NBCI Technical Manual

Covey Count

October | 2018

Covey Count Manual

NBCI™
National Bobwhite
Conservation Initiative

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Photos/Videos:

- “Covey Count” video based on NBCI training in Kansas, and observation by Mark McInroy, Iowa Department of Natural Resources (page 1).
- “Covey Count Overview” video based on NBCI training in Kansas, and observation in Missouri by Tim Kavan, Missouri Department of Conservation (page 1).
- Photo of covey count training, based on observation by Jeff Prendergast, Kansas Department of Wildlife, Parks and Tourism (page 2).
- Photo of sunrise covey count, based on observation in Missouri by Tim Kavan, Missouri Department of Conservation (page 3, page 7).
- “Performing a Covey Count” video based on NBCI training in Kansas, narration by Mark McInroy, Iowa Department of Natural Resources, and observation by Tim Kavan, Missouri Department of Conservation (page 6).
- “Advantages of Electronic Callers” video based on NBCI training in Kansas for a large group of biologists (page 10).
- Photo of trainees in Kansas (page 10).
- “Training Field Personnel” video based on NBCI training in Kansas, trainees comparing observations (page 10).

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Introduction

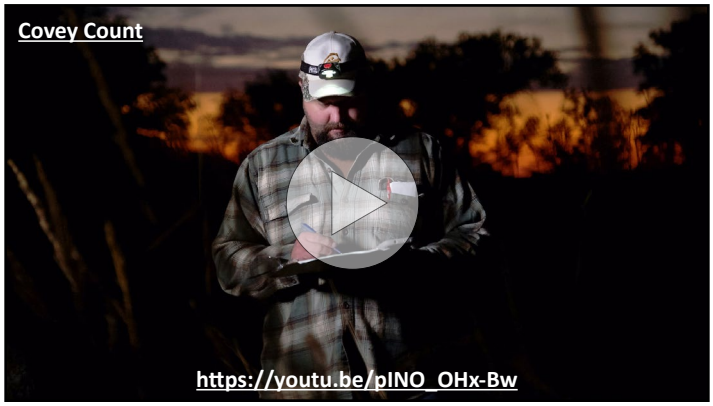
The National Bobwhite Conservation Initiative (NBCI) Coordinated Implementation Program (CIP) provides guidance to state wildlife agencies and partners for successfully implementing bobwhite conservation. An important part of the CIP is a standard method to estimate population density of northern bobwhite. NBCI CIP is an addendum to the foundational plan, NBCI 2.0, located at https://www.quailcount.org/nbci2_0.html. The population monitoring portion of NBCI 2.0 (Evans et al. 2011) describes the importance of using methods that provide for estimation of density by incorporating variation in detection probability. Beyond the technical aspects of monitoring, keeping track of quail abundance is important in the context of quail hunting. NBCI 2.0 and the National Bobwhite Technical Committee (NBTC) are tied directly to state wildlife agency quail hunting programs through population objectives based on opportunity for sustainable recreational hunting. Although hunting per se isn't relevant for all CIP areas, CIP quail population goals are defined by measurement during fall (NBCI 2.0, Table 1), just prior to the hunting season.

This manual will serve as an introduction and reference guide for measuring bobwhite abundance during fall and is an extension of NBCI CIP v1.1. Make sure to familiarize yourself with CIP, particularly Tables 1 and 3. A revised version of Table 3 is located on the fall covey count web page (https://www.quailcount.org/monitoring/fallcovey.html), where you can also find videos that illustrate protocol.

Background for Fall Population Monitoring

Bobwhite management has historically focused on providing opportunity for quail hunting, and consequently, pre-hunting season counts of bobwhite abundance are a standard practice. Fall bobwhite covey calling observations are one of the highlights of a wildlife manager's job, as seen in video titled "Covey Count" of bobwhites greeting the morning.

With quail hunting as the driving force behind state agency-based quail restoration—and the purpose of the NBCI and NBTC—bobwhite population objectives are in most cases well above minimum viable population levels. Quail hunters have high



expectations, and thus management concepts from 60 years ago are still relevant today. Aldo Leopold put it best: "Continuous census is the yardstick of success or failure in conservation" (*Game Management*, 1933, 169-70). Although modern breeding-bird surveys add important information to bobwhite management, success or failure is based on quail abundance closer to hunting seasons. The following video, "Covey Count Overview," illustrates the importance of fall covey counts to state agency quail management.

Bobwhites are recognized as one of the most studied wildlife species (e.g., Thomas G. Scott's *Bobwhite Thesaurus* published in 1985), and estimation of bobwhite abundance has long been a focus (for recent examples, visit NBCI's National Quail Symposium Proceedings). Approaches to estimating abundance include:

- Statistical population reconstruction using wings from harvested bobwhites (Terhune et al. 2017);
- Mark and recapture of quail (O'Brien et al. 1985);
- Visual counts of quail by observers on foot, horseback, vehicle, or aircraft, in some cases with the aid of hunting dogs, searching a defined

area, or using line transects (Guthery 1988, Janvrin et al. 1991, Guthery and Mecozzi 2008, Bruno et al. 2017);

- Auditory observations of quail in a defined area (Wellendorf and Palmer 2005); and,
- Auditory observations of quail around a point (DeMaso et al. 1991, Rusk et al. 2006, Smith et al. 2006, Sisson and Terhune 2017).

