

Data Standards and Survey Protocol for Pinyon Jays

Version 1.0

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Pinyon Jay Working Group

Audience and Purpose: This document presents the interagency Pinyon Jay Working Group’s (PJWG) recommended Pinyon Jay data standards and survey protocol. The PJWG encourages all researchers, agency biologists, contractors, and others involved in designing or conducting Pinyon Jay surveys in 2021 to follow these guidelines. Feedback from the first year of implementation will then be used to evaluate, revise and optimize the guidelines as needed.

This document has two primary purposes. First, it provides a “how-to” guide for surveying Pinyon Jays that is specifically tailored to the unique characteristics and distribution patterns of this species. Second, it ensures basic compatibility among multiple data sets to facilitate coordinated and collaborative learning, analysis, and management. The objective of these protocols is to combine range wide survey data to achieve required sample sizes needed to address questions about land management. Large sample sizes are required to answer questions about the effects of different vegetation treatments and best practices for woodland management. All other data collection methodologies and objectives are not addressed in these protocols (see “Exclusions” below). The guidelines are based on the collective experience of PJWG biologists who have conducted many years of research on this species. More information about Pinyon Jay biology, conservation, and status is available at (<https://partnersinflight.org/resources/pinyon-jay-working-group/>).

Content and Applicability: The guidelines are divided into two sections. “Section 1: Data Standards” describes data fields that should be recorded for all Pinyon Jay observations and surveys. “Section 2: Survey Protocol” describes standardized methods for collecting these data. This protocol focuses on collecting Pinyon Jay presence and absence data that can be used to create spatial distribution models, monitor trends in project areas, and find Pinyon Jay flocks for subsequent nest studies. More examples of potential applications of the protocol are given later in the document.

Exclusions:

- 1) The guidelines do not make specific recommendations about how to select sampling units or analytical approach, which are left to the discretion of each project.
- 2) Survey protocol guidelines (Section 2) are not applicable to nest searches (see <https://www.partnersinflight.org/resources/pinyon-jay-working-group/>), telemetry tracking, extended observational studies of Pinyon flocks, or opportunistic data collection by citizen scientists or others. However, projects conducting these types of data collection should adhere to PJWG data standards (Section 1) to the extent possible.

- 1) These guidelines do not specify a shared repository for Pinyon Jay data. However, the PJWG is actively investigating options, and a suitable repository may be noted in future updates.
- 2) The guidelines do not address the statistical problem of how to estimate the accuracy of Pinyon Jay “absences” that are recorded while performing the PJWG survey protocol. The significance of this topic is discussed more fully below, and future versions of this document may contain additional information and recommendations.

Section 1: Data Standards

The most fundamental requirement for data compatibility is ensuring that all survey efforts – regardless of survey protocol – record a common set of attributes describing Pinyon Jay detections and the context of these detections. We distinguish among three different types of attributes, as follows:

- 1) Sighting-level attributes that characterize each detection of a Pinyon Jay flock: Examples of this attribute type are estimated flock size and flock activity type (foraging, nesting, etc.). These attributes should be recorded for every unique detection of Pinyon Jays by all projects regardless of protocol.
- 2) Survey-level attributes that characterize a single survey: Examples of this attribute type are plot ID number, surveyor name, and weather conditions. A given survey can be described by these attributes in a single data record, but there may be many sighting-level records (item 1, above) associated with that survey. Collecting survey-level attributes is critical for projects that adhere to the PJWG survey protocol, but may or may not be relevant for other projects.
- 3) Project-level attributes that characterize projects: These attributes function as metadata for a whole data set, and provide contact information, description of project purpose, and details about project design. These attributes should be recorded for all projects, whether they adhere to the PJWG survey protocol.

Appendices 1 - 4 at the end of this document provide full details about the sighting-level, survey-level, and project-level attributes that are recommended by the PJWG. Additional attributes can be recorded at the discretion of each project. For example, the Appendices do not specify attributes that describe habitat, but many projects may wish to incorporate habitat descriptors into their data collection.

