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Butterfly
CONSERVATION EUROPE

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Bending the curve

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Authors

Chris A.M. van Swaay[1,2], Reto Schmucki[3], Simona Bonelli[1,10], Nigel Bourn[1], Sue Collins[1], Sam Ellis[1], Anne Eskildsen[1,11], Richard Fox[4,5], Evrim Karacetin[1], Zdravko Kolev[1,6], Dirk Maes[1,12], Miguel Munguira[1,7], Lars B. Pettersson[1,8], David Roy[1,3,4], Martina Šašić[1,13], Josef Settele[1,14,15,16], Cristina G. Sevilleja[1,2,7], Constanti Stefanescu[1,17], Anu Tiitsaar[1,18], Rudi Verovnik[1,19], Albert Vliegenthart[1,2], Aidan Whitfield[1], Martin Wiemers[1,20], Irma Wynhoff[1,2], Martin Warren[1]

Affiliation

1. Butterfly Conservation Europe.
2. De Vlinderstichting/Dutch Butterfly Conservation, Wageningen, The Netherlands.
3. UK Centre for Ecology & Hydrology, Wallingford, UK.
4. Centre for Ecology and Conservation, University of Exeter, UK.
5. Butterfly Conservation, East Lulworth, Dorset, UK.
6. Bulgarian Butterfly Monitoring Scheme, National Museum of Natural History, Sofia, Bulgaria.
7. SOCEME - Society for the Conservation and Study of Butterflies in Spain, Spanish Butterfly Monitoring Scheme, Spain.
8. Swedish Butterfly Monitoring Scheme, Lund University, Lund, Sweden.
10. Italian Butterfly Monitoring Scheme, Zoolab Department of Life Sciences and Systems Biology, University of Turin, Italy.
11. Danish Butterfly Monitoring Scheme (Danmarks Dagsommerfugle), Aarhus, Denmark.
12. Flanders Butterfly Monitoring Scheme, Research Institute for Nature and Forest (INBO), Belgium.
13. Croatia Butterfly Monitoring Scheme, Croatian Natural History Museum, Croatia.
14. German Butterfly Monitoring Scheme, (Tagfalter-Monitoring Deutschland - TMD), Helmholtz-Centre for Environmental Research – UFZ, Germany.
15. Department of Conservation Biology and Social-Ecological Systems, Helmholtz Centre for Environmental Research - UFZ, Halle, Germany.
16. German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany.
17. Catalan Butterfly Monitoring Scheme, Natural Sciences Museum of Granollers, Spain.
18. Estonian Butterfly Monitoring Scheme, University of Tartu, Department of Zoology, Estonia.
19. Department of Biology, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia.
20. Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany

Citation

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Corresponding authors

Chris van Swaay <chris.vanswaay@vlinderstichting.nl> & Reto Schmucki <retoschm@ceh.ac.uk>

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Content

Executive Summary

1. Grassland is an important habitat for butterflies and many other pollinating insects. Over half of the 501 European butterflies use grasslands as one of their main habitats.

2. The **Grassland Butterfly Index** has been adopted by the EU as a key measure of progress towards the target of halting biodiversity loss, restoring nature in agro-ecosystems and reversing the decline in pollinators by 2030, but the **index has declined by almost 50% between 1990-2024**.

3. The main reasons for the decline of butterflies on grassland are habitat loss due to conversion to cropland, or habitat deterioration due to unsuitable management or abandonment. However, research has shown that **declines can be halted and reversed** in grasslands and arable landscapes, given the appropriate management.

4. Reversing the decline of butterflies and other insects in grassland habitats is a vital component to help meet the EU targets laid out in the **Pollinator Initiative**, the **Biodiversity Strategy 2030** and the **Nature Restoration Regulation**.

5. When a Member State chooses to use the Grassland Butterfly Index (GBI) as one of the three indicators under Article 11 of the Nature Restoration Regulation (NRR), it must within its Nature Restoration Plans '*put in place measures which shall aim to achieve an increasing trend at national level*'.

6. We outline how Member States can establish a monitoring programme to produce a high-quality GBI, including appropriate quality control and investment in a paid coordinator to build and maintain the monitoring network. This network of national coordinators underpins the strength and breadth of European Butterfly Monitoring Scheme (eBMS), while harmonised protocols and collaborative data synthesis offer a unique tool for measuring progress towards conservation and restoration targets.

7. Finally, this report gives information on how an **effective management approach can help to halt and reverse the decline of butterflies**, both on grasslands and arable land (where several species live), and thereby 'Bend the Curve' of the GBI in a positive direction.

8. We make the following general recommendations to benefit butterflies:
   - Manage at the landscape scale
   - Maintain low-intensity pastoral systems
   - Manage for increasing diversity - variety of species
   - Avoid uniform management (especially in hay meadows).
   - Maintain habitat mosaics
   - Prevent desiccation and drainage in wet meadows
   - Reduce nitrogen deposition and pesticide use
   - Implement targeted measures for specialist butterflies in the GBI
   - Ensure landscape connectivity (maintaining and restoring ecological corridors such as roadside verges and railway embankments to support dispersal and metapopulation dynamics)
   - Monitor the results and engage in adaptive management

9. On farmland we recommend:
    - Start with a farm assessment to identify existing areas of value and opportunities for enhancement
    - Enhance existing semi-natural habitats
    - Manage field boundaries to create diverse structures with hedges and ditches around the farm
    - Create flower-rich areas, such as permanent wildflower margins, meadows and ‘butterfly banks’
    - Implement sympathetic farming practices, such as strongly reducing use of pesticides, herbicides, and fungicides
    - Connect habitats by linking them with habitat corridors to allow wildlife movement
    - Monitor the results and identify future enhancements based on experience on your farm

Lysandra coridon, ***one of the GBI species, has a preference for calcareous grasslands.***

Chapter 1 / Introduction

Grassland is an important habitat for butterflies and many other pollinating insects. More than half of the 501 European butterflies occur in grassland habitats (dry, alpine, subalpine, mesophilic and dry siliceous grasslands and steppes; Van Swaay *et al.* 2006) and many of them have declined dramatically in Europe in recent decades (Melero *et al.*, 2016; Habel *et al.*, 2019a; Warren *et al.* 2021; Sunde *et al.*, 2024). The new Red List of European Butterflies shows that almost one-third (30.9%) of extant butterflies are now threatened or Near Threatened in the EU27 countries (Van Swaay *et al.* 2025). These declines are often linked to habitat loss and unsuitable environmental conditions due to land-use change, pesticide applications and other pollution, and climate change (Van Swaay *et al.* 2025, Rashid *et al.* 2023). In grasslands, the main causes of decline are habitat loss due to conversion to cropland, or habitat deterioration due to unsuitable management and abandonment (Copernicus 2021; Van Swaay *et al.* 2025). However, research has shown that declines can be halted and reversed in both grasslands and arable landscapes, given appropriate management (e.g. Thomas *et al.* 2009, Wix *et al.* 2019, Warren *et al.* 2021, Bladen *et al.* 2022, 2025, Jarvis *et al.* 2025, Favarin *et al.* 2026).