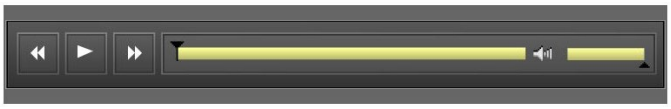
Each approach has strengths and weaknesses, and some studies have addressed bias and accuracy (e.g., Janvrin et al. 1991, Bruno et al. 2017). Auditory observations of calling bobwhites around a point during fall and the breeding season have been used recently for nationally-coordinated monitoring programs such as the CP-33 Habitat Buffers for Upland Birds National Monitoring Program (Evans and Burger 2013). NBCI CIP adopted these point transects in fall and the breeding season. (For information on breeding season monitoring, visit https://www.quailcount.org/monitoring/springbb.html.)

There are key differences in bobwhite auditory behavior between the breeding season and fall, affecting monitoring protocol and estimation of abundance. Bobwhite males call repeatedly during the day in the breeding season, whereas bobwhites call in fall just prior to sunrise, and only for a few minutes. The resulting opportunity for daily measurement of abundance is multiple points per observer per day in the breeding season, but only one point per day per observer in fall. Abundance of calling male bobwhites is estimated in the breeding season (male bobwhites/acre), whereas during fall, covey density (coveys/acre) is estimated. In both breeding season and fall, the observer estimates calling quail locations around the observation point (allowing calculation of distance measurements in the office) and number of calling "units"—males in the breeding season, coveys in the fall. For fall counts, several iterative steps allow estimation of individual bobwhites in the population (bobwhites/acre). Size of the covey needs to be measured or assumed, which is the first iterative step to determining abundance of individuals. Decades of bobwhite research has produced relatively good estimates of covey size, but because of seasonal and geographic variation, measurements of covey size for each CIP project are more appropriate. Although it is tempting to provide estimates of covey size encountered separate from pre-dawn covey counts (during field work, hunting, etc.), those estimates are not acceptable for CIP population estimation.

Another iteration of estimation can be made in analysis, adjusting raw daily covey counts with empirically determined covey calling rates. This analysis is based on data from several study sites around the species range (Evans et al. 2012). However, Evans et al. (2012) caution that further research is needed concerning utility and ubiquity of calling rate predictors. Alternatively, calling rates can be estimated using the time-of-detection method (Riddle et al. 2008), and this is the approach adopted for CIP. Further, the approach of Royle et al. (2004) is being used to provide a distance-sampling model that yields analysis of the relationship between habitat and wildlife population density (personal communication, James A. Martin, University of Georgia).

Covey Calling Behavior

Fall is a transition period for northern bobwhites. Individual males are no longer trying to define their territory and attract mates with the famous "bob-white" whistle. Instead, males and females have fledged many young and begin forming coveys and establishing their winter ranges. Consequently, quail enthusiasts conducted considerable research to understand bobwhite calling behavior during the non-breeding season—at the end of the nesting season and prior to hunting seasons—simultaneously meeting information needs for the species and for hunting. Coveys announce their location to their neighbors using the less known "koi-lee" covey call. Covey call surveys provide an easy opportunity to estimate bobwhite populations on NBCI CIP focal and reference areas. Understanding where bobwhites roost and how the time of day and year, weather, and covey densities affect calling behavior will help observers conduct the covey call surveys.



Nocturnal Roosting Locations

Observers can improve estimation of covey locations using their knowledge of covey roost locations. In the fall, bobwhites call prior to leaving roosts. Bobwhites roost in herbaceous vegetation in open landscapes (grass, weeds, crop fields, etc.) rather than in woody vegetation (shrubs, briars, fence rows, trees, etc.). During winter when herbaceous vegetation is reduced by farming, snow, ice, etc., bobwhites still prefer to avoid roosting in woody vegetation, and, as a major study in Missouri found, they typically use old fields, early successional vegetation, and native warm-season grasses (Chamberlain et al. 2002). Observers lacking radio-telemetry locations can learn roost locations from repeated auditory observations and by flushing quail immediately after they call (described below).

Calling Behavior

Several studies elucidated quail calling behavior (Demaso et al. 1992, Hamrick 2002, Wellendorf et al. 2004, Seiler et al. 2002) and found bobwhites typically call 20-30 minutes before sunrise. Per Wellendorf, the average number of calling events for a covey was 1.5 per morning, and each calling event consisted of approximately 31 distinct "koi-lee" calls. The short but intense burst of calling activity highlights the importance of starting the survey on time and mental concentration. If you miss the first call of a covey, you may not hear it again.

Time of Year

The survey period for the CIP fall monitoring is a 6-8 week window centered on the peak calling period for bobwhite and ending prior to the hunting season. Evans et al. (2012) summarized observations of Wellendorf et al. (2004) and Seiler et al. (2002) that peak calling is about the end of October. The peak in calling can vary regionally, so local information can be beneficial to picking a start date.