Information about how to integrate sighting-level and survey-level records are discussed in the Appendices. Ideally, survey-level (i.e. “parent”) data are related to sighting-level (i.e. “child”) data using a common data field, or “key”, and project-level data are attached to the data set as metadata. This arrangement provides maximum flexibility and compatibility with normal relational database practices. The PJWG can provide additional information upon request about configuring ArcGIS Collector, ArcGIS Field Maps or other electronic field forms to accommodate this data structure.

Section 2: Survey Protocol

Introduction

Wide use of a standard survey protocol has significant benefits, as illustrated by the North American Breeding Bird Survey (BBS), the Integrated Monitoring in Bird Conservation Regions (IMBCR) program, and others. Neither of these two survey protocols, however, is optimized for Pinyon Jays, which have a year-round presence along with distributional and movement patterns that are unusual for passerines. Therefore the PJWG has created a taxon-specific survey protocol for collecting Pinyon Jay presence-absence data which is described below. The development of taxon-specific protocol follows the precedent taken by the interagency Desert Thrasher Working Group in 2017-2018 (<https://borderlandsbirds.org/projects/desert-thrasher/>) in response to a similar set of circumstances and considerations.

The PJWG encourages all groups to use this survey protocol. Feedback from the first year of implementation will be used to evaluate, revise, and refine the protocol as needed.

PJWG Survey Protocol

The key elements of the recommended PJWG survey protocol are:

- 1) A 2.5 x 2.5 km plot survey unit.
- 2) 1 – 3 visits to each plot (with 7 - 10 day intervals), with three visits recommended where feasible.
- 3) Standardized per-plot survey effort using either an area search approach or a point count approach.
- 4) Typical time for plot survey of 3 – 5 hours.

The PJWG determined that a plot-based approach to sampling design and surveying was most appropriate given the large home ranges and movement patterns of Pinyon Jay flocks. The 2.5 x 2.5 km plot size was selected as a compromise between typical home range size of Pinyon Jays, typical scale of Pinyon Jay habitat selection (as it is currently understood), and logistical tractability. This plot size is likely to create a good balance of biologically-meaningful presence-absence data and potentially informative plot-scale covariates. Larger plots would subsume too much habitat variation and would be difficult to survey thoroughly within daily time constraints (see below). Additionally, 2.5 x 2.5 km plots can be fit evenly into the existing military UTM grid, which can serve as a continuous sampling frame for plot selection across the Pinyon Jay's range. Selecting plots for a given project within this larger sampling frame can be done using random, stratified-random, non-random, or other approaches at the discretion of each project.

Conducting three visits to a given plot, with 7 - 10 days between visits, will provide the best overall accuracy when categorizing plots according to Pinyon Jay presence or absence. However, conducting three visits to every plot may be difficult or unnecessary for some projects, and

therefore number of visits to each plot is discretionary. The PJWG encourages all projects to conduct three survey visits to at least some of its selected plots, however. The reason for this recommendation is that as data for 3-visit plots accumulates, it will become possible to quantify how much additional accuracy and confidence is obtained with each successive survey visit. This information will then be used to refine and optimize future versions of these survey guidelines

To achieve standardized per-plot survey effort, surveyors can conduct either an area search of the plot or counts at points spaced evenly across the plot. The area search approach gives the surveyor flexibility to choose a survey route within the plot that avoids difficult areas and takes advantage of good observation points. The point count approach provides a more structured way to cover a plot that is less reliant on surveyor judgement. For purposes of characterizing Pinyon Jay presence / absence within a plot, the PJWG considers the two approaches sufficiently comparable.