The European Grassland Butterfly Index (GBI) has been developed to show trends in grassland butterflies across Europe. It comprises a composite trend of 17 characteristic grassland species gathered from all 27 countries within the EU (Van Swaay *et al*. 2026). The EU GBI shows a decline of 49% since 1991, showing that grassland butterflies are declining at an alarming rate across the EU and that urgent action is required to protect and restore habitats to reverse this trend, not only for butterflies but also for other wild insect pollinators and the ecosystem services they provide. This report aims to help Member States take evidence-based action to improve butterfly habitats on grassland and in agricultural landscapes, to help 'bend the curve' of butterfly decline that is shown in the GBI. Recent studies have shown that butterflies react very quickly to habitat restoration on farmland and give a bigger response than other pollinators such as bees (Favarin *et al.* 2026). The report also explains how Members States can develop a highly cost-effective Butterfly Monitoring Scheme to calculate their own GBI and assess the impact of measures that they take to meet their biodiversity commitments.

***Flower-rich, moist meadows, like this one in NE France, can harbor important species of the Grassland Butterfly Index, as the HD species* Euphydryas aurinia.**

Chapter 2 / The EU policy background

The EU has produced several strategies and policies to halt the decline of biodiversity, including butterflies and other pollinators. The Habitats Directive (1992) contains a series of Annexes that identify habitats and species of European Community concern. Member States are required to designate Natura 2000 sites for the species listed in Annex II, which includes 22 butterflies; while species listed in Annex IV are subject to a strict protection system, including 27 butterflies (see Van Swaay *et al.* 2025). The Biodiversity Strategy for 2030 (part of the EU Green Deal Initiative) includes specific actions and commitments to protect nature and to reverse the degradation of ecosystems by 2030. Its key targets include protecting 30% of the EU's land and sea areas and restoring 20% of the EU's currently degraded land and sea areas by 2030. The EU GBI has been adopted as a key indicator on the dashboard showing progress in implementing the Biodiversity Strategy.

The EU Pollinators Initiative (adopted in 2018) aims to tackle the decline of wild pollinators, including butterflies; and has objectives to tackle the causes of pollinator decline and promote stakeholder and societal engagement in building solutions to the problem. The EU Nature Restoration Regulation (NRR) was adopted in 2024 and requires Member States to put measures in place to restore at least 20% of the EU's land and sea areas by 2030, and all ecosystems in need of restoration by 2050. EU Member States are required to submit National Restoration Plans to the Commission by September 2027, outlining how they plan to deliver on the targets provided by the regulation. They are also required to monitor and report progress on the implementation of the National Restoration Plans on a regular basis, as well as to review and revise their plans periodically.

Three provisions within the Nature Restoration Regulation are particularly relevant to grassland butterflies and other pollinators:

- Article 4 on the restoration of terrestrial, coastal and freshwater ecosystems requires Member States to achieve an increasing trend towards the sufficient quality and quantity of the habitats of the species listed in Annexes II, IV and V of the Habitats Directive, which include a number of butterfly species that contribute towards the GBI.

- Article 10 is a binding obligation on Member States to reverse pollinator decline by 2030 and improve pollinator diversity and populations thereafter.

- Article 11 requires Member States to put in place measures to improve biodiversity in agricultural ecosystems by 2030 with butterfly monitoring and the Grassland Butterfly Indicator (calculated at Member State level) as one of three measures of success (the others being the stock of organic carbon in cropland mineral soils, and the share of agricultural land with high-diversity landscape features); at least two out of these three indices have to be selected by member states.

Reversing the decline of butterflies and other insects in grassland and other agricultural habitats is therefore a vital component to help meet the EU targets laid out in the Pollinator Initiative, the Biodiversity Strategy 2030 and the Nature Restoration Regulation.

Chapter 3 / Butterfly Monitoring in Europe

Butterfly monitoring is increasingly popular in Europe, mainly supported by Butterfly Conservation Europe (BCE) and its partners. Butterfly Monitoring Schemes are present in an increasing number of countries and new ones are being established in many regions, although long-term data are currently available for only a limited number of countries. The EU Grassland Butterfly Indicator (GBI) uses data up to and including the 2024 field season from all 27 Member States of the European Union (Figure 1; see Figure 5 for EU27 and Europe-wide GBI).

