## 3.2. INDIRECT METHODS

These methods are based on the detection of signs of presence, but not on living animals.

### 3.2.1 Pellet counts

#### Objective

Record the number / frequency of faecal pellet group per unit of effort to calculate local density.

#### Measure estimated

Local density.

#### Applicability

All ungulates.

#### Methodology

Pellet counts are frequently used to monitor wildlife species. In fact, there are lots of different approaches towards the estimation of ungulate abundance based on the counting of faecal pellet groups along transects or within plots. Two main groups of approach may be distinguished based on the cleaning or not of the investigate area before the counting of the faecal pellets (Putman, 1984). The faecal standing crop (FSC) is implemented by counting the number of accumulated pellet groups within randomly distributed sample quadrats, or along fixed transect lines without cleaning the study area. In this case, to estimate the population size, it needs to know the defecation rate (the increase of faecal pellet every day per each animal) and faecal decay rate (how many faecal groups disappeared).

Conversely, faecal accumulation rate (FAR) removes the source error intrinsic in the estimation of the decay rate. Initially the operators must clean the sample areas of all ungulate faeces and then re-examining the same areas after a fixed time to determine the number of pellet groups accumulated during this interval. The precision of the density estimation can be calculated by the dataset, whereas the accuracy of these different techniques has been estimated several times in several species obtaining variable conclusions. The precision of both FAR and FSC declines with declining pellet group density (Campbell et 2004).

One of the more important sources of variability is the defecation rates which are not uniform in space and in the time. Variations of defecation and decay rates, which can be very local, need to be assessed to make results comparable and able to be converted into estimates of local population density. This prevents this method to be used to estimate population density, but indices of abundance. A huge effort is required to locally estimate defecation and decay rate. Some approaches are used for wild boar (Massei et al. 1998, Ferretti et al. 2014, Plhal et al. 2014, Ferretti et al. 2016).

A proxy of the population aggregation can also be estimated from this method by statistically analysing the dispersion of faeces along the transects (Acevedo et al. 2007). Population abundance and aggregation are two key parameters for epidemiology. Therefore, this method is widely applied in epidemiological studies. Nonetheless, variations of defecation rate and dung persistence rate, which can be very local, need to be assessed to make results comparable and able to be converted into estimates of local wild boar population density. Evaluation of this method can be seen in Table 1.

#### Evaluation

- Appropriateness to estimate: Local density
- Pro: low costs/efforts.
- Con: defecation and decay rates should be known on a local basis and referred to a specific season for every study area.
- Accuracy: species, habitat and locally related.
- Habitat: all, performs well in forest and mixed landscapes.

## Recommendations to improve comparability and accuracy:

• To estimate density, calculate local defecation rate and dung persistence rate for that population during season and for the year when count is to be performed.

• Design must be adapted to aggregation of faecal pellets distribution.