Survey protocol guidelines common to the area search and point count approaches are as follows:

- 1) Configure the field data form to include the data fields specified in Appendices 1 - 4. Additional data fields can be added to the survey form at the discretion of each project.
- 2) Electronic field data collection apps should depict plot boundaries and basemap imagery.
- 3) Surveys can be conducted at any time of year, depending on the goal of the program. Surveys focused on the breeding season should occur between March and May.
- 4) The direction of the area search route or the order of point count points (below) should vary on successive survey visits to avoid reinforcing any confounding effects of time-of-day.
- 5) Survey a plot for at least three hours, ranging up to five hours as needed. The minimum time can be reduced proportionally if some of the plot is covered by habitat that is clearly unsuitable for Pinyon Jays.
- 6) Avoid surveying during times of day when Pinyon Jay activity is likely to be reduced, which can vary by region and season. For projects that wish to standardize time-of-day across all surveys, the morning period (beginning just after sunrise) is recommended.
- 7) Do not conduct surveys during periods of steady precipitation or when average wind speed exceed 25 km / hr.
- 8) Upon detection of a flock, sufficient observation time should be spent to obtain a good estimate of flock size and predominant activity time (Appendix 1).
- 9) A Pinyon Jay flock will nearly always move during the period that a survey is being conducted, and it may therefore be detected several times at different locations as the survey progresses. Ideally, each sighting-level data record represents a meaningfully-different location (separated by ~200 m or more, as a general rule of thumb) for the flock, or a change in the predominant activity type of a flock within a location. New records should always be created in any cases where they likely represent a new flock within the survey area.

Additional protocol guidelines specifically applicable to the area search approach only are:

- 1) The surveyor may choose a search path through the plot to utilize good scanning and listening points and avoid difficult terrain. However, the survey path should lie no farther than 1 km from any point in the plot that contains potential Pinyon Jay habitat. Closer spacing is desirable to the extent possible, with a goal of relatively even plot coverage. Using an electronic field form that illustrates the surveyor track and plot boundaries is ideal for this purpose.
- 2) The coordinates associated with each Pinyon Jay sighting-level record should indicate the estimated position of the flock. This is easily accommodated in the ArcGIS Collector or ArcGIS Field Maps apps. Alternately, it is acceptable to record observer coordinates along with estimated distance and bearing to the flock (see Appendix 1 for details), and then post-process data to generate an estimated flock location.
- 3) If Pinyon Jays are detected outside the plot boundaries, they are considered incidental observations (Appendix 1).

Additional protocol guidelines specifically applicable to the point count approach only are:

- 1) Point locations should be spaced in a 3 x 3 grid with ~ 1 km spacing that is centered within the plot. Deviation from ideal point layout to avoid difficult terrain and take advantage of good observation points is acceptable, but the point grid should provide the most even coverage of the plot that is practical, and in general point spacing should lie within the range of 800 – 1,200 m. Established points should be waypointed and used for each successive survey visit. In cases where a plot contains a large area that is clearly unsuitable for Pinyon Jays, the point count grid can be reduced accordingly.
- 2) Conduct a 6-minute count at each point using a timer. Surveyors should visually scan the area with binoculars in addition to listening. If a flock is detected within the 6-minute period, it is acceptable to extend the observation period as needed to obtain a good estimate of flock size and predominant activity type (Appendix 1).
- 3) All of the required data fields specific to the point count approach (Appendix 1) must be recorded at each point, including points with no detections.
- 4) A rangefinder should be used to get the best estimate of distance from the point to detected Pinyon Jay flocks.
- 5) The coordinates associated with each Pinyon Jay sighting-level record should be the coordinates of the point, not the flock. However, if using an electronic field form with a base map, additional data fields can optionally be created to directly record estimated flock position.
- 6) If Pinyon Jays are detected between point counts (within the plot) or outside the plot, this is considered an incidental observation (see Appendix 1 for details).

Road-Survey Protocol

Road-based point counting is an approach that has been used by some PJWG scientists to obtain the broadest possible geographical coverage. For this reason, and because road-based surveys provide a simple, structured approach for data contributions from citizen scientists, a road-based survey protocol is described below for reference. However, it is not possible to standardize per-plot survey effort using a road-based approach and therefore road-based surveys are NOT interchangeable with or equivalent to the PJWG survey protocol.

The key elements of the road-based protocol are:

- 1) Use of 5 x 5 km plot to define survey units.
- 2) Delineation of survey route along selected roads within the plot. Plots must include enough accessible road to allow at least three point count stops (see below).
- 3) Stops spaced every 1 km along roads, with 6-minute point counts at each stop.
- 4) Surveys completed within a 4-hour period or less.
- 5) Flexible number of visits to each plot, though three visits is recommended where logistically feasible (see “Number of Visits” section, below).