Weather

Wellendorf et al. (2004) found that coveys were more likely to call when barometric pressure was rising, cloud cover was minimal, and wind was light. The NBCI CIP protocol requires collecting this weather information so that it can be used in the analysis estimating covey densities (CIP, Table 3; Covariates for estimating detection probability: Wind, noise, weather, barometric pressure). The protocol also limits daily measurements to these weather conditions: cloud cover <75%, wind speed lower

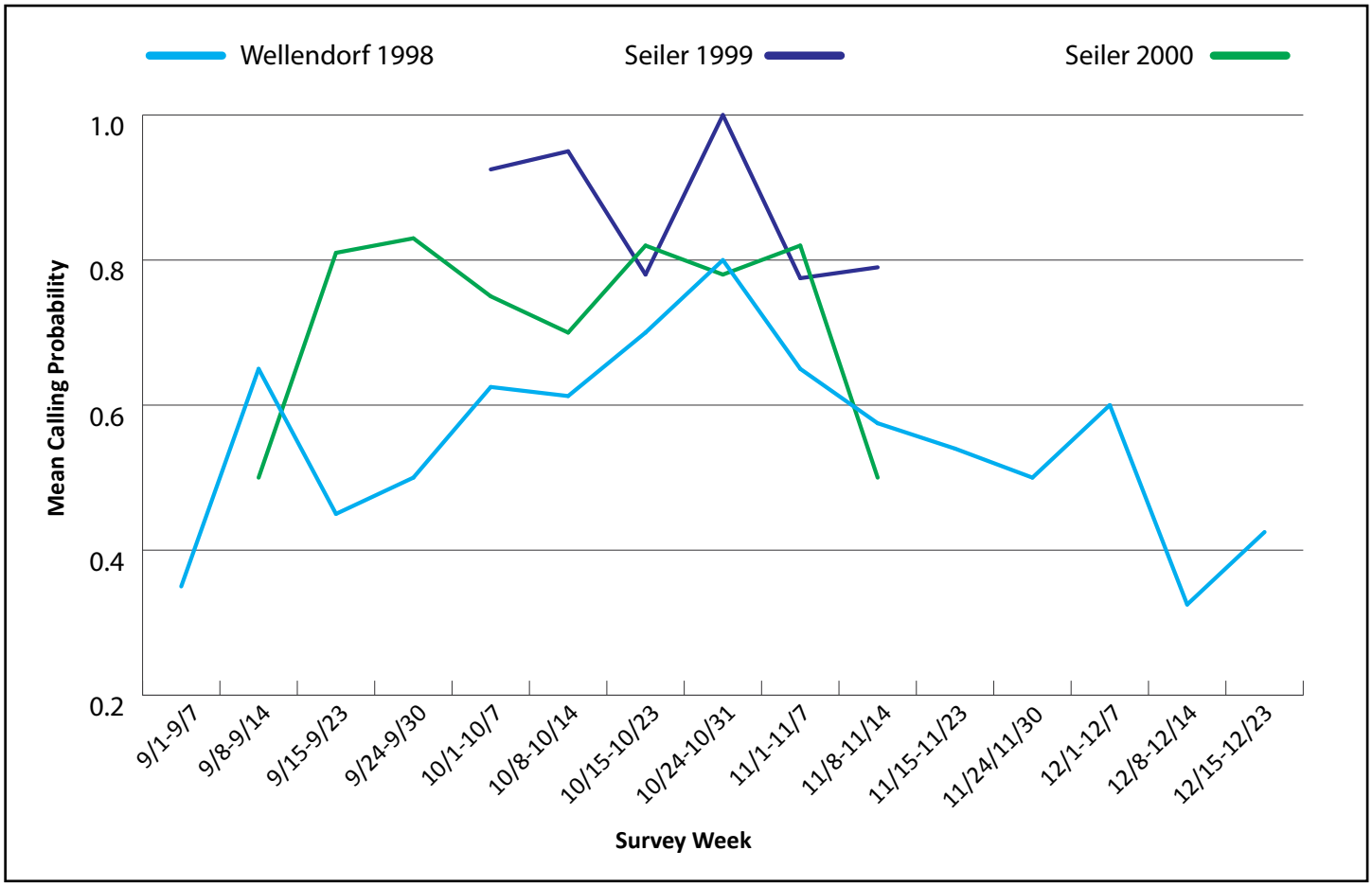


Figure 1: Mean bobwhite calling probability for southeastern states and Missouri (personal communication, Kristine Evans, Mississippi State University).

than a four on Beaufort scale, and no rain or snow. Obtaining an adequate number of observations can be enhanced by sampling on mild weather days; however, experience teaches this could necessitate beginning call counts early in fall before seasonal calling rates peak. Also, earlier in the Fall, family groups are breaking up into coveys, resulting in potentially higher variability in calling, covey size, etc.

Covey Density

There is a strong social component to covey calls for bobwhite. Wellendorf et al. (2004) found the likelihood of a covey calling increased with the number of other coveys nearby (Figure 2). This behavior is problematic in areas with low populations because it may lead to false zeros during surveys. Playing a recording of a covey call may help stimulate calling activities for areas with low bobwhite densities. This should only be done with low populations. If observers intend to broadcast covey calls during a CIP survey, they should survey each point twice before using a recorded call. Alternatively, the call could be played after the survey is completed (after sunrise).