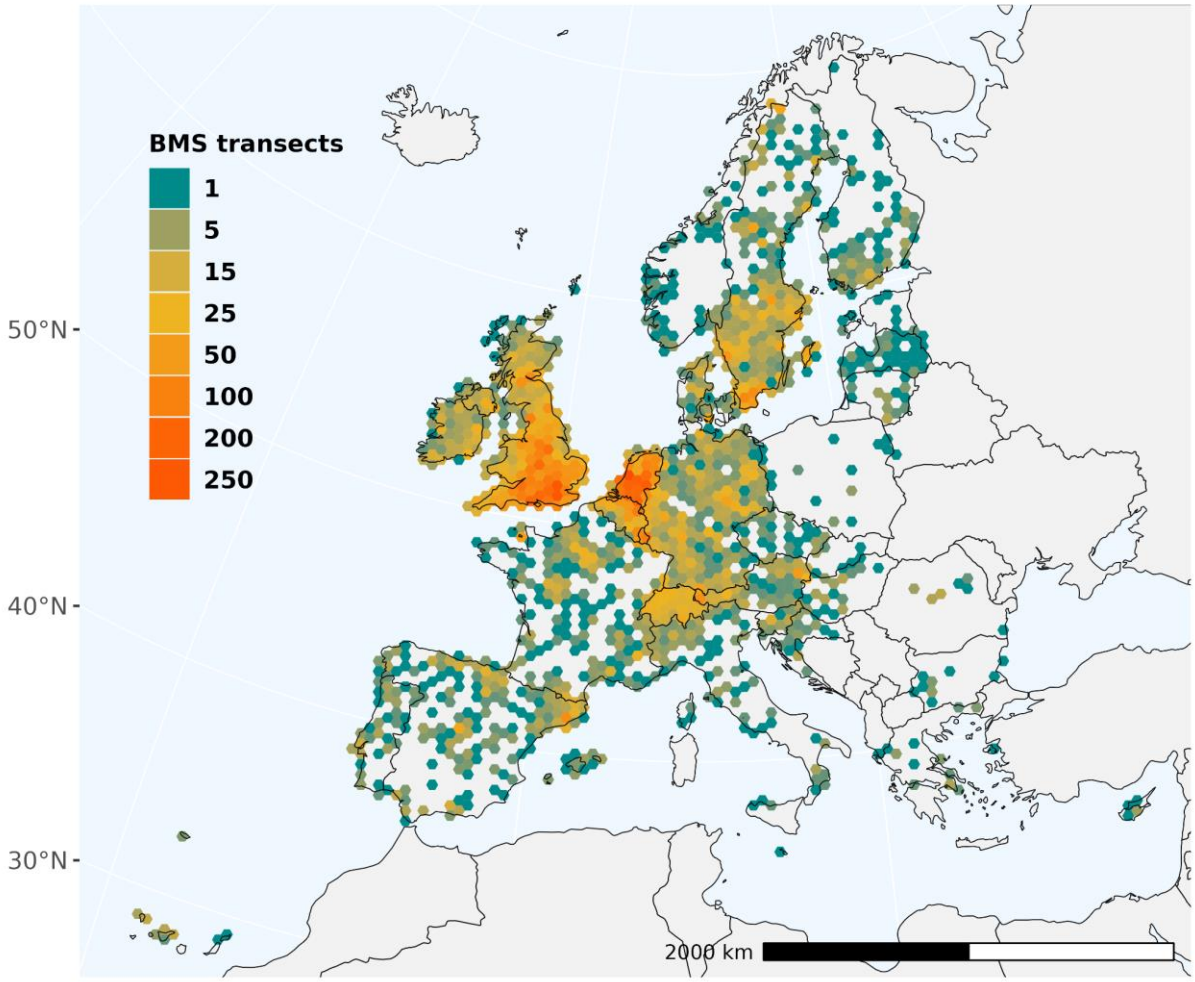


Figure 1: Density of Butterfly Monitoring sites since 1990.

In 2024, more than 3,800 standardised butterfly transects distributed across 28 monitoring schemes in nearly all EU27 Member States were counted (Figure 2). Since 1990, more than 9,600 separate transects have contributed to the EU27 GBI indicator. Outside the EU, 6,551 additional transects have been counted in Europe, mainly in the United Kingdom, Switzerland and Norway.

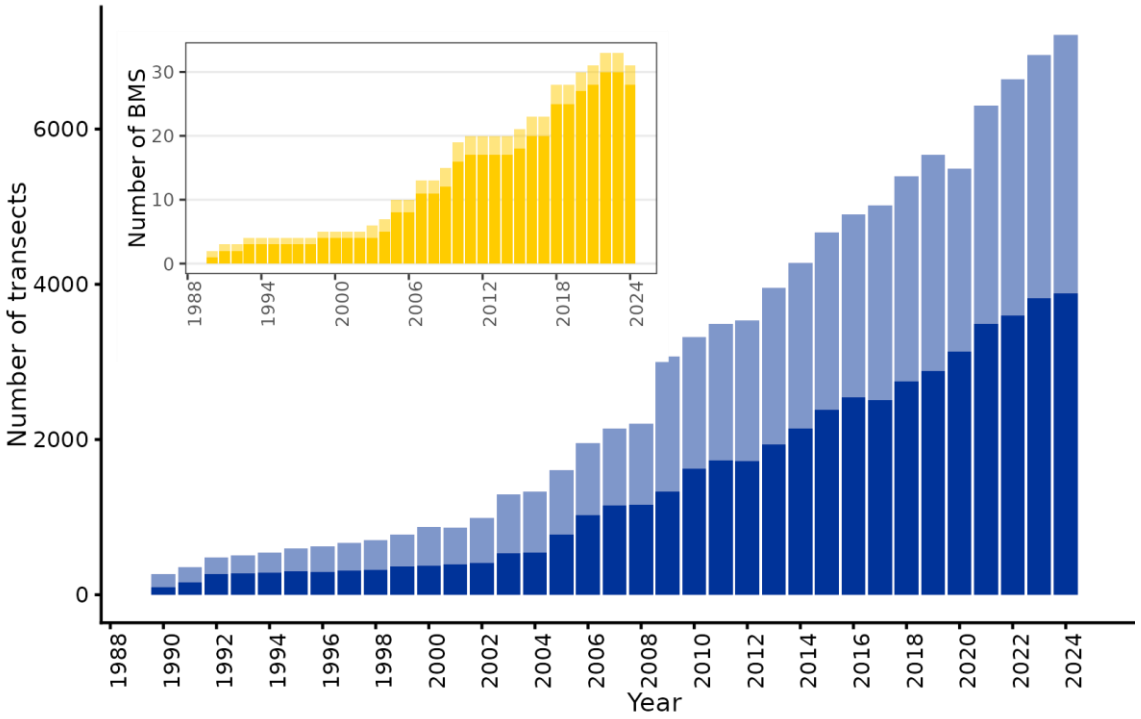


Figure 2: Number of butterfly monitoring transects (blue) and number of Butterfly Monitoring Schemes (yellow) in Europe. Dark colored=EU27, light colored=rest of Europe.

Maniola jurtina ***is one of the most abundant butterflies from the GBI.***

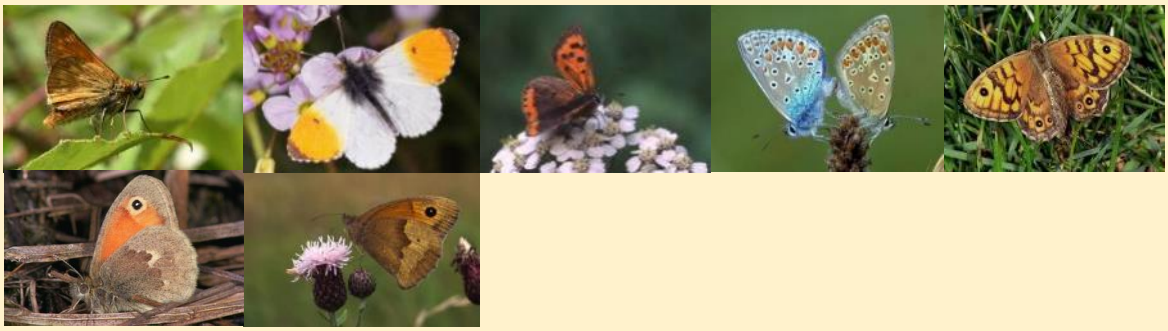
Chapter 4 / Grassland Butterfly Index

Method

The Grassland Butterfly Index is based on field observations conducted by thousands of trained volunteers and professional recorders, who have counted butterflies on more than 16,000 transects across Europe (Figures 1 and 2). These counts are made under standardised conditions, providing high-quality data that are suitable to assess species status and trends. National coordinators collect the data and perform the first quality control.

All standardized butterfly counts are recorded along fixed transect routes that are repeated in time (since 1976 in the UK) and the results are collected in the European Butterfly Monitoring Scheme (eBMS) database. Volunteers and professionals have recorded nearly 60.6 million butterflies identified at the species level in the eBMS database.

For the EU Grassland Butterfly Indicator (GBI), we combined annual abundance indices collected at the scheme level and aggregated data across the European Union Member States to estimate annual indices and trends for the EU-27 for each of the selected 17 grassland butterfly species (Box 1). These indices are then combined to produce a time series of multi-species indices and inform the EU Grassland Butterfly Indicator. For full details on the method, see the most recent report on the GBI (Van Swaay *et al.* 2026).