Given the greater geographical coverage possible with road-based surveys, 5 x 5 km grids are the most reasonable approach to defining survey units. These plots should be configured to fit evenly into the military grid system. Within each plot, decisions about which road segments to survey and total length of the survey route should be determined based on road density and pattern.

Along the driving route, stops should be made every 1 km to conduct a 6-minute point count, using a timer. Extended time at the stop is acceptable if needed to obtain a good estimate of flock size or activity type (Appendix 1) for a flock initially detected within the 6-minute period. It is permissible to move the stops up to 200 m from the idealized spacing to take advantage of good observation and listening points. Stops should be waypointed to use in subsequent survey visits. At each stop, surveyors should visually scan the area with binoculars in addition to listening. All of the required data fields specific to point counts (Appendix 1) must be recorded at each point, including the distance category and time category of each Pinyon Jay sighting. A rangefinder should be used to get the best possible estimate of distance. The coordinates associated with the record should be the coordinates of the point, not the flock. However, if using an electronic field form with a base map, additional data fields can optionally be created to directly record estimated flock position. If Pinyon Jays are detected between point counts or outside the plot, this is considered an incidental observation (see Appendix 1).

Surveys should avoid times of day when Pinyon Jays may be less active, which may vary by region and season. For projects wishing to standardize time-of-day, the morning period starting just after sunrise is recommended. The time required to complete a road survey within a given plot will be highly variable depending on the amount and type of roads present within a given

plot. As for foot-based surveys, three survey visits to a plot are recommended where possible, but in some cases this may not be necessary or desirable.

Analytical Considerations

This document does not stipulate specific approaches to data analysis. However, the PJWG has identified a number of relevant issues that analysts should consider, including the following:

Duplicate flock sightings: Pinyon Jay flocks range across relatively large areas compared to most passerine birds, and are thought to have little or no spatial overlap with other flocks as a general rule. Therefore, multiple Pinyon Jay sighting-level records obtained within a given plot are likely to represent the same flock. This should be understood and accounted for during data analysis and summarization. In particular, estimating abundance or density cannot be accomplished by summing flock sizes across a plot, but would instead require that each record be attributed to (a) specific flock(s). This could require additional effort using telemetry or extended observational methods to determine the home ranges of flocks.

Significance of activity type: Pinyon Jay flock home ranges may be comprised of discontinuous areas that the flock flies between. Therefore, Pinyon Jay records with the “flyover” activity type (Appendix 1) should not routinely be equated with “presence”. Additionally, certain parts of the home range may be used only or predominantly for one activity type. For instance, a flock may fly to roosting area (potentially disconnected from the rest of the home range) each evening that is used only for roosting.

Plot-level vs. point-level analysis: Using the recommended survey protocol standardizes per-plot survey effort, and further provides a relatively consistent likelihood of detection assuming that Pinyon Jays use the surveyed area. This standardization justifies a plot-level analytical approach using both presence and absence data. At the analyst’s discretion, these data can also be used for presence-only models, at either the plot-level or point-level. When using road-based surveys, survey effort cannot be standardized at the per-plot level, and will likely be concentrated in the lower and flatter portion of plots where roads are more likely to be present. Therefore a point-based analytical approach using presence data is probably most appropriate.

Scale of analysis: Using 2.5 x 2.5 km plots as the primary unit of data collection does not preclude analyzing data at smaller scales by subdividing plots, or at larger scales by aggregating plots. Further, presences can also be analyzed as point-data with an associated buffer of any size that is used to derive values for habitat and environmental covariates.

Detection issues: Given how widely Pinyon Jay flocks range, an absence record within a plot-based survey can have three potential meanings:

- 1) Pinyon Jays do not use the plot (i.e., a legitimate absence);
- 2) Pinyon Jays were present in the plot during the survey but were not detected (i.e., a traditional “detectability” issue); or
- 3) Pinyon Jays use the plot as part of their home range, but were in some other location during the survey and were therefore unavailable for detection.