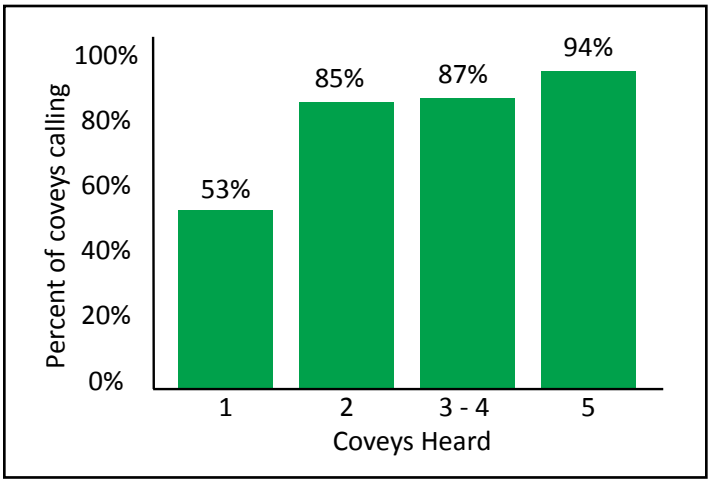


Figure 2: The probability a bobwhite will call in relation to other bobwhites that are calling nearby.

Distance Sampling and Fall Covey Counts

Point count surveys are a common method to survey bird populations. However, the raw counts are not perfect estimates of the population at a point. The best and most experienced observers will still miss coveys during a count. A covey may not call at all, or a covey that does call could be undetected because of noise interference (wind, other calling coveys, etc.), distance from the observer, topography, etc. These issues are common problems with all bird surveys. However, with good survey design, there are statistical methods that can estimate how many coveys were missed during a survey.

A key factor in detecting calling quail is distance, and a substantial amount of research on bobwhites in the fall indicates they can commonly be heard 500 meters away and as far as 900 meters (Rusk et al. 2009). Obviously, an observer is more likely to hear a covey that is close than one that is far away. The relationship is easily seen by looking at the number of coveys detected by distance from the observer (Figure 3). Close distances will have a lot of detections, and further distances will have few. If an observation point is randomly located on the landscape, the number of coveys close to the observer should be similar to the number of coveys far away from the observer.

The CIP uses distance sampling to survey coveys. This requires observers to estimate the location of each covey on a map, which is used to measure the distance from the observer. Buckland et al. (2001) describe the statistical analysis that can use the distances from the observer for each covey and estimate how many coveys were missed.

The following are key assumptions of Buckland et al. (2001) and application to CIP point distance sampling:

1. All coveys near the observer are detected. Therefore, if coveys nearby and far away call simultaneously, the observers should prioritize the closest coveys. In addition, in distance analysis, far-away distance measurements are often not used in the analysis, the data are often truncated at <500 meters.
2. Coveys are detected at their original location. Unlike breeding male calls, fall covey calls from roost sites last only minutes, so it is unlikely that this assumption is violated.
3. Location of coveys are estimated accurately, and estimates are unbiased. It is most important to avoid systematic bias, i.e., habitually overestimating or underestimating calling locations (ideally a net observer error of zero meters). Training and practice (see *Training Observers* section) on wild quail, using electronic callers, and understanding roosting behavior, can increase accuracy and reduce bias.

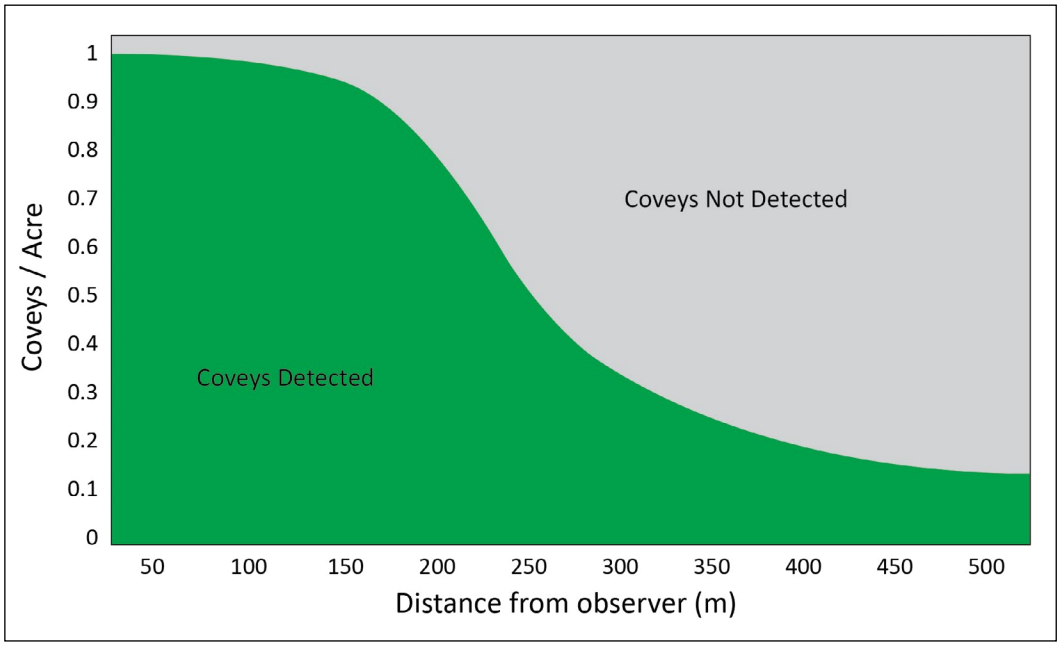


Figure 3: The densities of coveys detected near observers is higher than away from observers. The rate of this decline can change from many factors. Distance sampling analysis can incorporate these factors and estimate how many coveys were not detected.

