoria to have its centre of occurrence in Germany in arable landscapes and not in grassland. It prefers unmown, sunny field margins and fallow land. The grasshopper betrays its presence through its song: Although very quiet, it is very distinctive and sounds like a steam locomotive. And for this reason the species is also called "Locomotiefje" in Dutch!

Where is special protection worthwhile?

Along the field margins and in legume-grass leys on sandy soils. Legume-grass is particularly interesting for measures if nearby field margins make the settlement of the field easier.

Preservation of the habitats

The basic prerequisite for the long-term survival of the Upland Field Grasshopper is the preservation of unmown or only rarely mown margins at the edges of fields. Medium sites on sandy soils are ideal. What is more important than the width of the field margins is that the boundary line is as long as possible and that the habitats are connected.

	Measure	Main effects	Priority
	in legume-grass leys		
M 4	Bird strips*	Refuge area after mowing	●
M 5	Butterfly strips*		●
	in grain crops		
M 13	Small-scale set-aside	Habitat, undisturbed reproduction	●
	Landscape elements		
M 16	Field margins on dry poor soils	Habitat; undisturbed reproduction and refuge area;	●●
	Narrow field margins**	connectivity of habitats	●●

* only in the 1st production year

** see p. 81

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Larvae	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasshoppers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A 11

The Upland Field Grasshopper feeds primarily on grasses.

Population trend ↘

Threat

Germany	NT
North-east Germany	*

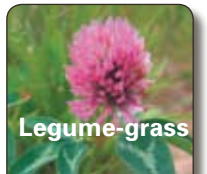
The Upland Field Grasshopper prefers a continental climate. That is why the species is becoming rarer from the north-east to the south-west.

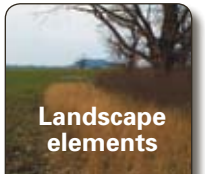
Habitat

The Upland Field Grasshopper prefers soils without vegetation alongside soils with taller but not too dense vegetation. The boundary line between the field margin and the field or the field margin and country lanes is therefore ideal for the grasshopper. The saltatoria then also migrate from the field margins to fallow land, legume-grass leys, stubble fields and into the peripheral areas of cereal fields rich in herbs.
Field margins which are frequently used for driving tend to remain unsettled.

Reproduction

The females lay their eggs in the course of the summer in the ground at locations without vegetation. They often use the burrows of ants or small mammals as the soil is very loose there and warms easily. While the eggs overwinter in the ground, the adults die in the autumn. Successful reproduction is not possible on arable fields with soil tillage as the clutches are destroyed during tillage.





Roesel's Bush-Cricket

The monotonous buzzing "song" of Roesel's Bush-Cricket is as much a part of a summer meadow flickering in the heat as a bottle of cool water in a picnic basket. Everybody has probably heard this sound even if they have perhaps not consciously perceived it. The cricket produces its characteristic buzzing by rubbing both its front wings, which are covered with small tooth-shaped pegs, together very fast. The Bush Cricket's 'ears' are in its front legs by the way. Roesel's Bush-Cricket requires long, but not too dense vegetation. It prefers sparser areas in legume-grass leys with a higher proportion of grasses. However it is found most frequently in dry meadows and field margins. After mowing, the Bush-Cricket leaves the legume-grass – unless it is offered a refuge area there in the form of unmown strips.

Where is special protection worthwhile?

In legume-grass leys and along the field margins. The species is only rarely found in pure clover or lucerne stands. Roesel's Bush-Cricket prefers medium soils. On very poor soils the vegetation is too low, on productive soils too dense.

	Measure in legume-grass leys	Main effects	Priority
M 4	Bird strips*	Refuge area after mowing	●●
M 5	Butterfly strips*		●●
	Landscape elements		
M 15	Field margins on rich soils	Habitat, undisturbed reproduction and refuge area; biotope connectivity	●●

* only in the 1st production year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eggs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Larvae	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grasshoppers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A 12

Population trend →

Threat

Germany	*
North-east Germany	*

Roesel's Bush-Cricket is one of the bush-crickets, which differ from the field grasshoppers due to their long antennae. The light stripe around the pronotum is characteristic.

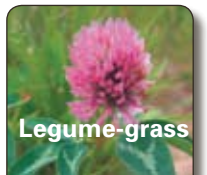
Way of life and abundance

Roesel's Bush-Cricket is a very mobile species – although most of the individuals only have short wings and cannot fly. Under certain environmental conditions, for example when the population density is high, animals capable of flight emerge with fully developed wings. Roesel's Bush-Cricket feeds on grasses and small insects.

The density of individuals is, as for other large grasshoppers, considerably lower than for the smaller grasshoppers (A 10, A 11), in legume-grass leys usually less than 1 individual per 100 m². Legume-grass is nevertheless a significant habitat because of its high proportion of land in organic agriculture.

Reproduction

Roesel's Bush-Cricket lays its eggs at the base of plant stalks in the summer; its eggs overwinter there. Eggs laid in late summer however do not develop until the next year but one, which is determined by the lengths of the days. The adult animals die in the autumn. Successful reproduction is not possible in cereals due to tillage operations.



Forking Larkspur

Night-flowering Catchfly
Dwarf Spurge

The original home of the Forking Larkspur, like that of many segetal flora species, lies in the eastern Mediterranean and in the Middle East. As a cultural companion, the species settles in sparse cereal crops on calcareous or base-rich soils. The Larkspur represents many other often vulnerable species with similar site requirements. These plants disappear when fertilizers and herbicides are used intensively, but also under set-aside. In north-east Germany, the Larkspur is still usually widespread in organic agriculture. The Larkspur can be supported with a low crop density, which also creates good prerequisites for many other threatened segetal flora species.

Where is special protection worthwhile?

In winter cereals on base-rich areas. The effects of drilling gaps (M 8) or reduced sowing density (M 9) are especially positive on productive soils with a high crop density.

Suitable measures

The following measures can be implemented on the entire field or small-scale on suitable sub-areas.

	Measure in grain crops	Main effects	Priority
M 7	No harrowing	No losses due to harrowing	●●
M 8	Drilling gaps	50 to more than 100 % increase in blossoms and fruit	●●
M 10	Delayed stubble breaking*	ripening of fruit on the stubble	●●
M 9	Reduced sowing density	50 to more than 100 % increase in blossoms and fruit	●

* Important for the Dwarf Spurge and the Night-flowering Catchfly, two vulnerable companions of the Larkspur. A large part of the fruit of the Larkspur ripens before the cereal harvest.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Young plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fruit maturity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

On favourable soils, the Larkspur develops strong plants with a lot of blossoms.