Probability of “false” absences (items 2 and 3) could potentially vary according to season, habitat type, flock size, home range size, and flock activity type. Addressing this issue is potentially complicated, though important for understanding how to produce the most accurate models of estimated Pinyon Jay occurrence across landscapes. This issue will be further considered by the PJWG and individual researchers and potentially addressed in a future revision of these guidelines.

Applications

The PJWG data standards and survey protocol can accommodate many different project-specific goals and analytical approaches. Some examples of applications that are possible include:

- 1) Creating spatial distribution models using presence / absence or presence-only data over a large region. This would likely involve random-stratified selection of plots to survey.
- 2) Monitoring Pinyon Jay trends and responses in specific project areas. This may require non-random selection of contiguous plots to fully cover the area of interest.
- 3) Conducting clearance surveys in specific areas (using contiguous plots as needed) to determine whether Pinyon Jays are present (see also “Guidance for Locating Pinyon Jay Nests and Confirming Breeding” doc at <https://partnersinflight.org/resources/pinyon-jay-working-group/>).
- 4) Characterizing seasonal habitat use patterns and activity-specific habitat use patterns.
- 5) Performing multi-scale (or other) models using detection histories to quantify likelihood of occurrence at the plot level.
- 6) Finding Pinyon Jay flocks for subsequent nest searching, nest monitoring, or activity tracking.

Tailoring the guidelines for these specific purposes is generally a matter of determining an appropriate sampling frame and sampling plan to select plots; determining whether plots will be surveyed once or at regular intervals (seasonally, annually, etc.) over time; determining whether a given survey will consist of a single visit or a series of visits; and identifying an appropriate analytical approach.

Data Management and Sharing

At present, the PJWG has not identified a preferred mechanism for collaborative data sharing. Future versions of these guidelines will likely identify preferred or suggested data repositories that will facilitate data-sharing.

Additional Information and Assistance

The follow individuals are experienced Pinyon Jay biologists who contributed to the development of these data standards and protocols.

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The following webinar provides an overview of Pinyon Jay survey methods.

<https://www.youtube.com/watch?v=4dc6W-SLiGQ>

APPENDICES. Data standards recommended by the Pinyon Jay Working Group.

Appendix 1. Sighting-Level Attributes

Overview: Sighting-level attributes describe the properties of each Pinyon Jay sighting and are recorded each time a Pinyon Jay flock is detected. Most projects can and should adhere to these sighting-level data standards regardless of whether the PJWG survey protocol is being used or not. Tables 1-A and 1-B below list all the PJWG's recommended sighting-level attributes. Each attribute is given both a full name (called an "alias") and a shorter database (DB) name that adheres to 8 character limits required in some data systems. For all attributes that specify a "Pick List" within the "Field Type and Unit" column, see Appendix 4 for relevant pick-list values. Table 1-A lists attributes that should always be recorded. Table 1-B lists attributes that are relevant in some cases, but not others, as described in the table.

Coordinates: It is assumed that point coordinates are recorded for each detection. This happens automatically when using electronic field forms on a GPS-enabled device. Note that project-level data (Appendix 3) should define the type of coordinate system used by the project. Depending on the method of data collection, these coordinates may represent either the location of the surveyor or the estimated location of the Pinyon Jay flock (more specifically, the approximate center of the flock, since the flock technically occupies a polygon). For example, if surveying a plot using the point count approach, the coordinates recorded must represent the location of the surveyor on the established survey point. In contrast, if surveying a plot using the area search approach and an electronic field form, the record can be placed at the point where the flock occurs. It is important that the data set specify whether the coordinates represent surveyor location or flock location. This can be done either in the survey-level data (Appendix 2) and/or project-level data (Appendix 3).

Table 1-A. Attributes for sighting-level records that should always be recorded.

