BREEDING FARMLAND BIRDS

# Best practice guidelines to survey breeding farmland birds

## *Territory mapping*

Farmland birds are among the fastest declining group of birds in Europe and hence practical solutions that halt and reverse this decline are urgently needed to help meet national farmland Biodiversity targets. To evaluate the effectiveness of proposed or implemented conservation efforts, reliable, reproducible monitoring is vital. Territory mapping, detailed in this factsheet, provides a user-friendly and efficient tool for anyone interested in monitoring farmland birds that utilise a defined habitat feature. The following protocol draws upon extensive experiences gained during the seven-year North Sea Region Interreg PARTRIDGE project.

## WHY

Farmland birds are in decline in Europe and hence urgent action is needed to halt and reverse this decline. Agri-environmental schemes (AES) play a key role in helping to achieve the EU's biodiversity targets on farmland. Many different habitat measures are implemented across EU member states. A range of these habitats are aimed at improving the amount and quality of farmland bird breeding habitats in summer and providing more food and cover for wintering residents and migrants. However, it is not always clear whether the intended objectives are achieved. To find out, standardized monitoring is required. The field protocol that we describe here to investigate the breeding farmland bird population is easy-to-use. It can be applied by everybody, from professional ecologists to volunteers, who have enough experience to recognise (farmland) birds in the field. It is also a nice subject for a citizen science project for experienced birders that want to use their skills in the winter season. To analyse the data, detailed ecological background knowledge of the target birds is needed; consequently, this analysis should be carried out by an experienced/professional ornithologist/ecologist.

## PROJECT SET-UP

Ten PARTRIDGE-project demonstration sites were compared to paired reference sites, to better interpret and detect meaningful changes and evaluate the effectiveness of management practices on the number of breeding territories. For studies aiming to answer similar research questions to ours, monitoring should be conducted in both demonstration and paired reference sites. Apart from NOT receiving any of the management measures or other experimental treatments that are otherwise undertaken at the demonstration site(s), the reference site(s) must be spatially near and agriculturally similar to the demonstration site(s). However, to ensure that the two areas are independent, they should be at least 6 km apart to avoid birds moving between sites. To obtain a reliable population count, study sites should be sufficiently large. A minimum area of 500ha is recommended. The current technique can be used for other projects as well, but without a comparison, i.e., a reference site, it will be more difficult to interpret any changes recorded in farmland bird numbers.

## TERRITORY MAPPING

Two methods are commonly applied in bird surveys: distant sampling and territory mapping (Bibby et al. 2000, Buckland 2006). In brief, for distant sampling, all birds seen or heard from a counting point or line transect are recorded and the distance (used to calculate detectability) is estimated each time. These data are used to calculate bird densities. For territory mapping, all birds seen or heard in the monitoring area are noted on a map. The observations of several visits during the breeding season are combined based on a set of rules to delineate breeding territories.

Some studies compared both techniques in the field but did not find a clear pattern (Gillings et al. 1998, Shankar Raman 2003, Buckland 2006, Gottschalk & Huettmann 2011). Gregory (2000) compared line transects, point transects and territory mapping and concluded that territory mapping was much more precise than both transect methods. A drawback according to his paper is that territory mapping is not very efficient since the time required to analyse mapping data was seven times greater than for the transect data. However, at that time, no dedicated computer software was available that streamlined and standardised the translation of the field data into territories.

Gottschalk and Huettmann (2011) argue that territory mapping does not take detectability of the target species into account. Distance sampling includes a species-specific detection function based on the distance between the observed bird and the observer (Buckland et al. 2015). To derive this detection function reliably, it is postulated that at least 60-80 observations are needed along line transects and 75-100 for point transects (Buckland et al. 2015). Some authors claim that it might be possible to get useful estimates with less observations (Gottschalk and Huettmann, 2011), but then it is still a drawback since it is impossible to get enough observations when species only have one or a few territories in the survey area, as is often the case for (threatened) farmland birds. Territory mapping accounts for imperfect detection by setting a minimum number of observations needed. Bibby et al. (2000) suggest at least two observations obtained during 8, or fewer, field visits. To define a territory based only on a fixed number of observations, usually equal for the different bird species, might be problematic. According to Gottschalk and Huettmann (2011) better criteria such as a species-specific minimum number of observations and a species-specific maximum distance between registrations should be used to set a territory.