A 13

Population trend ↘

Threat	
Germany	3
Brandenburg	3
Mecklenburg-W.P.	3
Saxony-Anhalt	*

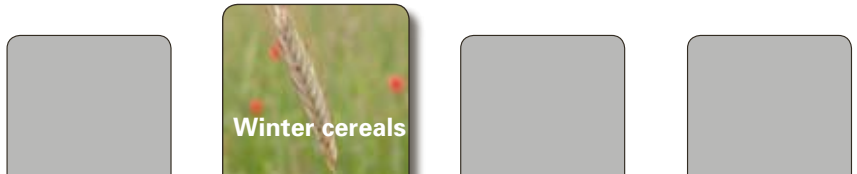
Biology and companion plant species

The Larkspur is a member of the family of the ranunculaceae, and is for example related to the Field Nigella (A 15). Characteristic of both species are the pinnately dissected leaves.
In north-east Germany the Forking Larkspur populates a wide spectrum of base-rich soils. It grows there equally as well on deep, loamy soils as on dry, calcareous hilltops or on base-rich sandy soils. A regular and likewise vulnerable companion is the Night-flowering Catchfly. The Corn Poppy is conspicuous on nutritious, not too dry sites. A typical plant on dry sparsely covered hilltops on the other hand is the endangered Dwarf Spurge.

Influence of the use of fertilizers

As long as the crop does not block out too much light, the Larkspur reacts positively to the use of fertilizers. The species therefore grows especially well in drilling gaps on rich soils.

The Night-flowering Catchfly (above) and the inconspicuous Dwarf Spurge are companions of the Larkspur.



Field Madder

Corn Buttercup
Dark Speedwell

The Field Madder is non-competitive and thus profits greatly from low crop density. Under favourable conditions, the plant can form regular mats on the stubble. The Field Madder is an indicator of loamy soils with good water holding capacity, upon which other extremely rare species also grow. Such as the Corn Buttercup for example, which is critically endangered in north-east Germany today. It is hard to believe that this plant was once one of the worst weeds in England.

Where is special protection worthwhile?

In all winter and spring crops. In north-east Germany, the Field Madder prefers loamy, base-rich soils with good water holding capacity.

Suitable measures

The following measures can be implemented on the entire field or small-scale on suitable sub-areas.

	Measure in grain crops	Main effects	Priority
M 7	No harrowing	No losses due to harrowing	●●
M 8	Drilling gaps	Less competition, better development opportunities	●●
M 10	Delayed stubble breaking	Ripening of fruit on the stubble	●●
M 9	Reduced sowing density	Less competition, better development opportunities	●

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Young plants	■	■	■	■					■	■	■	■
Flowering season				■	■	■	■	■	■	■		
Fruit maturity							■	■	■	■		

A 14

The pale pink blossoms of the low-growing Field Madder are unspectacular. The plant resembles the Goosegrass, except that it does not cling.

Population trend ↘

Threat

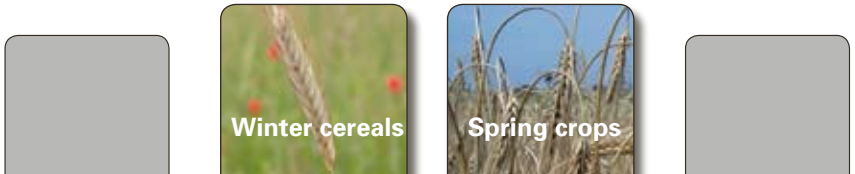
Germany	*
Brandenburg	2
Mecklenburg-W.P.	2
Saxony-Anhalt	3

Lifespan and Distribution

The seeds of the Field Madder seem to have only a short lifespan in the ground, so that the plant usually disappears quickly if there is no tillage. The species can also reproduce however in gappy legume-grass leys and is sometimes even spread with the legume-grass seeds.

Companion plant species

Frequent companions of the Field Madder for example are Perennial Sow-thistle, Spear Saltbush, Persian Speedwell and Sun Spurge. Among other companions under threat are the Dwarf Spurge and Forking Larkspur (A 13), as well as the Corn Buttercup and Dark Speedwell, which are critically endangered in north-east Germany.
The Dark Speedwell is in addition vulnerable throughout Europe. As north-east Germany represents a large part of its geographic range, protection of this species here is of great significance.



Field Nigella

Dwarf Spurge
Annual Woundwort

Field Nigella reaches its northernmost distribution boundary in north-east Germany. It has become very rare throughout Germany whereby the Oder area represents a centre of occurrence. The low level of precipitation and the rapidly warming soils meet its requirements well.

The species is notable only in its blooming period at the height of summer. The non-competitive plant is as a rule dependent upon soil management, which repeatedly creates open habitats. Field Nigella can only survive in very gappy dry grassland even without the farmer.

Where is special protection worthwhile?

In all winter and summer crops apart from root crops. Field Nigella is frequently found at the edges of fields, in contact with alkaline dry grassland. It also grows on dry hilltops where calcareous and/or alkaline soils have come to the surface through erosion.

Preservation of the habitats

The basic prerequisite for the long-term survival of Field Nigella is the extensive arable use of low yield sites.

Suitable measures

The following measure can be implemented on the entire field or small-scale on special low yield, alkaline sites.

	Measure in grain crops	Main effects	Priority
M 10	Delayed stubble breaking	Ripening of fruit on the stubble	●●

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Young plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fruit maturity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Where Field Nigella occurs, cereals usually only grow very sparsely.

A 15

Population trend ↘

Threat

Germany	2
Brandenburg	2
Mecklenburg-W.P.	1
Saxony-Anhalt	2

Development and related species

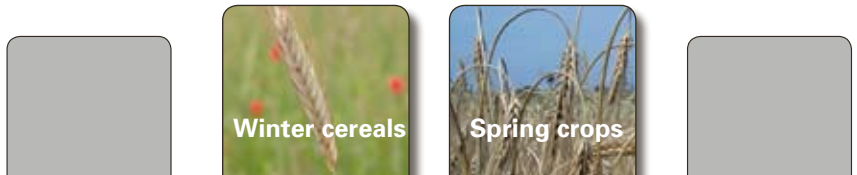
Field Nigella only germinates in the spring. The late-flowering plant does not fructify until August.

Two well-known and closely related species are the Nigella Damascena or "Love-in-a-Mist" and the Nigella Sativa. The seeds of the Nigella Sativa have been used in the Orient as a spice for more than 2000 years. The black cumin seed oil common in natural medicine is made from this species. Another related species for example is the Forking Larkspur (A 13).