Widespread species: *Ochlodes sylvanus, Anthocharis cardamines, Lycaena phlaeas, Polyommatus icarus, Lasiommata megera, Coenonympha pamphilus and Maniola jurtina*

Specialist species: *Erynnis tages, Thymelicus acteon, Spialia sertorius, Cupido minimus, Phengaris arion, Phengaris nausithous, Lysandra bellargus, Lysandra coridon, Cyaniris semiargus and Euphydryas aurinia*

Box 1. Counts of 17 butterflies were used to build the European Grassland Butterfly Indicator, comprising seven widespread and ten specialist species.

The EU Grassland Butterfly Indicator (GBI) is the trend of the combined index calculated for the 17 grassland species across the 27 EU Member States. We then aggregate these annual multi-scheme index for the 17 grassland butterfly species by computing the geometric mean across all species, assigning equal weight to each species, and setting the first year to 100. The resulting time series of the annual multi-species geometric mean (grassland butterfly index) is then used to calculate the trend and the annual indices for the EU Grassland Butterfly Indicator.

Like the bird indicators (Gregory *et al.* 2005), this approach provides a consistent measure of biodiversity in which an increase in one species can be offset by a proportional decrease in another species, resulting in a stable trend (indicator). On the other hand, if the number of declining species exceeds the number of increasing species, the multi-species trend will reflect an overall decline; conversely, if the number of increasing species exceeds the number of declining species, the trend will reflect an overall increase. Further details on the methods used to calculate population trends and the indicator at the EU27 level can be found in the most recent report on the GBI (Van Swaay *et al.* 2026).

The EU Grassland Butterfly Index

The EU27 Grassland Butterfly Index (Van Swaay *et al.*, 2026; Figure 3) is 49% lower in 2024 than in 1991, the first year for which we can compute the indicator. The decline across the whole of Europe is 47% over the period 1990-2024, with a smaller confidence interval as more transects (especially from the United Kingdom and Switzerland) have been used.

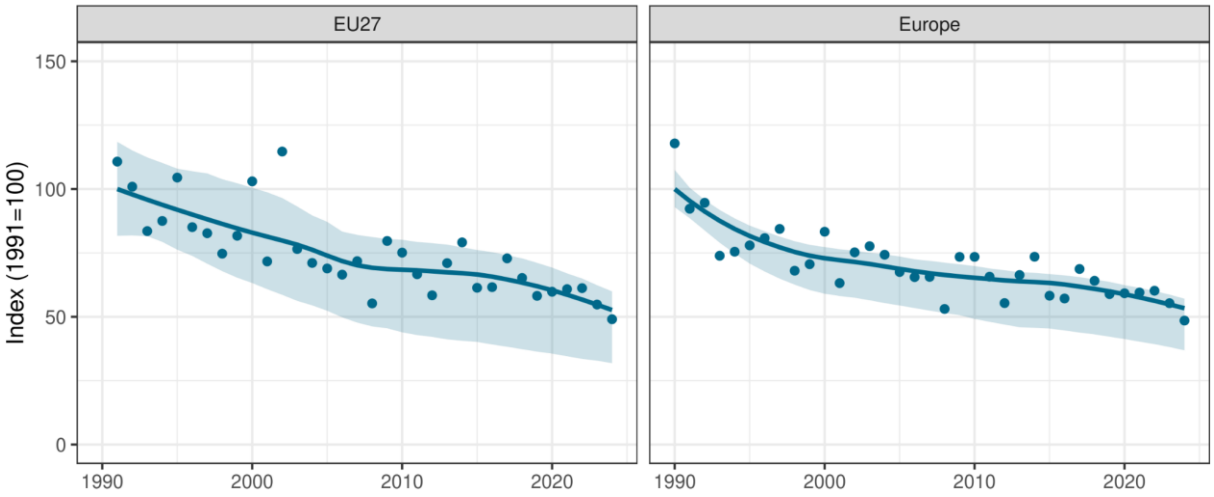


Figure 3. The Grassland Butterfly Indicator (smooth line) through annual index (points) calculated for the EU27 countries from 1991 to 2024. The shaded area represents the 95% CI of the smoothed trend. Note that the Europe-wide GBI could be calculated from 1990, as we need the annual index to be informed by at least two monitoring schemes.

In Northwestern Europe, the decline of butterfly populations is primarily attributed to habitat loss resulting from the intensification of agricultural grasslands (Warren *et al.*, 2021; Maes *et al.* 2022). This process includes the conversion of semi-natural habitats into intensively-managed high-yield monocultures, often accompanied by the widespread use of agrochemicals such as fertilisers, herbicides, and insecticides. These practices reduce habitat extent and heterogeneity, degrading the quality of wild plants that provide essential food for butterflies and their caterpillars (Osumanu &

Kosoe, 2023; Deynze *et al.*, 2024; Sánchez-Bayo & Wyckhuys, 2019; Habel *et al.*, 2019b; Genty *et al.* 2026).

Even within protected areas, butterflies are declining due to **pressures including habitat loss and agricultural intensification** (Rada *et al.*, 2018; Copernicus 2021; Percel *et al.*, 2025; Ulrich *et al.*, 2025). Lowering of groundwater levels—often a consequence of drainage for agriculture—alters wet ecosystems, which are critical habitats for specialised butterfly species. Nitrogen deposition, especially ammonium from intensive livestock farming, leads to soil enrichment and the encroachment of coarse grasses and shrubs (Vogels *et al.*, 2023). This process diminishes the availability of open, nutrient-poor microhabitats that many butterfly species depend on (Öckinger *et al.*, 2006). The use of herbicides negatively impacts the diversity and abundance of caterpillar host plants and nectar sources, while both herbicides and insecticides pose a direct threat to butterflies, often as non-target insects (e.g. Santovito *et al.* 2020 for *Lycaena dispar*, an Annex II and IV species of the Habitats Directive). These pressures all contribute to the fragmentation and degradation of butterfly habitats, even in areas designated for biodiversity conservation (Osumanu & Kosoe, 2023).

In large parts of Europe the **abandonment of grasslands** is also a significant driver, as shrub and forest encroachment reduce habitat for grassland butterflies (MacDonald *et al.* 2000; Sunde *et al.*; 2024, Ubach *et al.*, 2019). European butterflies are also much affected by **climate change** (Parmesan *et al.*, 1999; Rashid *et al.*, 2023). While some parts of Europe have seen an increase in the numbers of some widespread generalist butterflies with warmer climate (Sunde *et al.*, 2023), the recent series of extremely hot and dry summers has reversed this trend and resulted in additional declines (Van Bergen *et al.*, 2020). Extreme climatic events, such as heavy rainfall, winter heatwaves and long droughts, also appear to be negatively impacting some butterfly populations (Shan *et al.*, 2024; McDermott Long *et al.*, 2017).

The 49% decline of the GBI observed over the last 34 years probably reveals only part of the historical decline in grassland butterflies, as many populations were extirpated from the landscape before 1990. In the Netherlands, for example, the distribution of butterflies (including those found in grasslands) has dropped by more than 80% since 1890 (Van Strien *et al.* 2019). Similar patterns were also observed in other lowland countries like Belgium-Flanders (Maes *et al.* 2022).