An advantage of territory mapping is that it is spatially explicit. It gives fine spatial details where the territories of the birds are situated which can be correlated to environmental variables such as farmland agreement measures (Douglas et al. 2009, Burgess et al. 2015).

## FIELD METHOD

The aim of the territory mapping method is to estimate the number of (potential) breeding pairs in the area (Bibby et al., 2000). All birds seen or heard in the monitoring area are noted on a map. The observations of several visits during the breeding season are combined, based on a set of rules to delineate breeding territories. An advantage of territory mapping is that it is spatially explicit. It gives fine spatial details where the territories of the birds are situated which can then be correlated to environmental variables such as farmland agri-environmental measures (Douglas et al., 2009; Burgess et al., 2015). The method described here is derived from Bibby et al. (2000) and Vergeer et al. (2023).

Field work is carried out in both the demonstration and reference site(s). The whole area should be covered during one monitoring session. In general, about 200 - 250 Ha (3 to maximum 4 hours of counting, about 6-7 km walking) can be covered in one morning in flat open areas, such as Flanders and The Netherlands. When the area is hilly, with many hedges, as in the UK or Germany, the area will probably be smaller. For large areas, sometimes several mornings are needed for a complete session. Field surveys take place in the morning, starting around sunrise, preferably on days with calm, sunny weather and average temperatures and should be finished in about 4 hours. Most birds are active around sun rise. Activity declines rapidly and almost stops around noon. The survey of the demonstration site and corresponding reference site should be carried out on two consecutive days to avoid data being affected by varying weather conditions. At least 5, but better 7 to 10, field visits (minimum 10 days apart) during the breeding season of the target birds (for the PARTRIDGE sites this was between the beginning of April and end of July (peak overall breeding season) are required. Ideally, the same observer should monitor all survey points at the demonstration and reference sites. If two surveyors are used, they should be RANDOMLY allocated to survey demonstration and reference sites, whereby both surveyors monitor at both sites and NOT one doing the demonstration and the other the reference site only - this can result in biased data.

## Counting session

The observer walks slowly along a transect that covers the whole area that must be monitored. Every bird that is seen or heard is noted carefully on a map of the site. Each observation is assigned a breeding code from 0 to 16. A higher number indicates a higher breeding certainty. When two birds are seen/heard simultaneously, or when two birds are seen along the transect and it is unlikely that these observations belong to the same bird, these are exclusive observations that indicate that these birds represent two separate territories.

Breeding codes. Adapted from (SOVON 2016).

| Breeding code | Description |
|---|---|
| 0 | Other / outside breeding habitat |
| **Birds seen in breeding habitat** | |
| 1 | Adult bird in breeding habitat |
| 3 | Pair (when singing/display, use code 2 or 5) |
| **Territory indicating behaviour** | |
| 2 | Singing / displaying male |
| 5 | Courtship and display behaviour |
| **Nest indicating behaviour** | |
| 6 | Visiting probable nest site |
| 7 | Agitated behaviour or anxiety calls (adults) |
| 8 | Adult with brood patch |
| 9 | Nest building |
| 10 | Distraction display or injury feigning |
| 11 | Recently used nest |
| 12 | Recently fledged young |
| 14 | Transport of food or feacal sac |
| **Nest found** | |
| 13 | Used nest (adult entering or leaving) |
| 15 | Nest with eggs |
| 16 | Nest with young |

Since bird activity changes over the course of the morning, routes should vary between visits to prevent the same sections being visited during the same period across subsequent sessions.

## TERRITORY INTERPRETATION

At the end of the monitoring season, the field maps of the different field visits are combined to construct an overall seasonal map. The clustering of the individual points of a species is based on a number of rules summarised below. For more details we refer to Bibby et al. (2000) and Vergeer et al. (2023).