The fruit of the Field Nigella is five-piece, here with a snail in aestivation.

Companion plant species

Other rare plant species grow along with the Field Nigella such as the Littlepod False Flax, Corn Gromwell, Larkspur, Annual Woundwort and Dwarf Spurge. The latter two species are also dependent upon delayed stubble breaking to form sufficient ripe fruits.



Prickly Poppy – community

Fingered Speedwell, Strict Forget-Me-Not

The Prickly Poppy is a small, rather inconspicuous species of poppy and prefers poorer sites than its larger brother, the widely spread Corn Poppy. It is eponymous for a community of plants with a distribution focus in north-east Germany. This Prickly Poppy-Segetal Flora community is particularly eye-catching in April with several early bloomers: The deep blue Fingered Speedwell, the white Thale Cress or the (also) white blossoming Spring Draba. They use the time when the crop plants are still low. The Prickly Poppy itself then blooms mainly in May. The Prickly Poppy-community hardly exists any longer in conventional agriculture due to the intensive use of fertilizers and widespread application of herbicides.

Where is special protection worthwhile?

In all winter cereals, because the characteristic species typically germinate in autumn. Suitable sites are sandy to slightly loamy, weakly acidic to weakly alkaline and relatively dry.

Suitable measures

The following measures can be implemented at suitable sites as a strip or on sub-areas of the field.

	Measure in grain crops	Main effects	Priority
M 7	No harrowing	No losses due to harrowing	●●
M 8	Drilling gaps*	Better development opportunities	●
M 9	Reduced sowing density	Better development opportunities	●

* The plants of the Prickly Poppy-community usually find good development opportunities on medium to poor soils in organic agriculture. The measure is therefore only useful in vigorous crop stands.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Young plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fruit maturity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A 16

The Prickly Poppy is much smaller than the Corn Poppy.
The bristles on the elongated fruits are characteristic (below left).

Population trend ↘

Threat

Germany	2
Brandenburg	n. s.
Mecklenburg-W.P.	3
Saxony-Anhalt	3

Deep-blue flowers and palmately lobed upper leaves differentiate the Fingered Speedwell from other speedwell species.

Companion plant species

The arrival of spring is accompanied by the Fingered Speedwell, Spring Draba, Thale Cress, Strict Forget-Me-Not and the Ivy-leaved Speedwell. They are hardly to be seen by early summer; taller species such as Scentless Mayweed, Cornflower or Wind Bent Grass then dominate. The Parsley-Piert is typical for moderately moist locations. In more acidic areas, Annual Knawel and Sheep Sorrel are found. Weak alkaline sites on the other hand are characterised by the presence of the Forking Larkspur (A 13).

Lamb's Succory

Slender Parsley-Piert
Downy Hempnettle

In historical times Lamb's Succory was widespread on fields with nutrient-poor, dry sandy soils. Today it is vulnerable throughout Europe because low yield sites have either been set-aside or transformed into higher yield sites through the use of fertilizers and liming. A worldwide centre of occurrence of the species lies in north-east Germany, so that an important contribution can be made here to the preservation of this old crop companion.

Where is special protection worthwhile?

In all winter and summer crops. The species prefers little or unfertilized, acidic sandy soils with a pH value below 5. Extensive growths of Sheep Sorrel are usually noticeable at such sites during legume-grass cultivation and set-asides.

Preservation of the habitats

The basic prerequisite for the long-term survival of Lamb's Succory is the extensive arable farming of low yield sites.

Suitable measures

The following measures can be implemented on the entire field or small-scale on suitable sub-areas of the field.

	Measure in grain crops	Main effects	Priority
M 7	No harrowing	No losses due to harrowing	●●
M 12	Reduced use of fertilizers and liming	Preservation of favourable site conditions and sparse crop cover	●●
M 10	Delayed stubble breaking*	Ripening of fruit	●

* Above all important in areas with a more continental climate. For under such conditions, the species does not germinate until spring, and fructification continues into late summer.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Young plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fruit maturity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

A 17

Gappy crop stands are characteristic for sites with Lamb's Succory.

Population trend ↘

Threat

Germany	2
North-east Germany	2

The similar-looking Cat's-ear differs from Lamb's Succory through the long hairs on its fruits.

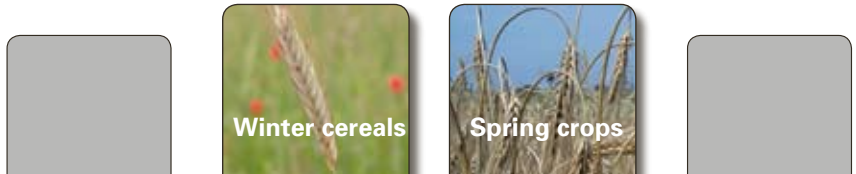
Biology

Lamb's Succory belongs to the Compositae family. It is relatively frost-susceptible, meaning that plants germinated in autumn only survive mild winters. Under an Atlantic climate the species mainly germinates in the autumn, under a more continental climate on the other hand, primarily in spring.

The plants can definitely benefit from moderate amounts of fertilizer and develop more fruits, however only as long as they are not suppressed by the crop.

Companion plant species

Species frequently found on Lamb's Succory sites are Sheep Sorrel, Corn Spurrey, Annual Knawel, Little White Bird's-foot, Slender Parsley-Piert, Common Cat's-ear and the grasses Finger grass, Bristle grass and Annual Vernalgrass. The rare Downy Hempnettle is also found in the west of north-east Germany.



Other relevant species

Partridge

Threat

Germany	2
North-east Germany	2

Partridge

The partridge is a typical inhabitant of richly structured agricultural landscapes with a variety of crops (arable fields, grassland) and landscape elements such as field margins, country lanes, hedges, embankments, small fallow areas or "waste land". Areas with large-scale agriculture, as is typical in north-east Germany today, only have a low partridge population. This is because partridges, which are territorial in the breeding season, see each other and react aggressively towards each other, and also without sufficient coverage available, many partridges fall prey to their enemies. Alongside the preservation of remaining landscape elements, the partridge can be helped above all by the planting of hedges (p. 81) and copses and the establishment of field margins (M 15, M 16). In principle it also benefits however from all agronomic measures undertaken in grain crops that promote a wealth of insects and foster crop stands, which are easy for partridge chicks to run through (M 7 to M 9).