National Grassland Butterfly indexes

For Article 11 of the NRR, it is necessary for Member States to achieve an increasing trend in the GBI by 2030. Several countries have already published their GBI, based on their ongoing national BMS programmes:

- Netherlands: CLO (2025) https://www.clo.nl/indicatoren/nl118118-trend-van-graslandvlinders-1992-2024
- Luxembourg: Vray *et al.* (2024)
- Germany: Harpke *et al.* (2025)
- Catalunya (Spain): Ubach & Stefanescu (2025)
- Flanders (Belgium): Maes & Piesschaert (2026)
- Sweden: https://www.dagfjarilar.lu.se/om-oss/english/indicators

Chapter 5/ How can a Member State organize the GBI?

In order to use the GBI as an indicator for Article 11 of the Nature Restoration Regulation, EU Member States need to facilitate and develop a highly cost-effective Butterfly Monitoring Scheme for the acquisition of high-quality data: only in this way can a robust and reliable GBI be obtained. This chapter briefly outlines the pathway a Member State can follow to achieve this.

Establishing the GBI at the Member State level consists of five phases:

1. Fieldwork and data acquisition;
2. Quality control;
3. Calculation of species trends and the GBI;
4. Forwarding the counts to the eBMS for use in calculating the GBI for the EU27;
5. Feedback to recorders, authorities, and other stakeholders.

Step 1: Fieldwork and data acquisition

Some countries, particularly those with a longer-established BMS, have developed their own database, website, and app. Member States wishing to start using the GBI may opt for this approach, but an online database with a web portal and an app (ButterflyCount) is freely available (eBMS tools). However, **a national BMS coordinator is essential** to ensure that data are gathered in a systematic way and with sufficient quality control. In some countries, such a coordinator is already being funded and a BMS is already gathering data that can be developed to produce a robust indicator. However, in countries with an unfunded BMS, an investment will have to be made in a paid national coordinator who can over time develop the network of transects to gather sufficient data.

When establishing the fieldwork for butterfly monitoring for the GBI, Member States may choose to implement monitoring schemes using volunteers (citizen scientists), professionals, or a combination of both. These three options are discussed separately below:

- **Volunteers**

  Working with volunteers can offer significant advantages. Individuals who choose to participate generally possess considerable species knowledge or are willing to acquire it, potentially with support from the coordinator. When survey sites are located near their home or workplace – minimizing travel time – and the transect is no longer than approximately two kilometers, volunteers can easily complete a count during a break. A mainly **volunteer BMS has large cost saving** compared to multiple professional surveyors.

  Transects do not necessarily need to be situated in the most butterfly-rich areas of the region to contribute to the GBI, provided they are surveyed frequently within a season (ideally 10–20 times a year) and across multiple years. A well-organized volunteer network with numerous survey sites can lead to more precise species trends and, consequently, a more reliable GBI with narrower confidence intervals. This enables earlier detection of changes in the GBI. However, a drawback of working with volunteers is the difficulty of obtaining survey sites in remote areas that host rare or specialist species relevant to the GBI, especially in Northern and Central Europe. Targeted recruitment campaigns in such regions may help, but success is not guaranteed.

  Although volunteers collect data without financial compensation, this does not mean the process is cost-free. It is essential to have a national coordinator who supports volunteers, assists in selecting survey sites, validates observations, provides feedback, calculates species trends and the GBI, forwards data to eBMS for inclusion in the EU27 GBI, and ensures overall

quality control. Furthermore, the national coordinator acts as a crucial link between the surveys, trends, and GBI, as well as between volunteers, regional and national authorities, eBMS, and the EU. This role can only be fulfilled effectively if carried out professionally, making the coordinator an indispensable component of successful volunteer-based monitoring. Experience from many countries shows that supporting a coordinator allows schemes to grow much more quickly and achieve good coverage of species and types of land.

- **Professionals**
  Monitoring by professionals offers the significant advantage of enabling survey sites to be selected strategically for optimal results. This ensures that reliable trends can be obtained with a minimum number of sites. Specialist species relevant to the GBI can also be included in the planning. Fieldwork by professionals can be combined with monitoring of species listed under the Habitats Directive for Article 17 reporting, as three butterfly species (*Euphydryas aurinia*, *Phengaris arion*, and *Phengaris nausithous*) are included in the Directive and must therefore be monitored.

  The monitoring of pollinators for article 10 of the Nature Restoration Regulation (EUPoMS) will involve professional surveyors, a stratified-random design (e.g. representative) of transect and include butterflies, which would make this data a valuable addition for the GBI. However infrequent sampling will limit it's statistical power for the GBI.

  The main disadvantage of working with professionals is cost (and sometimes availability, as even paid staff may have competing workloads). There is also a lack of certification which means that it is difficult to evaluate the quality of the counts. Even when skilled professionals are part of a contracted company, it can still be junior partners that carry out the actual work. It is also not guaranteed that the same individuals will consistently conduct surveys over time. Although the field method is robust to such variation, this may still introduce greater differences between surveys and years, ultimately reducing the sensitivity of the GBI.

  To implement professional monitoring effectively, a sufficient workforce is required. This necessitates government investment in training and education, as well as opportunities for long-term employment. Stable contracts are essential; without them, professionals may seek alternative careers offering greater long-term prospects.

  As with volunteer-based monitoring, a professional coordinator is necessary to ensure the timely completion of surveys, calculation of species trends and the GBI, data submission to eBMS, and presentation of results to regional and national authorities.

- **Volunteers and Professionals**
  Because volunteers tend to prefer monitoring butterflies near their home or workplace, widespread species are generally well covered. While some volunteers are willing to monitor specialist species in nature reserves, there is always a risk that one or more of the rarest species – often restricted to remote sites – will not be surveyed sufficiently to produce reliable trends. Professionals can fill these gaps.

  In many countries with successful butterfly monitoring programs, a mixed approach using both volunteers and professionals is employed to achieve the most comprehensive coverage and the highest possible data quality.

Step 2. Quality control

A rigorous quality control process is essential to ensure the generation of reliable and representative data, which in turn enables the calculation of statistically robust indices, trends, and ultimately the GBI. Again, this will require a paid national BMS coordinator or data technician who can validate and check the data before analysis can begin. Such quality control involves:

- *Verification of technical correctness:* checks on date, time, and weather conditions are necessary. For example, counts conducted in the evening or under unsuitable weather conditions should be excluded from analyses, as they do not match the protocol.

- *Verification of photographic evidence:* submitted photographs can be screened using image recognition tools. If the automated identification does not match the observer's identification, an expert must review the photograph.

- *Assessment of species occurrence at the location:* experts often know whether a species is likely to occur at a given site, but this can also be validated using external distribution range data, such as those from the Global Biodiversity Information Facility (gbif.org).

- *Assessment of species phenology:* many butterflies have restricted flight periods. For example, in most regions *Anthocharis cardamines* flies only in spring; observations reported in August, for example, must therefore be verified and validated by an expert.

- *Assessment of reported abundance:* some butterfly species can be observed in large numbers together, whereas others are typically seen singly or in very small numbers. In such cases, the coordinator may need to confirm whether the record is a data-entry error or whether photographic evidence is available.