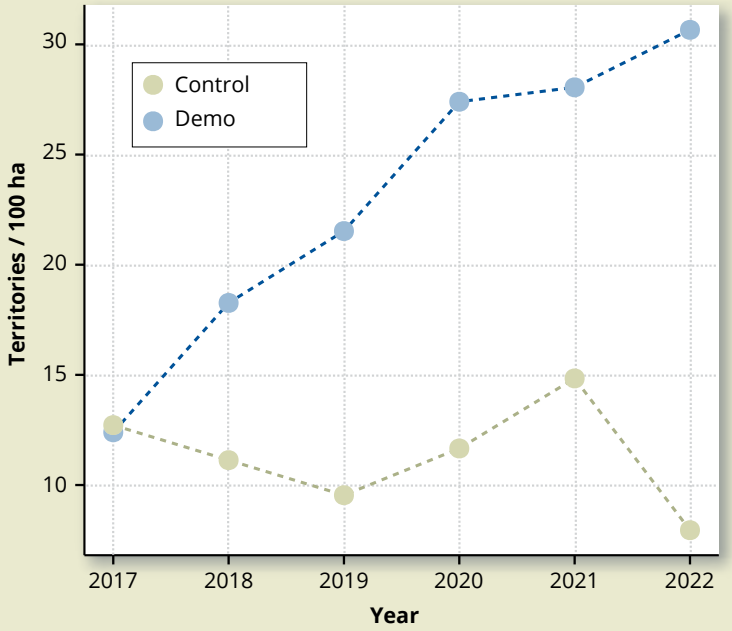
- **Minimum number of observations:** For breeding codes 1-6 (single individuals up to territorial behaviour), a territory consists of a minimum of 2 points in the case of 8 or less field visits, or three points with more visits. Nests or nest-indicating behaviour (codes 7 and higher) always results in a designation of a territory, even with fewer observations.
- **Excluding observations:** Two birds recorded during the same visit, and determined to represent two different birds, cannot belong to the same territory.
- **Date limits:** These limits help to delineate nesting behaviour. To exclude migrants or vagrants, an observation must fall within these date limits to be valid, except when a nest is found, or nest-indicating behaviour is observed.
- **Fusion distance:** Maximum distance between two non-exclusive observations to allow inclusion in the same territory.

The values for date limit and fusion distance are species specific and can be found in Vergeer et al. (2023). The values reported in Vergeer et al. (2023) may seem too precise and not reflecting the range of likely values. Of course, in real life, territories do not have a fixed size. But the numbers used for calculations are based on long-term experience and have resulted in the most reliable results. When combining the observation points into clusters, consistency is more important than any notion of absolute correctness.

In 2013, SOVON, the Dutch Centre for Field Ornithology, developed an auto-cluster tool (Van Dijk et al. 2013). This automated technique standardises the interpretation of the observation clustering which makes the results comparable over survey areas and years. Clustering is based on nearest neighbourhood agglomerative clustering. In subsequent steps, the nearest observations are grouped, considering the previously mentioned species-specific characteristics. To simplify and standardise the fieldwork, SOVON also developed an AVIMAP-app to allow the entry of the observations directly in the field on a smartphone or tablet (SOVON 2015). The app runs on a smartphone/tablet with GPS. After completing a survey, the data are uploaded to a server for further analysis. In PARTRIDGE we successfully used this app.

## DATA ANALYSIS

The total number of territories is divided by the surveyed area of the site in Ha, multiplied by 100 to get an index of breeding density per 100 ha. Breeding densities are compared between the demonstration site and reference site to assess the effect of the implemented habitat measures. A graph of the breeding density indices for the demonstration site(s) and control site(s) over several years gives a good indication of the trend in breeding bird abundance and whether this trend is more positive (or less negative) on the demonstration site(s) versus the reference site(s). The territory mapping should begin before the habitat measures are implemented to better capture the effect of any changes on breeding bird abundance.




## WORDS OF CAUTION

Deviations from the protocol should be avoided as much as possible, as they can seriously affect the precision of the counts. Therefore, it is important that all participants are aware of the protocol guidelines and comfortable with the implemented technique before monitoring starts. Especially when different sites are counted by different observers. It is important to be very precise when adding observations on a map (also in the AVIMAP-app) because distances between points is an important part of determining whether recorded bird locations indicate a separate territory or not. Also, surveyors must carefully observe and record the behaviour of a bird as a higher breeding code results in a higher probability of a territory.

When territory interpretation is done manually, interpret the rules as consistently as possible to allow comparison between sites and years. The more discrepancies in interpretation, the more difficult it will be to understand the results.

### BACKGROUND

*This factsheet is based on experiences collected during the seven years of the North Sea Region Interreg PARTRIDGE project, where farmland birds (and other species groups) were monitored at 10 demonstration and 10 reference sites across Belgium, England, Germany, the Netherlands, and Scotland. For more information visit: PARTRIDGE, Interreg VB North Sea Region Programme.*

## BACKGROUND LITERATURE

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