Lapwing

Threat

Germany	2
North-east Germany	2

The Lapwing breeds in the spring on barren sites with high ground water level. It builds its nest mainly on short (moist) grassland, on arable fields (above all maize, spring cereals, fallow land) as well as beside field wet-spots or small water bodies. Most young birds hatch in May. The Lapwings travel where possible with their young into neighbouring meadows and pastures in the search for food. Food is looked for on the ground and consists mainly of invertebrates (earthworms, insects). In order to stabilize the population of the Lapwing and thereby also other meadow breeding species, the decisive measure is the large-scale rewetting of grassland in connection with no use before the end of June and keeping high water levels. In arable landscapes with little grassland, the preservation of field wet-spots (p. 80) and kettle holes and their water catchment areas is of great importance.

Quail

Threat

Germany	*
Brandenburg	2
Mecklenburg-W.P.	*
Saxony-Anhalt	*

Quail

Up until the middle of the 20th century, the Quail was a "mass bird" in arable landscapes; but a dramatic collapse in the population began with the intensification of agriculture. Reliable information on the population trend of the Quail is however difficult to come by, as large-area migrations are normal for this species throughout the entire breeding season. As a migratory bird, the Quail begins courtship in north-east Germany at the end of April at the earliest, the number of calling males reaches a maximum in June. The birds preferably settle perennial fallow land on poor soils, spring cereals and legume-grass leys. On cultivated arable land, the species benefits from many of the measures described in this manual (above all M 1 to M 10). Moreover a large proportion of set-aside arable land is beneficial for the Quail (providing there is no mowing there during the breeding season from May to August).

Montagu's Harrier

Threat

Germany	2
North-east Germany	1

As a ground-breeding bird, the Montagu's Harrier prefers large, unused meadows to nest in, with a vegetation height by May of more than 40 cm already. The original habitat of this bird of prey has however been destroyed throughout Western Europe through the widespread destruction of large-scale moors and humid meadows. As the natural breeding sites are missing, the Harriers today settle mainly in lucerne and winter cereals. The most important protective measure is the extremely time-consuming search for breeding sites on fields and the establishment of a protection zone (50×50 m) around the nests, which is given a wide berth during the mowing and/or harvest, until the young birds fly off in July. In several federal states (e.g. Brandenburg, Lower Saxony, Schleswig-Holstein, North Rhine-Westphalia) the farmer is granted appropriate financial remuneration for leaving out the nest protection zones.

Threat

Germany	2
North-east Germany	1

Habitats Directive
Annex IV

European Hamster

European Hamsters dig their burrows primarily in deep loam and loess soils. They can however also be found on poorer soils such as the diluvial soils in Brandenburg formed by the Ice Age. The European Hamster withdraws into its burrow in October at the latest to hibernate. Today's fast, large-scale, low-loss harvest as well as the stubble breaking which often follows directly afterwards hardly leave the European Hamster enough time to gain in weight before hibernation and to gather a winter stockpile. Measures which help it to successfully overwinter therefore help the Hamster most of all: These include shallow or non-inverting tillage (M 11), delayed stubble breaking (if possible not before mid-October; p. 80, M 10) and the establishment of non-harvested cereal strips (p. 80), blossom strips (M 14) or bird and/or butterfly strips (M 4, M 5). In several federal states (for example Saxony-Anhalt, North Rhine-Westphalia, Hesse), financial support for "hamster-friendly cultivation" is provided through special agri-environmental programmes.

Threat

Germany	NT
Brandenburg	NT

Brown Argus

Brown Argus

The Brown Argus achieves its highest population in north-east Germany on long-term set-asides of dry sandy soils. But the species is also frequently found on poor blossom-rich field margins. This also applies to the even more numerous Sooty Copper that lives moreover in humid meadows. The first generation adult Brown Argus is present from mid-May to mid-June, the second generation from mid-July to August. Its caterpillars in north-east Germany live on Cranesbills and Storksbills, the Sooty Copper's caterpillars on Sorrel. They overwinter on the ground. Both butterfly species are best supported in agricultural areas through field margin establishments on poor soils (M 16) or long-term set-aside on poor, dry sandy soils.

Field Gagea and Meadow Gagea

The Field Gagea and the Meadow Gagea belong to the lily family and are related to tulips. They sprout from their bulbs early in the year and can thereby optimally exploit the periods of light and water before the main development of the vegetation. The striking yellow blossoms can be seen in March and April. In the summer and winter the plants, with their newly formed daughter bulbs, survive buried in the ground. Both species were once widespread on fields, today they are almost only found on churchyards and cemeteries, in old parks and in grass margins along lanes. During ploughing, the overwintering bulbs are buried too deeply in the ground. For the preservation of these beautiful plants, it is necessary that ploughing is shallow.

Threat
Field Gagea

Germany	3
Brandenburg	3
Mecklenburg-W.P.	3
Saxony-Anhalt	*

Marsh and aquatic plants on arable fields

The many non-draining hollows and overflowing kettle holes, in which the water gathers in winter in years with high precipitation, are a special feature of north-east Germany. Many plant and animal species are specialized on these only occasionally emerging habitats. These include very rare aquatic plants as well as representatives of the so-called "dwarf plant communities" who do not appear until the wet-spots start to dry up in late spring or summer. Several species are in sharp decline and vulnerable throughout Europe, such as for example, the "Sand Rush" *Juncus tenageia and Elatine alsinastrum*. The most important measure for the protection of these endangered species is the preservation of the habitats, i.e. neither draining nor filling them in (p. 80). Delayed stubble breaking (M 10) retains its importance for late-fructifying species. Other than that, customary soil management should be carried out including primary soil tillage. Without agronomic use, fast-growing, dense vegetation soon arrives, and the species named are displaced. The Lapwing and amphibians such as the Common Spadefoot Toad or the Fire-bellied Toad also benefit from the measures described here (A 6, A 7).

Threat
Elatine alsinastrum

Germany	2
Brandenburg	2
Mecklenburg-W.P.	1
Saxony-Anhaltt	1

Elatine alsinastrum at a field wet-spot in north-east Brandenburg

Long-term Nature Conservation: The nature conservation plan for the whole farm

Each of the measures presented that you use on one of your fields has a positive effect on biodiversity and leads to management which is friendlier to nature conservation. The profiles provide information about which conditions – relating to the individual fields – have to be fulfilled to ensure the measures are successful. How can the whole farm however, be correctly assessed from a nature conservation viewpoint, and which opportunities arise from this for the long-term development of the farm while doing justice to nature conservation.