Certification of recorders (certain professionals, but also potentially volunteers) can also be used as a way to increase the quality of the data. The current EU funded EPIC-Butterfly project can play a role in this.

For quality control, coordinators frequently need to contact the observer. This process is required whether the counts are conducted by volunteers or professional experts. It is essential that all communication between the coordinator and the observer is stored with the record, ensuring that the observation can be re-evaluated if new information becomes available.

All these **validation steps are integrated into the eBMS database and website** (www.butterfly-monitoring.net), enabling countries to adopt the system without developing their own procedures. The eBMS includes an automatic verification system for species phenology and distribution to assist verifiers in the validation process. Member States with an existing BMS often already have a database, website, and procedures in place, usually tailored precisely to national needs. Such BMS's should certainly continue to operate in this way, but for countries without an established BMS, eBMS can facilitate a rapid start.

In all cases, it remains essential to have a dedicated coordinator who safeguards data quality, ensures volunteer commitment, and provides timely GBI results to authorities. With existing websites and tools within eBMS, there is no longer a need to develop or maintain a separate database, website, or app. This enables the coordinator to focus on organizing and supporting fieldwork and ensuring that results are delivered efficiently.

Step 3. Calculation of species trends and the GBI

For this step, the web portal (e.g., www.butterfly-monitoring.net) and dedicated methods and tools (e.g., Annex I in this report) are already available. However, a scientist with suitable analytical skills will be needed to produce the GBI from the raw data.

Step 4. Forwarding the counts to the eBMS for use in calculating the GBI for the EU27

Once the annual data has been checked and collated, it should be passed to the eBMS so that they can contribute to the calculation of the GBI for the whole of the EU 27 (and contribute to the EU Biodiversity dashboard and to evaluate other EU policies).

Step 5. Feedback to recorders, authorities, and other stakeholders

Providing feedback is essential to ensure that recorders are recognised for their important contribution and motivated to continue their work in future years; and to ensure that funders, officials and stakeholders know how the BMS is going and understand the importance of the results. Providing feedback and summary reports is typically the role of the national coordinator, who again should be paid to ensure timely reporting and high quality feedback.

The role of the European Butterfly Monitoring Scheme (eBMS)

The eBMS and Butterfly Conservation Europe can offer training and support for each of these steps. Member States that make use of these resources only need to focus on organizing the fieldwork and overall coordination. The eBMS can also provide a job description for the national coordinator and Data Analyst. The eBMS provides support for national BMS and national coordinators. It also produces the GBI and other products using data derived from the national schemes.

Chapter 6 / How to bend the GBI curve: General Principles

When a Member State chooses to use the Grassland Butterfly Index (GBI) as one of the three indicators under Article 11 of the Nature Restoration Regulation (NRR), it must '*put in place measures which shall aim to achieve an increasing trend at national level … measured in the period from 18 August 2024 until 31 December 2030, and every six years thereafter, until satisfactory levels … are reached*' (Article 11 of the NRR). The GBI is based on monitoring data from butterfly monitoring transects that record any of the 17 target species within the national territory, including routes located outside grassland or agricultural landscapes.

It is important to recognize that measures to increase the GBI run in parallel with those required to halt the decline of pollinators (Article 10 of the NRR). To monitor changes in pollinator populations, a dedicated indicator has been developed (EUPoMS; Potts *et al.*, 2024). Both monitoring networks (eBMS and EUPoMS) use a compatible field methodology to count butterflies in which a transect of 5m width is counted for all butterflies (in the case of EUPoMS of 1000m, in eBMS of variable length). See the delegated act for more details. Although the monitoring frequency for EUPoMS is monthly (weekly or two-weekly in eBMS), these counts can be integrated with those from the Butterfly Monitoring Schemes (BMS), thereby strengthening the results of the GBI. This methodological alignment contributes to making the **GBI a highly cost-effective indicator**.

Ensuring an increase in the GBI requires a comprehensive strategy that integrates the following measures (enhanced from Van Swaay *et al.*, 2012):

1. **Habitat management:** safeguarding and enhancing grassland quality through reduced intensification, pollinator-friendly grazing/mowing regimes, and avoidance of agrochemicals.

    1.1. *Manage at the landscape scale*
    Butterflies typically exist in networks of local populations, with some exchange of adults between them, forming a metapopulation (Thomas & Hanski 1997). Management should aim to **maintain connectivity and population networks** across the landscape, recognising that not every locality will be suitable at all times, although some core sites will be. Progressive loss of habitat suitability across a landscape, the removal of potential corridors (e.g., hedges, field margins, roadside verges, or natural forest edges), and the introduction of new barriers to dispersal can lead to the loss of local populations, hinder colonisation and eventually result in the regional extinction of a species through the breakdown of metapopulations (Ellis *et al.*, 2011, 2012).

    1.2. *Maintain low-intensity pastoral systems*
    Unfertilized, flower-rich meadows and pastures, the most important habitat for many butterflies, are both threatened by abandonment (Mora *et al.* 2023) and agricultural intensification (Copernicus, 2021), leading to significant habitat loss. Such land use changes pose a particular threat to member states in Eastern Europe, such as Poland and Hungary. Abandonment can temporarily create favourable conditions for many species but will soon lead to scrub encroachment and the eventual loss of suitable breeding conditions as open grassland becomes woodland. **Maintaining permanent open grassland is therefore essential**, usually by supporting active traditional and extensive pastoral systems, including livestock grazing and hay cutting. The extensive use of fertilizers should be avoided. Suitable socio-economic conditions must be considered and supported to ensure these pastoral systems survive.

1.3. *Manage for increasing diversity - variety of species*
Each grassland butterfly species has specific habitat requirements, particularly during the often-inconspicuous larval stage, so management should aim to provide a range of conditions, often based on traditional land use patterns (e.g. small field sizes with linear structures such as ditches and hedges). While some species require short vegetation for breeding, others need taller vegetation or a mixture. Managing habitat variety across a landscape is therefore essential to conserve and provide suitable habitats for the full range of grassland butterfly species. **Variation provides diversity** in micro-climates that enables butterflies to cope with extreme weather, as diverse habitats support and facilitate climate adaptation.

1.4. *Avoid uniform management (especially in hay meadows).*
Butterfly populations can be severely damaged or even be extirpated following intensive and uniform management, particularly hay cutting. Cutting dates should be varied as much as possible across a site and across the entire landscape, so that not all areas are cut within a short period. Ideally, a **mosaic of small-scale cutting regimes** should be implemented to replicate traditional management before mechanization (Maes *et al.* 2017; Fumy *et al.* 2023; Parmentier *et al.* 2025). This variation in management, both in time and space, should also be applied in other habitats, such as wet meadows, bogs and moors.

No room for butterflies on such intensively used, uniformly managed grasslands.