Field Protocol

Detecting Calling Coveys

As established previously in the "Covey Calling Behavior" section, fall covey monitoring typically begins in October and must be completed in a 6-8 week window prior to the hunting season. The local CIP coordinator sets the survey duration based on the peak calling period for bobwhites in the state. In areas with low densities of bobwhites, each point on the focal area should be surveyed at least two times separated by at least a week. Most survey locations will be along a road and easy to access. However, observers should visit the survey location before collecting data. Finding the point in the dark can be difficult, so use a GPS unit or mark a permanent fence post with reflective material. The survey begins 45 minutes prior to sunrise. Observers should arrive 15 minutes early to allow time to get ready. The survey ends at sunrise. Observers should not leave the point until the survey is completed.

Observers should bring the Observer Data Sheet and Covey Location Field Map. Focal area coordinators can download a copy of the Observer Data Sheet and an ArcGIS map document template to make the Covey Location Field Map from www.quailcount.org. Prior to starting the survey, observers should record their name, the point ID, date, sunrise time, and actual starting time on the Observer Data Sheet. Weather information should be recorded immediately after calling trails off, or no later than 15 minutes before sunrise if no calling is heard.

The Covey Location Field Map is used to mark the approximate location of each covey heard during the survey. Observers should place an "X" at the location of the covey, assign a number to the covey, and record the time the covey was detected. The covey ID and time it was detected should also be recorded on the Observer Data Sheet along with the confidence the observer had in estimating that location. Time-of-detection is used to estimate calling rates.

As indicated in CIP Table 3, observers should be conservative in estimating the number of coveys. For example, if calling coveys are close together, use the 30-meter rule, a convention arrived at arbitrarily by

past research. If two or more "coveys" are perceived to be, or are later measured to be, within 30 meters of each other, only count as one covey, retaining the location estimated first. This decision is best made in the field.

As indicated in CIP Table 3, broadcasting a recording of a covey call is allowed, but is recommended only if there is extreme uncertainty about the presence of bobwhites. If a broadcast call is used, do so either after two completed surveys on the point or after completing a normal 45-minute observation, i.e., on a third visit or after sunrise. You can download a five-minute recording of the covey call on www.quailcount.org. Set the speaker loud enough that you can hear it ~500 meters away, and play the recording once. You should continue listening for responses for three minutes after the recording ends.

Determining Covey Size

Upon completing the auditory survey, observers should locate and flush coveys detected. This is not a requirement of CIP, but it will help in estimating the total number of quail (i.e., quail per acre), and improve accuracy of locations. Per CIP Table 3, a minimum of 10 covey flushes should be used to estimate average covey size and the variance.

Most coveys move soon after they call, so begin searching immediately at sunrise, and if feasible, with a trained bird dog. If coveys are located, record the number of birds observed and the how confident you are in the accuracy of the count. It is very important to report the observation whether only one quail, or many, were observed. Do not report observations

of quail in coveys outside the call count survey (e.g., during routine field work or by hunters). Do not change the location of the covey on the Covey Location Field Map based on where the covey was flushed.

Research provides some understanding of finding coveys and flushing them. Systematic searches by multiple observers walking parallel directions and 10 meters apart can detect as many as 60% of coveys (Janvrin et al. 1991). Adding dogs to systematic searching can increase detections, and of course is the basis for most quail hunting (Guthery and Mecozzi 2008, Sisson et al. 2000). During quail hunting season, Sisson et al. (2000) estimated that with bird dogs, 53% of coveys were detected, on average, and Terhune et al. (2017b) reported 73% of quail ("within a dog's scent radius") were detected by pointing bird dogs, guided by hunters on foot and horseback.

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Covey Location Field Map

For each calling-covey location, mark (X) Covey ID and Time Detected and transfer this information to observer data sheet.

Notes:

N

50 100 200 300
Meters

1 Inch - 160 Meters

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Observer Data Sheet

Observer Name		Date	Start Time	Sunrise Time
Point ID		Latitude		Longitude
Cloud Cover %	Wind Code 0-3	Noise Code 0-3	Stimulation ☐ Yes ☐ No	Replication 1-3

NBCI Fall Covey Call Observer Instructions

1. Make sure you know how to find listening point (i.e., post marked with reflective tape) in the dark. Prior to the field, record Observer Name, Date Sunrise Time, and Point ID in the form above.
2. Collect data 45 minutes before sunrise. Record actual Start Time.
3. Weather: do not collect data if it is raining or snowing (fog is fine, but increases sound). Favorable wind speed is <4 mph, cloud cover <75% and <0.05 in./Hg change in barometric pressure (0100-0700 hr). Bobwhite calling is positively related to high barometric pressure.
4. On covey location field map, record location of each calling covey with an X, as well as Time Detected and Covey ID on the form to the right. A calling covey is defined as a single or grouped series of "koi-lee" vocalizations coming from a fixed location.
5. Data fields:
   - Cloud Cover, Wind Code and Noise Code: Estimate immediately after calling trails off. If birds are not heard calling by 15 minutes before sunrise, measure immediately (don't wait until sunrise).
   - Wind Codes:
     0 - 0 mph/still
     1 - 1-3 mph/wind shown by smoke drift
     2 - 4-7 mph/wind felt on face, leaves rustle
     3 - 8-12 mph/leaves in constant motion