A nature conservation plan is especially suitable for farms which

- want to do more than simply participate in individual measures,
- want to include 10% or more of their arable land in a nature conservation concept,
- want to determine the nature conservation potential for their entire farm,
- need a basis for decision-making for their engagement in nature conservation.

It is worthwhile to begin considering measures suitable for the whole farm and to integrate them at best step-by-step into farming procedures on the basis of a detailed nature conservation plan.

How much time is required for the preparation of a nature conservation plan?

Various possibilities are presented below of how a nature conservation plan can be drawn up for the whole farm. The first time you occupy yourself with this, you should allow 2 to 3 hours in order to familiarise yourself with the fundamental elements. With this knowledge, a nature conservation plan can be generated – either independently or with the aid of an adviser. The preparation can be completed in a few working days. The plan is then also usable in subsequent years. If changes are necessary or desired later, the time required is slight.

What does the nature conservation plan consist of?

What is important is that the measures are specifically selected and located at suitable sites. This is because many of the measures achieve the greatest success for the species being promoted on sites where the animals or plants are very common or the prevailing living conditions are particularly good for them. The scope of measures to be aimed at for the whole farm is a target figure of 10 to 30% of upgraded arable land.

The nature conservation plan consists of five elements:

The Nature Conservation Field List: Notes are made for each field as to which animal and plant species the field is particularly well suited as a habitat, or whether a field is less suitable. From this, 'maps of biotic potential' can be drawn up in which fields are marked which are particularly suitable for specific measures.

Hot Spot map: Includes all the special locations (= 'Hot Spots') which have special significance for nature conservation. These could be unused 'biotopes', but also field locations with special soil properties, for example.

LE map: Includes existing (and where appropriate, planned) landscape elements such as field margins, water bodies or hedges.

Optimised crop rotation: The proportions of the individual crop species and their spatial distribution (corresponding to M 19 and M 20) are included in the planning.

List of measures: A selection of measures that is adapted to both farm and regional conditions.

From the plan it can be seen

- which animal and plant species are to be supported,
- where on the farm this should happen and with which measures,
- what opportunities (and challenges) exist on the level of landscape elements and biotope connectivity,
- which measures are most suitable for the farm.

In this way a plan of measures can be derived to suit the specific farm for a particular year or for a particular time period. The individual steps of the nature conservation plan are explained in more detail below.

The Nature Conservation Field List: Which species can I support and where?

The Nature Conservation Field List offers an aid to decision-making on the question of which of the species presented in the manual should be supported on which fields on a farm.

As a first step, the available information concerning the typical animals and plants on the farm area or those in need of special protection should be ascertained, for example because scientific investigations have been carried out in the area. The occurrence of rare species is often known by the regional nature experts, it is worthwhile inquiring or collaborating with nature conservation associations, nature conservation authorities or local landscape conservation associations. Farms within large nature reserves can moreover find out from the authorities whether area-specific conservation goals exist. If farm areas lie within the Natura 2000 network, certain species or habitats must normally be respected.

How can I prepare the Nature Conservation Field List and Biotic Potential Map myself?

The next step is to evaluate the suitability of each field as a habitat for the species presented in the manual. The results can be recorded in a list (Nature Conservation Field List) or in a map (Biotic Potential Map). Even if there is no concrete information available about the existing species, the farmer or his adviser can make this assessment himself with the aid of Table 1 on the basis of the field characteristics of 'Soil rating index', 'Relief' and 'Configuration with landscape elements'.

Table 1

Chart for the evaluation of the potential habitat suitability of fields

	Skylark	Corn Bunting	Yellow Wagtail	Whinchat	Red-backed Shrike, Barred Warbler	Brown Hare	Fire-bellied Toad, European Tree Frog	Common Spadefoot Toad	Butterflies, Saltatoria	Segetal Flora
Soil rating index										
<30	●	●	●	●	●			●		●
31–45	●	●	●	●	●			●		
46–60	●	●						●		
Relief										
With hilltops						●				●
Landscape elements										
Water bodies, wet-spots							●	●		●
Dry grassland									●	●
Fallow land, waste land		●	●	●	●	●		●	●	
Field margins		●	●	●	●	●			●	
Forest, edge of forest	●	●	●	●		●	●		● *	
Hedges, copses		●	●	●	●	●	●		● *	
Roads					●	●	●	●	●	

● required
● positive
● negative
* south-exposed
no entry = no effect

A field is 'suitable', if it has at least one 'positive' orange characteristic. Where a green 'required' characteristic is also shown for a species, this is a requirement for suitability. **A field is 'unsuitable',** if it has a 'negative' red characteristic. In all other cases, **a field has 'low to medium suitability'.**

For the documentation in the Field List (Table 2), it suffices to label fields by species or species group as

+	(suitable)
–	(unsuitable)
no entry	(low to medium suitability).

Table 2
Nature Conservation Field List for the Ökodorf Brodowin GmbH & Co.KG biodynamic farm (excerpt)

No.	Field designation	Skylark	Corn Bunting	Yellow Wagtail	Whinchat	Red-backed Shrike, Barred Warbler	Brown Hare	Fire-bellied Toad, European Tree Frog	Common Spadefoot Toad	Butterflies, Saltatoria	Segetal Flora
1	Rummelsberg	+	+	+	–	–	–	–	–	+	+
2	Dreschberg	+	+	+	+	+	+	+	+		+
3	Judenfriedhof	–	–	–	–	+	+	+	+	+	
4	Zaunlinks		–	–	–	+	+	+	+	+	+
5	Marktberg	–	–	–	–	+	+	–	–	+	+
6	Kirchenland	+	+	+	+	+	+	+	+	+	+
7	Herford	+	+	+	–	+	+	–	–	+	
8	Dahms	+	+	+	–	+	+	+	+	+	+
9	Wacholderberg	–	–	–	–	+	+	–	–	+	+
10	Trompeterberg	–	–	–	–	+	+	+	–	+	+

As an alternative or supplement to the Nature Conservation Field List the results can also be marked on a map in different colours. This provides you with a 'Biotic Potential Map'.