1.5. *Maintain habitat mosaics*
Many butterfly species require several habitat types and, therefore, need mosaics of different habitats occurring in close proximity. For example, some species breed along scrub or woodland edges due to the shelter they provide and need a mixture of scrub and grassland. Other species may lay eggs in one habitat type and use nectar resources in another. The spatial scale of the mosaic varies across regions and often depends on traditional land-use patterns. Sometimes such a mosaic consists of small fields with small blocks of scrub or woodland, while in more extensive landscapes the mosaic may be on a much larger scale. Scrub, woodland and hedgerows can benefit grassland butterflies, as they prefer some shelter, especially in windy areas. Landscape diversity is also essential for species to survive increasing weather extremes due to climate change.

1.6. *Prevent desiccation*
Some of the grassland butterfly species are primarily associated with wet meadows at least in part of their European distribution, including the **Habitats Directive Annex II species *Euphydryas aurinia***, ***Phengaris nausithous*** and ***P. teleius***. For these wet grasslands, maintaining sufficient moisture is essential. This is becoming increasingly difficult due to climate warming, prolonged drought, progressively drier summers, and hydrological drainage in the surrounding landscape. Such drainage may result from water abstraction for drinking water, irrigation or industrial use, but more commonly arises from intensive agriculture, where field drainage and a lowered groundwater table allow the use of heavy machinery in spring. The impact of drainage activities is not limited to agricultural land; it also affects adjacent wet grasslands, including those within nature reserves or Natura 2000 sites. Reduced groundwater levels in the wider environment cause these areas to dry out, and during dry summers, they may become so desiccated that target species disappear and fail to recolonize. In addition to mitigating climate change, it is therefore crucial to ensure that wet grasslands remain moist and that management measures within and around these habitats explicitly address their vulnerability.

1.7. *Reduce nitrogen deposition and pesticide use*
Intensive agricultural practices often lead to increased emissions of nitrogen compounds and widespread use of pesticides. These inputs directly affect not only cultivated fields but also nearby habitats, such as roadside verges. Furthermore, their impact extends into protected Natura 2000 sites (Brühl *et al.* 2021), where declines in butterfly populations have been observed even several kilometres from the source areas (Vogels *et al.* 2023). Therefore, nitrogen deposition and pesticide use must be reduced as much as possible.

2. **Targeted measures for specialists:** implementing site-specific interventions for species with restricted distributions, thereby improving local populations that disproportionately influence the Grassland Butterfly Index (GBI) (Van Swaay *et al.* 2012).

   Of the 17 species included in the Grassland Butterfly Index (GBI), ten are considered specialists. These species often persist in local populations restricted to semi-natural grasslands, some within nature reserves or protected areas such as Natura 2000 sites. Many NGOs and managing organizations, regardless of whether they receive financial support, lack the resources to implement management regimes specifically tailored to the requirements of GBI specialists. Yet, this is precisely where substantial conservation gains can be made. A **butterfly species confined to a few sites can often be supported through relatively inexpensive, targeted interventions** (e.g. Thomas *et al.* (2009) for *Phengaris arion*; Porter & Ellis (2011) for *Euphydryas aurinia* and Jansen *et al.* (2012) for *Phengaris nausithous*), thereby improving the annual index for that species and ultimately having a positive impact regionally and on the overall GBI of a Member State.

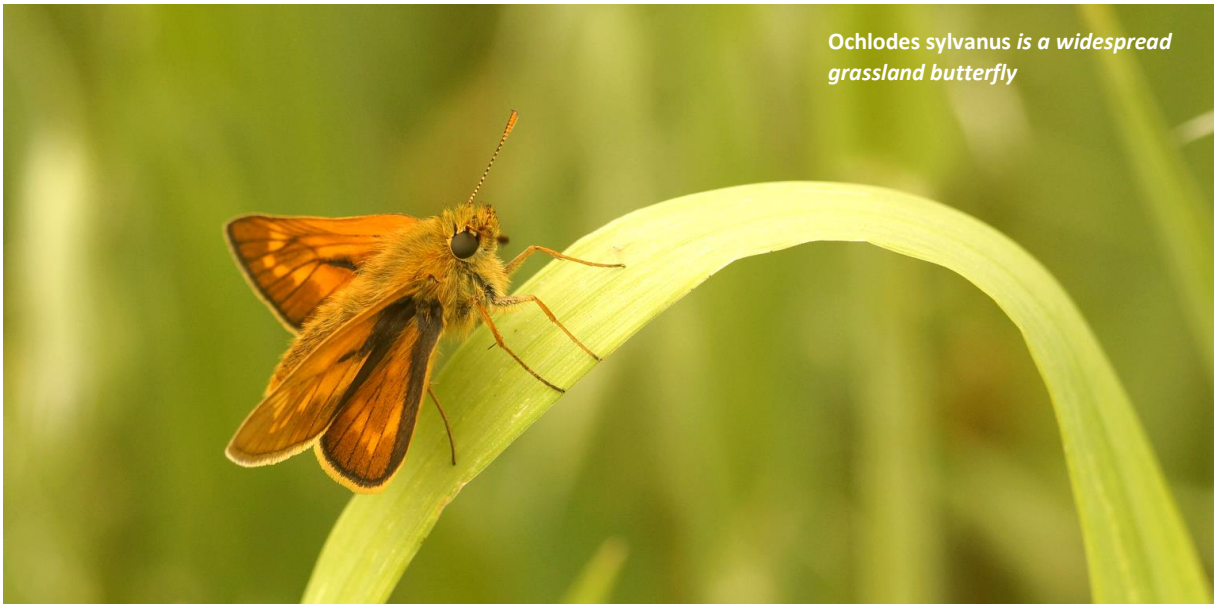
3. **Landscape connectivity:** maintaining and restoring ecological corridors such as roadside verges and railway embankments to support dispersal and metapopulation dynamics (Brückmann *et al.* 2010).

   In many Western European countries, grasslands outside protected areas are used so intensively for agriculture that grassland butterflies are often restricted to roadside and railway verges. In the Netherlands, infrastructure verges and embankments cover 6–8% of the national territory (Vliegenthart, 2024). These linear habitats are typically owned and managed by municipalities or other local authorities, who can increase pollinator abundance and grassland butterfly diversity

through pollinator-friendly management practices. These practices include refraining from fertilization, avoiding pesticide use, reducing mowing frequency, and, when mowing is necessary, implementing a staggered mowing regime (Phillips *et al.* 2020). **These practices can often help reduce management costs**. In the Netherlands, these principles have been formalized in the Kleurkeur certification scheme (www.vlinderstichting.nl/kleurkeur), which contractors can obtain to demonstrate to clients their qualifications in ecological and pollinator-friendly management. Such ecological verge management can make a significant contribution to the recovery of pollinator populations (Bakker *et al.* 2026). Ecologically managed verges support twice as many insects and 2.5 times as many pollinator species compared to conventionally managed verges (Verhoogt *et al*. 2025). The operational capacity required for large scale implementation is already in place; remaining constraints relate primarily to policy integration, procurement frameworks and long-term contractual arrangements. Embedding ecological management as a standard requirement within maintenance and procurement processes would provide a robust and cost-effective measure that simultaneously enhances climate resilience and infrastructure safety. In urban landscapes parks and gardens can also play an important role for grassland butterflies, especially by providing nectar sources (Neumann *et al.* 2024; Timberlake *et al*. 2024).