     Noise Codes:
     0 - silent
     1 - distant noise not interfering
     2 - at times difficult to hear
     3 - constant noise, hard to hear
   - For each mapped X (covey location), transfer Time Detected and Covey ID, indicate your Confidence in Covey Location Estimation, and if a covey was flushed, record the number of Quail in Covey. Estimated calling covey locations (Xs) <30 meters apart are classified as one covey. Be conservative.
   - Do not stimulate calling, except as specified in CIP Table 3. Use of any stimulation (e.g., electronic call) significantly reduces capacity for estimating abundance. Check the box Yes or No for Stimulation.
   - Complete the remainder of data as instructed by coordinator.

Covey ID	Confidence in Covey Location Estimation: High, Medium or Low	Time Detected	Quail in Covey #	Confidence in Quail Counted: High, Medium or Low

Training Observers

As illustrated in the video titled “Kansas Training” found on the CIP Overview page of quailcount.org, fall covey counts and associated training are integral parts of state agency bobwhite management. Training and practice are important to improve accuracy of estimating covey calling locations, including using wild coveys prior to surveys, reinforced with flushing of observed coveys during surveys, and/or electronic speakers playing the call. Be aware that coveys can sound further away if the calling quail are facing away from the observer, can sound closer in dense fog (which magnifies sound), and can echo near stands of trees. Again, practice is the key to improving location estimates. At a minimum, observers should have one practice session with wild bobwhites prior to collecting data.

Training using electronic game callers and a recording of a covey call can be used at any location, at any time, for any amount of time, for a large group, and can be designed to illustrate numerous population and auditory scenarios (near, far, echo near forests, topography, etc.) (Seiler et al. 2005). However, game callers are not a perfect replacement for coveys because it is difficult to match the volume of real bobwhite. Game callers should be set just loud enough to be heard 500 meters away to best replicate real bobwhite.

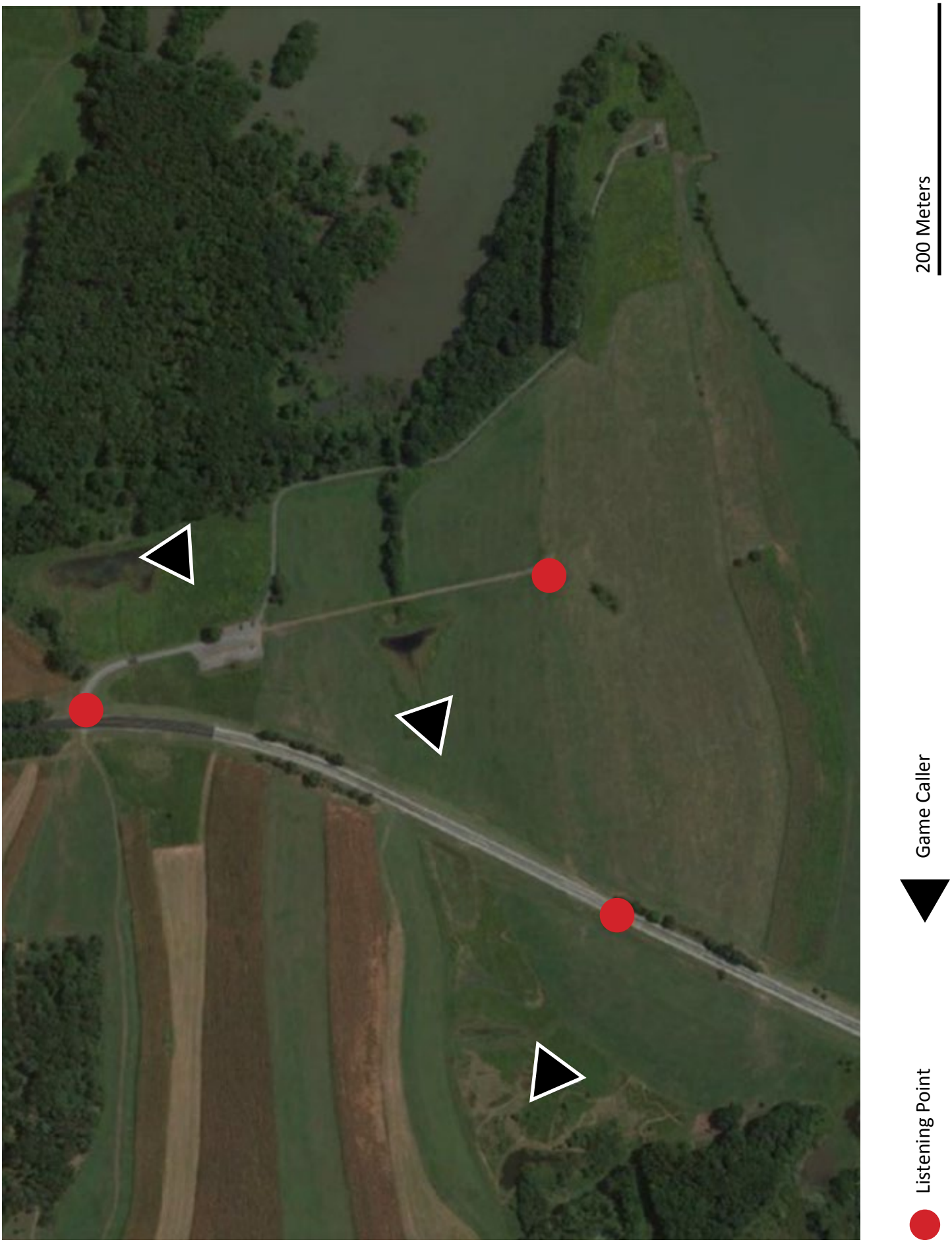
The NBCI has game callers that can be loaned to help train observers for the CIP covey monitoring program. Below are tips for training with game callers:

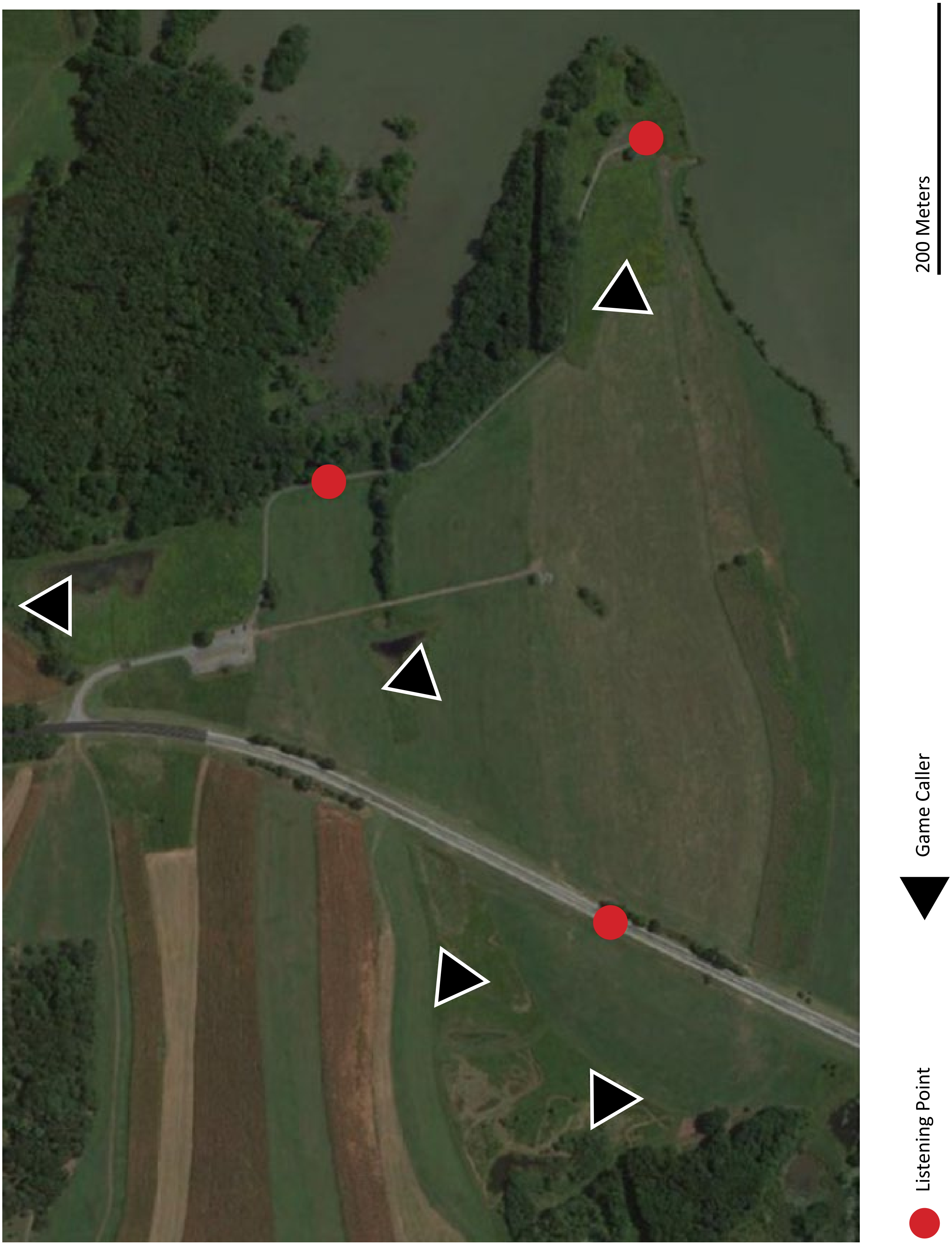
- For beginners, do not start with too many callers playing at once. Start with one or two add more as observers improve.
- After covey locations have been marked on the map, have an assistant walk to each caller so the observer can relate their perceptions to physical locations.
- Place callers in fields with vegetation tall enough to hide them from the observers. However, you should mark or record GPS location of all callers so they can be found afterward.
- If there are multiple observers practicing from the same location, they should work independently. At a minimum, observers need to ignore other observers’ behavior. The best approach is for the trainer to ensure observers cannot see each other using vegetation or designed visual barriers (e.g., cloth hung between tall fence posts).
- Set up multiple listening points for the same caller arrangement. This will reduce the amount of time needed to set up and move callers. It will also help observers understand how sound changes based on their location and direction of calling.
- Provide multiple scenarios that could be encountered in the field, including:

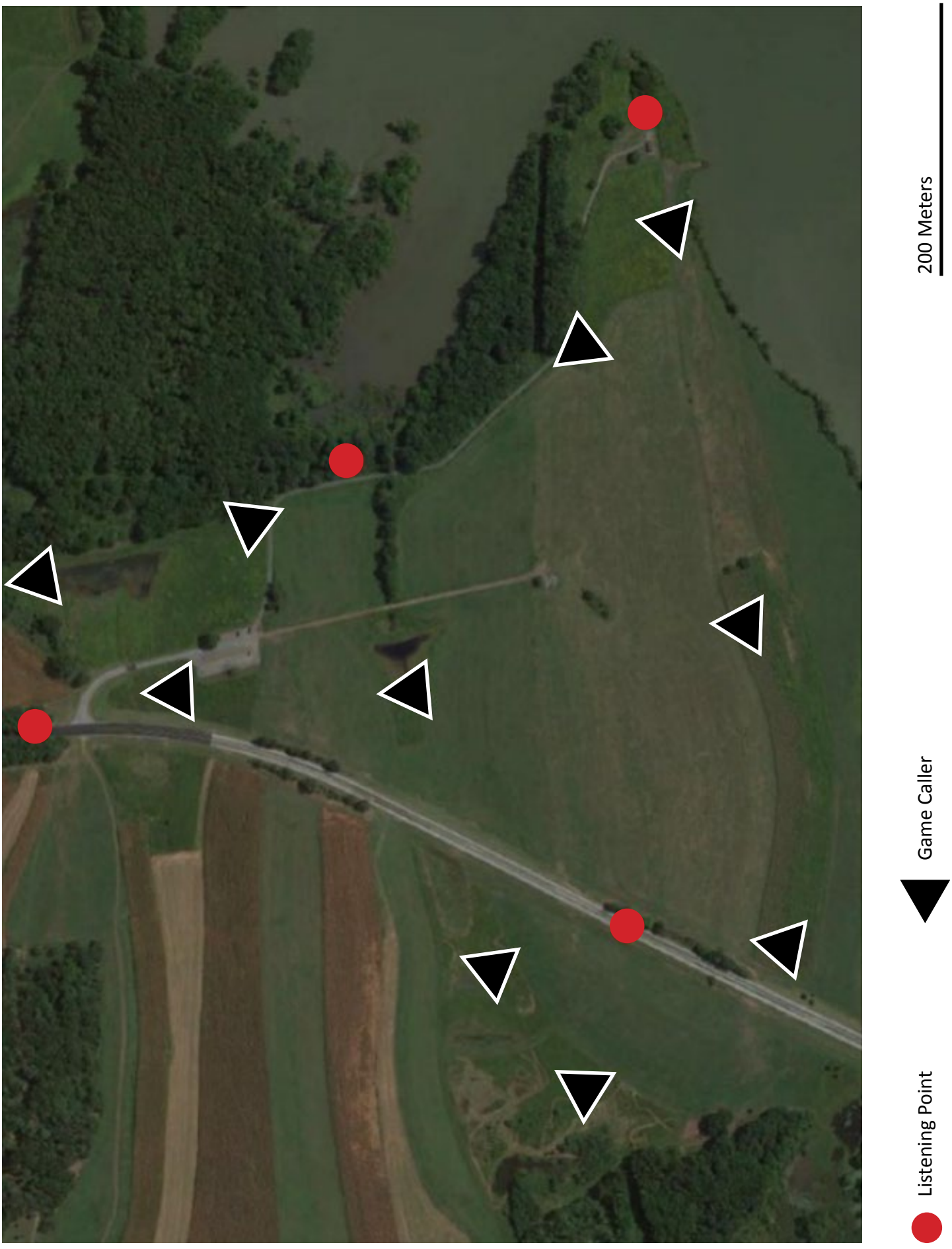
- Placing callers at the top and bottom of hills.
- Place callers in all directions around listening points.
- Place callers at multiple distances from each listening point.
- Place callers behind patches of trees or shrubs but not in the patches.
- Make sure callers are at least 30 meters from each other.

The following pages contain examples of how a field can be set up for training observers using the game callers. The scenarios go from least difficult to most difficult. The most difficult scenario would likely be too difficult for observers who have never conducted bird point count surveys. It would be best to start with the least difficult scenario and work up to the most difficult.

Icotec GC 350 Game Caller with remote. NBCI owns many of these callers and can loan them for covey count trainings.


200 Meters
Game Caller
Listening Point


200 Meters
Game Caller
Listening Point


200 Meters
Game Caller
Listening Point

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