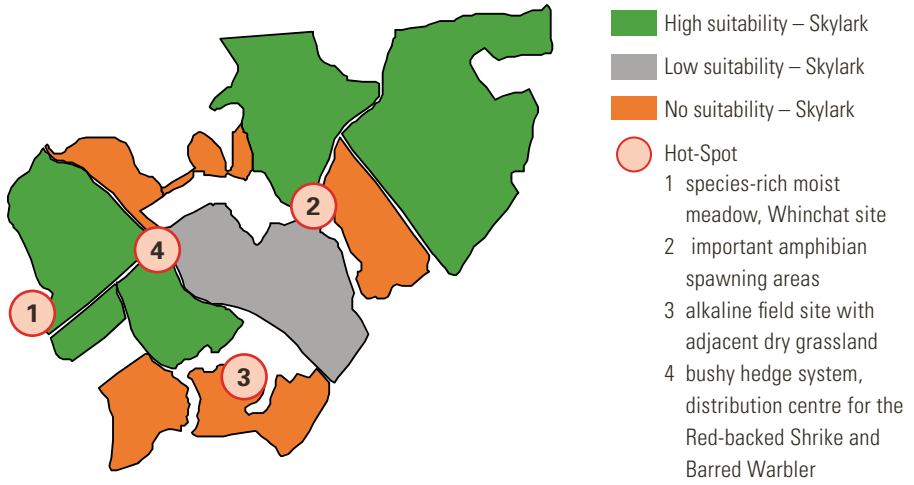
Taking the example of farmland birds, Map 1 shows how the information from Table 1 and/or from the Nature Conservation Field List can be converted into a 'Biotic Potential Map' for the 'Skylark'. If a farm has a number of "good Skylark fields" such as in Map 1 and wants to support the species, it is sensible to carry out measures primarily on the fields which are particularly suitable.

The Hot Spot map: Where are particularly valuable sites or species?

Hot Spots are defined within the scope of the manual as special sites of major significance for nature conservation. Among the segetal flora, there is a series of specialists with very particular soil requirements, which are only met on a small-scale on a few fields on a farm. Or the farm has an area that has remained unused for many years for example, which represents an undisturbed reproduction habitat for the farm's Whinchat population.

If no concrete information is available potential Hot Spots can be deduced from the site information ('Where

Map 1
Biotic Potential Map and Hot Spots of the Ökodorf Brodowin GmbH & Co.KG biodynamic farm (extract)



is special protection worthwhile?') in the profiles of the species. The farm should not make any changes or eliminate such extremely valuable sites if possible without consulting specialists. Several Hot Spots belonging to the Ökodorf Brodowin GmbH & Co.KG biodynamic farm (red circles 1 to 4) are marked in Map 1.

The LE Map: Preserve, establish, connect landscape elements

All of the larger landscape elements on the farm (primarily water bodies, woody structures, field margins and fallow land) are marked on the LE Map. With the aid of this map, the quantity and distribution of landscape elements can be seen at a glance. Thus for example, extremely isolated landscape elements or certain sub-areas of the farm (e.g. cleared or hedge-dominated areas) can be identified. The optimisation of the farm network of landscape elements can be well planned: The following can be marked or indicated, for example

– hedges, which require medium-term maintenance
– amphibian water bodies, which require a buffer strip
– landscape elements which need to be established.

The implementation of the relevant measures can then follow in the long-term and step-by-step. The target figure

for the whole farm is a proportion of landscape elements of at least 5% of the farm area, ideal would be 10 to 15% (see p. 35). From a nature conservation viewpoint, it is particularly effective to promote landscape elements primarily in those sub-areas of the farm where a relatively large number of elements is already available. In doing so, the focus should be on wood-free landscape elements such as field margins and fallow land in order to preserve the open character of the north-east German landscapes. To reduce erosion for example, it can also be useful in individual cases however to initially provide large, unprotected fields with suitable landscape elements.

Planning crop rotation from a nature conservation viewpoint

The share of cultivated crop species in the crop rotation, the size of the fields and the spatial distribution of the crop species on the farm area are subject to longer-term farm planning. If a farm commits itself to the protection of farmland and hedgerow birds, Brown Hare or amphibians, then crop rotation planning for the whole farm also needs to take the habitat requirements of these animal groups into consideration (see M 19 and M 20).

List of farm measures:
Which measures suit my farm?

According to the type of farm, site conditions or the desires of the farm manager, only a selection of the proposed measures come into question. Particular weather conditions can moreover necessitate short-term changes to the planning of measures.

Therefore it is sensible to draw up a list of measures which can be realistically implemented on the farm. Aids for decision-making are provided through the detailed information in the profiles of the measures. Alternatively, using Table 3, an individual selection can be made on the basis of the effort required by the farm and the losses to be expected. It must be noted that the estimates of effort and yield losses for M 1 to M 6 as well as for M 15 and M 18 are based on dairy farms.

Table 3
Effort and yield losses in small and/or large-scale implementation of measures

	Measure	Large-scale		Small-scale	
		Effort	Loss	Effort	Loss
M 1	Later 1st cut	●●	●●●		
M 2	Later 2nd cut	●●	●●●		
M 3	High cut	●●	●●	●●	●
M 4	Bird strips	●	●●	●	●
M 5	Butterfly strips			●	●
M 6	Amphibian strips			●●	●
M 7	No harrowing	●	●●	●	●
M 8	Drilling gaps	●●	●●	●	●
M 9	Reduced sowing density	●●	●●●	●	●●
M 10	Delayed stubble breaking	●	●●	●	●
M 11	Grubbing instead of ploughing	●	●●	●	●
M 12	Reduced use of fertilizers and liming			●	●
M 13	Small-scale set-aside			●	●
M 14	Blossom strips	●●	●●●	●●	●●
M 15	Field margins on rich soils			●●	●●
M 16	Field margins on dry poor soils		●	●	
M 17	Wood maintenance and management			●●	●●
M 18	Buffer strips around water bodies			●●	●
M 19	More spring crops	●●	●●		
M 20	Better distribution of crop species	●●	●●		

Effort ● low ●● medium to high
Yields loss / costs ● low ●● medium ●●● high
No entry = variant not planned

What first?
Implement priority measures first

The scope of the desirable nature conservation measures will always be limited by economic and organisational constraints. Several measures usually come into question for the protection of a species group, from which the most efficient can be selected with the help of Table 4. Measures with a very high priority achieve the comparatively greatest success for the species concerned. For the sector of landscape elements the following applies: The preservation, maintenance and connectivity of existing elements have precedence over new establishments.