4. **Monitoring and adaptive management:** strengthening long-term butterfly monitoring schemes and adjusting management practices based on empirical outcomes. New transects may be established at sites with adaptive management to assess results and identify regimes that yield the most positive outcomes in the local context (Pullin *et al.* 2016).

By aligning conservation actions with these principles, Member States can not only bend the curve and achieve an increasing GBI trend but also contribute to a growing number of pollinators (Article 10 of the NRR) and to broader biodiversity objectives under the EU's Nature Restoration Regulation.



Ochlodes sylvanus ***is a widespread grassland butterfly***

Chapter 7 / How to bend the GBI curve: Managing farmland for butterflies and other pollinators

1. **Farm Assessment**
   - Start by conducting an ecological assessment of the whole farm and identify existing habitats of value for wildlife and areas with opportunities for enhancement.
   - Identify '*low hanging fruit*' where there could be quick gains for butterflies and other pollinators. Either tweaks in existing management or easy opportunities for enhancement.
   - Seek ecological advice if necessary.

2. **Enhance Existing Semi-natural Habitats**:
   - Prioritize improving current butterfly-friendly features such as flower-rich grasslands and woods by making them bigger, better, and more connected.
   - Manage grasslands by low-intensity or periodic grazing, maintaining a varied sward structure and abundant nectar sources. Alternatively cut annually for hay in late summer and autumn, removing cuttings and leaving some areas uncut for species that overwinter in taller vegetation.
   - Manage farm woods by creating some open areas such as clearings, tracks and pathways, (i.e., coppicing; Fartmann *et al.* 2013). Cut these areas every 1-4 years on rotation to create a diverse vegetation structure from grass to light scrub.

3. **Manage Field Boundaries**:
   - Create diverse structures with hedges and ditches around the farm, managing them on rotation (avoid cutting all in any one year).
   - Plant native species and maintain hedgerow trees for corridors.
   - Agroforestry in farmland can mitigate the increase of temperatures caused by climate warming.
   - Buffer boundaries and woods with tussocky grass strips to protect them from agricultural inputs or plant with wildflower mixes.
   - Leave parts of field boundaries uncut each year for overwintering species.

4. **Create Flower-Rich Areas**:
   - Establish permanent wildflower margins to support pollinators and birds. Plant with local, native, perennial plants such as *Lotus corniculatus, Trifolium* and *Medicago.* Manage by periodic cutting, and preferably remove cut material, always leaving some uncut areas for overwintering butterflies and other wildlife. They may need replenishing every 5-10 years, but do so on rotation to ensure breeding populations can survive.
   - Create wildflower meadows or low input grassland on the least productive parts of the farm. Plant with local, native species including nectar sources and butterfly foodplants such as *Lotus, Trifolium, Knautia, Scabiosa* and *Centaurea*. Graze lightly or cut periodically, leaving some uncut areas each year.
   - Create a '**butterfly bank**' by mounding sub-soil to create a low nutrient bank. Plant with wildflowers and manage as above. Such banks create small-scale variation in climate that can provide important shelter to butterflies during extreme weather events (Hayes *et al.* 2024).
   - Create '**beetle banks**' within large arable fields to provide habitats for natural predators as well as some butterflies. They comprise raised strips of uncultivated land, preferably planted with wildflowers and cut in patches, leaving some uncut areas each year.

5. **Implement Sympathetic Farming Practices**:
    - Strongly reduce use of pesticides, herbicides, and fungicides; and eliminate them in semi-natural and enhanced areas of the farm. Even low levels of these chemicals can have sub-lethal effects on butterflies that can reduce survival rates (e.g. Santovito *et al.* 2020)
    - Use cover crops and fallow plots to provide nectar resources and protect soils
    - Implement Integrated Pest Management (IPM).
    - Use **targeted grazing** with appropriate livestock to manage vegetation.
    - Maximise the value of cropland for biodiversity, for example rice fields and legume crops can provide valuable habitat for wildlife if suitably managed (e.g. Elphick, 2000; Giuliano, 2018).

6. **Connect Habitats**:
    - Link different habitat patches with corridors to allow wildlife movement.
    - Consider working with neighbouring farms to share experience and maximise landscape scale benefits.

7. **Monitor the Results:**
    - Look for butterflies and other insects in the enhanced areas and see what works.
    - See if local volunteers can help with farm biodiversity/habitat surveys.
    - Consider establishing a butterfly transect to help evaluate success and contribute to your country's GBI.
    - Identify future enhancements based on experience on your farm.

8. **Provide Suitable Support Payments**
    - Policy makers need to provide suitable support payments to encourage farmers to take positive measures to conserve butterflies and other pollinators. These may include **agri-environment schemes** that either take a whole farm approach or be targeted at specific habitats (e.g. EU CAP Network).
    - Market measures can be encouraged that provide a premium for products produced from pollinator friendly farms.

Cupido minimus ***is one of Europe's smallest butterflies.***

Further information

Practical guides for managing farmland for butterflies and other pollinators

- https://www.whatthesciencesays.org/briefing-sheet-conserving-insects/
- https://eu-cap-network.ec.europa.eu/sites/default/files/2023-10/MP3-FG_Biodiversity-HDLF_Managing%20HDLF%20for%20pollinators.pdf
- https://ieep.eu/wp-content/uploads/2022/12/Farmers_Guidance_EN_14_12.pdf
- https://cdn.buglife.org.uk/2019/08/Hedgerows-and-cereal-field-margins.pdf
- https://www.farmingfornature.ie/your-farm/resources/best-practice-guides/managing-species-rich-grasslands/
- https://www.allertontrust.org.uk/wp-content/uploads/2025/05/A-guide-to-insect-rich-farmland-habitats-v3-Jul-2024-LOW-RES.pdf

Creating butterfly banks

- https://butterfly-conservation.org/sites/default/files/2024-01/Butterfly%20Bank%20Factsheet_FINAL.pdf
- https://farmwildlife.info/2019/09/29/adding-value-to-chalk-grasslands-creating-chalk-banks-to-benefit-butterflies-and-other-insects/

Guides for managing woodland for butterflies and other pollinators

- https://tapio.fi/aineistopankki/oppaat-ja-tyovalineet/
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/707669/ewgs-on011-ride-mangt.pdf
- https://butterfly-conservation.org/sites/default/files/woodland_managemennt_for_butterflies_managingwoodland.pdf

Farm policy

- https://eu-cap-network.ec.europa.eu/index_en
- https://www.biodiversa.eu/wp-content/uploads/2022/12/policy_brief_CAP.pdf

Integrated pest management

- https://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/integrated-pest-management-working-with-nature.pdf

Legal information

- Nature Restoration Regulation: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1991&qid=1722240349976
- Delegated act for establishing a science-based method for monitoring pollinator diversity and pollinator populations: https://eur-lex.europa.eu/eli/reg_del/2025/2188/oj/eng

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