Table 4

Assessment of the measures according to their priority for the species groups presented in the manual

	Measure	Farmland birds	Hedgerow birds	Brown Hare	Amphibians	Butterflies	Saltatoria	Segetal Flora
M 1	Later 1st cut	●						
M 2	Later 2nd cut	●		●	●			
M 3	High cut	●		●	●			
M 4	Bird strips	●	●			●		
M 5	Butterfly strips					●	●	
M 6	Amphibian strips		●		●	●		
M 7	No harrowing	●		●				●
M 8	Drilling gaps	●		●				●
M 9	Reduced sowing density	●		●				
M 10	Delayed stubble breaking	●		●	●			●*
M 11	Grubbing instead of ploughing	●			●			
M 12	Reduced use of fertilizers and liming							●*
M 13	Small-scale set-aside	●*	●	●		●	●	●
M 14	Blossom strips	●*				●		●
M 15	Field margins on rich soils		●			●	●	
M 16	Field margins on dry poor soils		●			●	●	●
M 17	Wood maintenance and management		●		●	●		
M 18	Buffer strips around water bodies		●		●		●	●
M 19	More spring crops	●		●				●
M 20	Better distribution of crop species	●	●	●	●			

● very high priority
● high priority
● negative

* = for certain species
no entry = no priority

Recognising and solving conflicts of objectives from a nature conservation viewpoint

Table 4 also helps in the recognition of conflicting objectives between the requirements of different species. Measures which may negatively effect a certain species group, should not be implemented on sites which are favourable for the species, for example:

- *Segetal flora and the establishment of landscape elements*

Typical segetal flora is dependent upon soil management; these species disappear on perennial set-asides or permanent grassland. The establishment of set-asides (M 13), perennial blossom strips (M 14), field margins (M 15, 16) and buffer strips around water bodies (M 18) can therefore lead to conflicts with the protection of segetal flora, not least because field areas with poorer soil conditions are particularly suitable in each case. An analysis of the current status is required here: On sites where rare segetal flora are found, priority should be given to the continued arable use and conservation measures for the segetal flora.

- *Segetal flora and the optimisation of crop rotation*

Most of the vulnerable segetal flora species thrive particularly well or exclusively in winter cereals. For this reason, the proportion of spring crops should not exceed 50 %.

- *Amphibians and later 2nd cut in legume-grass leys*

Fire-bellied Toads, European Tree Frogs and other amphibian species live in and around small water bodies in spring and reproduce there. The young leave their water bodies from about the end of June and migrate across the arable fields. On legume-grass leys with an abundance of water bodies, conflicts of objectives can arise with the conservation of farmland birds and Brown Hare. For a late cut in the legume-grass leys would lead to great losses among the amphibians as the 2nd cut then falls during the migration period of the young animals. A later 2nd cut should therefore not be carried out in the area surrounding valuable amphibian spawning areas.

Site consistency of measures

Rare segetal flora are generally restricted in their occurrence to narrowly limited arable areas. These species therefore need to be continuously supported on the same field or field area. Site consistent (or permanent) measures also make sense for amphibians, saltatoria and butterflies. Farmland birds on the other hand are mobile across a wide area and are able to reselect the most suitable habitats on the farm every year. Here the locations of the measures can therefore be changed with the crop

rotation and be oriented towards the crops preferred by the species. This also applies to an extent to the Brown Hare.

Measurement of results: Have the targeted nature conservation goals been reached?

For the majority of the measures in this manual, extensive experience is available to indicate their effects on particular species, and the references to favourable conditions will aid the search for suitable locations for implementation.

In the same way as the farmer can optimise the crop rotation with the experience of several years with the soil and climatic conditions on his farm, it is also possible to learn from experience with nature conservation measures. For this it is sensible to investigate, at least on a case-by-case basis, every two to five years whether and/or to what extent goals have been reached. The method of measurement of such results will vary from farm to farm and depend upon the measures applied. On the basis of their knowledge, a number of farmers may be interested in carrying out this measurement of results themselves. There are already approaches to self-study and experience in practical application in Baden-Wuerttemberg within the framework of the MEKA II programme. It is however also possible that the farm's agricultural expert or nature conservation adviser can perform this task. Universities and technical colleges are often grateful for the opportunity to be able to carry out application-oriented research projects and dissertations. Farms within the Natura 2000 network or large nature reserves can possibly receive targeted assistance from the competent administrative bodies.

Explanation of important terms

Field margin	In the context of the manual: narrow (<1 m) up to 20 m wide strips of grasses and herbs without woody structures at the edge of a field directly beside a neighbouring biotope (e.g. bordering forest, lane or water body).
Landscape element (LE)	All punctiform or linear parts of the arable landscape that are not, or not regularly, managed. A distinction is made in the manual between permanent (usually already existing) and temporary LE which only exist for one or a few years. Permanent LE: e.g. hedges, woodland, rows of trees, embankments, field margins, fallow land, country lanes, kettle holes. Temporary LE: e.g. field wet-spots, blossom strips, one-year set-asides.
Outstanding structures	Trees or large bushes which protrude clearly above the remaining woody structures such as hedges, for example.
Grain crops	Cereals and grain legumes, which are harvested as grain crops; maize and silage from total crop plants are not included. Measures, such as blossom strips and small-scale set-aside, are listed in the manual with the grain crops as they are mainly implemented in these crops.
Legume-grass leys	Mixture of small legumes and grasses, for example lucerne-clover-grass.
Spring crops	Cereals, grain legumes and their mixtures which are sown in spring, as well as alternate wheat varieties suitable for autumn and spring sowing.
Winter cereals	In the context of the manual: only relates to the winter cereal species which are sown in the autumn.

Soil quality

Soil rating index (SRI) values relating to the site situation prevalent in north-east Germany

low	SRI < 30
medium	SRI 31-45
high	SRI 46-60

Red Lists (RL) and threat categories

The red lists provide information about the threatened status of individual species and thereby on the status of biological diversity. Population numbers, population trends, and where appropriate, special risk factors, determine the classification of the species. The following categories exist:

0 = extinct or presumed extinct (EX)
1 = critically endangered (CR)
2 = endangered (EN)
3 = vulnerable (VU)
* = least concern (LC)
NT = ("near threatened") species, whose populations have noticeably declined, but are not yet vulnerable

The Flora-Fauna-Habitat Directive (FFH) and Annexes

Council Directive 92/43 EEC of 21 May 1992 on the Conservation of natural habitats and of wild fauna and flora. Annexes I and II: Designation of the natural habitat types as well as the animal and plant species of community interest; Annex III: Criteria for selecting sites; Annexes IV to VI: Determination of special regulations for the protection of species.

The Birds Directive

Council Directive 79/409 EECof 2 April 1979 on the Conservation of wild birds.

Natura 2000

A Europe-wide ecological network of special protection areas. "Natura 2000" comprises the areas of community importance designated in the Habitats Directive as well as the special protection areas designated in the Birds Directive.

List of abbreviations

SRI	Soil Rating Index
BfN	German Federal Agency for Nature Conservation
DBH	Diameter at breast height
BMBF	Federal Ministry of Education and Research
DBU	German Environmental Foundation
dt	Decitonne
GJ	Gigajoule
ha	Hectare
kg	Kilogram
LE	Landscape element
MEKA	Market Relief and Cultivated Landscape Programme (Baden-Wuerttemberg)
MJ	Megajoule
NABU	Nature and Biodiversity Conservation Union Germany
NEL	Net Energy Lactation
NRW	North Rhein Westphalia
RL	Red List
DM	Dry Matter
Vol.	Volume

Species ABC

Sowing mixtures for blossom strips and field margins

Sowing mixtures are available for the seedings recommended in the manual (M 14, M 15, M 18), although these can differ greatly in species composition and price. What needs to be taken into consideration – apart from the price – are the site conditions, the planned usage, the duration of the measure and of course the requirements of the species to be supported. The planned long-term seedings (M 15, M 18) should be selected especially carefully and where appropriate a higher price also paid for an optimal mixture. A long-term stable species combination which is suited to the location is more useful (and more economic) for permanent seedings than an initial very high level of biodiversity. Optimal results can be achieved, if the sowing mixture is put together from individual species depending upon the sites to be seeded (for example, by nature conservation advisers, administrations or associations, there is also a lot of helpful information in Bosshard 2000).

With planned long-term seedings in particular, it is strongly recommended that seeds of designated regional origin are used, in order to avoid genetic "pollution" of the landscape (many wild plants have developed regional peculiarities and differ genetically from plants which hail from other areas of origin). To aid orientation for the consumer and quality assurance, certificates have recently been developed. You can find more information about them at www.natur-im-vww.de.

Blossom strips
M 14

- *Desired characteristics*

maximum coverage 70%, multi-level structural development with tall perennials, blossoms with nectar and pollen for insects, optically attractive blooms

- *Suitable plant species*

– crop plants: Borage and other spice plants, Sainfoin, White Mustard, all clover species, Lucerne, Mallow, Phacelia, Pot Marigold, Sunflower among others.
– Wild plants: Bird's-foot Trefoil, Corn Cockle, Parsnip, Yellow Sweet Clover, Wild Carrot among others.

- *Tips*

mix tall and low-growing as well as annual and perennial species (perennial plants with outstanding structures are important as hunting perches for farmland birds; do not use segetal flora species such as poppies or Cornflowers, unless seeds of regional origin are available. These and other species can emerge again after ploughing and crossbreed into the local segetal flora.

Field margins on rich soils
M 15

- *Desired characteristics*

rich in blossoms with high plant species diversity, near natural 1 to 2 cut meadow (False Oat Grass meadow, rich meadow, poor meadow)

- *Suitable plant species*

– herbs and legumes: Field Scabious, Smooth Hawkbit, Bird's-foot Trefoil, Lucerne, Oxeye Daisy, Red Clover, Sorrel, Common Yarrow, Ribwort Plantain, Yellow Goat's-beard, Meadow Knapweed, Spreading Bellflower, Upright Bedstraw, Rough Hawk's-beard among others.
– grasses: Downy Oat Grass, False Oat Grass, Creeping Red Fescue, Scented Vernalgrass, Common Meadow Grass, Meadow Lescue among others.
– additionally on alkaline dry soils: Black Medic, Origanum, Greater Knapweed, Meadow Clary among others.

- *Tips*

only use seeds of regional origin for wild plant flora. Max. 3% legumes (on nitrogen-poor sites up to 5%), keep proportion of competitive top grasses such as e.g. False Oat-Grass low.

Buffer strips around water bodies
M 18

- *Desired characteristics*

near natural 1 to 2 cut meadow (moist meadow, rich meadow)

- *Suitable plant species for moist sites*

– herbs and legumes: Cabbage Thistle, Ragged Robin, Oxeye Daisy, Yellow Meadow Vetchling, Sorrel, Tall Buttercup, Marsh Bird's-foot Trefoil, Meadow Knappweed, Cuckoo Flower among others.
– grasses: Downy Oat Grass, Crested Dog's-tail, Creeping Red Fescue, Scented Vernalgrass, Meadow Foxtail, Common Meadow Grass, Meadow Lescue among others.

- *Tips*

only use seeds of regional origin for wild plant flora, for sites with more dry to fresh soil conditions follow the recommendations for M 15, max. 3% legumes.

Addresses for seeds from north-east Germany

Here you can find seed mixtures for different locations and purposes, as well as a large selection of individual plant species as well as detailed instructions for sowing:

www.rieger-hofmann.de
Rieger-Hofmann GmbH
In den Wildblumen 7
74572 Blaufelden-Raboldshausen

www.saale-saaten.de
Matthias Stolle
Saalestrasse 5, 06118 Halle

www.wildsamen-insel.de
Wildsamen-Insel
Uta Kietsch Lindenallee 3,
17268 Temmen

www.saaten-zeller.de
Saaten Zeller
Erftalstr. 6, 63928 Riedern

www.natur-im-vww.de
Verband deutscher Wildsamen- und Wildpflanzenproduzenten e. V.

Further information on the subject of Nature Conservation in Organic Agriculture

www.bfn.de
Bundesamt für Naturschutz, Bonn

www.naturschutzhof.de
BfN-Projekt »Naturschutzfachliche Optimierung des großflächigen Ökolandbaus am Beispiel des Demeterbetriebes Ökodorf Brodowin«

www.brodowin.de
Landwirtschaftsbetrieb Brodowin GmbH & Co.KG im Biosphären-Reservat Schorfheide–Chorin

www.uni-kassel.de/hrz/db4/extern/frankenhausen
BfN-Projekt »Die Integration von Naturschutzzielen in den Ökologischen Landbau am Beispiel der Hessischen Staatsdomäne Frankenhausen«

www.gut-peetzig.de
Landwirtschaftsbetrieb Gut Peetzig im Biosphärenreservat

www.fibl.org
Forschungsinstitut für biologischen Landbau FiBL, Frick (Schweiz) und FiBL Deutschland e. V.

www.oel.fal.de
Institut für ökologischen Landbau, Trenthorst (Johann Heinrich von Thünen-Institut, Bundesforschungsinstitut Ländliche Räume, Wald und Fischerei [vTI])

www.naturschutzhoefe.org
Förderpreis Praktischer Naturschutz auf landwirtschaftlichen Betrieben

www.bluehende-landschaft.de
Netzwerk Blühende Landschaft

www.lpv.de
Deutscher Verband für Landschaftspflege e. V.

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