Attribute Name (Alias / DB Name)	Field Type and Unit	Description
Date Date	Date	YYYYMMDD format
Time Time	Time	HH:MM format using military (24 hr.) time
Observation Method ObsMeth	Text with Pick List (pick one)	Indicates whether the detection was visual, aural, or both. Also allows non-detections at survey points (when using the point count approach) to be noted.
Observation Type ObsType	Text with Pick List (pick one)	Indicates whether an observation is made while performing the PJWG survey protocol or not. Also allows identification of incidental observations while engaged in the PJWG survey protocol. The most commonly used value can be set as a default.
Flock Size FlockSz	Integer	Estimated size of the observed flock.
Site Type SiteType	Text with Pick List (pick one)	Distinguish areas that Pinyon Jays use for a specific type of activity, if that information is known.
Flock Resight FlkRes	Text with Pick List (yes or no)	A “yes” value indicates that in the judgement of the surveyor, a given Pinyon Jay record represents the same Pinyon Jay flock that was previously detected during that same survey. The first Pinyon Jay observation within a given survey visit will therefore always have a “no” value, but most subsequent records during that same survey will likely have a “yes” value.
Flock Activity Type FlAcType	Text with Pick List (pick one)	This field indicates the primary type of activity that the flock is engaged in at the time when the detection is made. When the whole flock changes its predominant activity type, a new data record should be created.
Other Behaviors OthBeh	Text with Pick List (pick any number)	This field represents specific behaviors of interest that some individual birds might be observed performing, but that will likely not reflect the activities of the whole flock at the same time.

Attribute Name (Alias / DB Name)	Field Type and Unit	Description
Comments Comments	Text	Free-form text to describe any useful information about the sighting not captured in other data fields. This does not need to be filled out for every record, but should always be an available option.
SurveyID SurveyID	Alphanumeric, usually system- generated	OPTIONAL BUT RECOMMENDED. For any project that collects survey-level data (see Appendix 2) to accompany sighting-level data (including surveys adhering to the PJWG's survey protocol), it is necessary to have fields that explicitly link sighting-level records to their parent survey-level record. More specifically, the value of the "SurveyID" field should exactly match the value of the "GlobalID" field for the survey during which those sightings were obtained (see Appendix 2). ArcGIS Collector and ArcGIS Field Maps can be set up to record both a survey-level record and associated sighting-level records in one configuration, where this relationship is explicitly enforced. Contact the PJWG for more information.

Table 1-B. Attributes for sighting-level records that should be recorded in some circumstances, as described in the Description column. Please note also that the “Observation Type” field from Table 1-A contains one pick-list value (Appendix 4) that is only relevant in some circumstances.

Attribute Name (Alias / DB Name)	Field Type and Unit	Description
Distance Category DistCat	Text with Pick List (pick one)	ONLY RELEVANT FOR THE POINT COUNT APPROACH. This field describes the distance range from the point to the detected Pinyon Jay flock.
Time Category TimeCat	Text with Pick List (pick one)	ONLY RELEVANT FOR THE POINT COUNT APPROACH. This field describes the time interval after initiation of the point count during with the detection is made.
Survey Effort SurvEff	Integer (min) (set a default)	ONLY RELEVANT FOR THE POINT COUNT APPROACH. This field describes the total time spent at the point conducting the count. Since the value should be the same throughout a given survey (six minutes) if using the PJWG protocol, this can be set for a default value when using electronic field forms so that it does not have to be entered for every sighting. This default can be changed whenever survey time at a point is truncated for some reason, or when using a non-standard protocol. NOTE that extended observation time spent to better estimate flock size or activity type does NOT require this value to be changed if the flock was initially detected within the standard point count window.
Point Number PointNo	Alphanumeric, optional Pick List (choose one)	OPTIONAL, AND ONLY RELEVANT FOR THE POINT COUNT APPROACH. Points used in the point count approach may be given Point ID values (1, 2, 3, etc.) if desired.
Distance Distance	Integer (m)	OPTIONAL. This does not need to be recorded if the coordinates associated with the record indicate flock position (Appendix 2). If the coordinates associated with the record represent the surveyor’s position and not the flock’s position, then recording the estimated distance from the surveyor to the flock (along with “Bearing”, below) can allow an estimated flock position to be calculated during data post-processing. An alternative is to use the optional “Flock Coordinates” field, below.

Attribute Name (Alias / DB Name)	Field Type and Unit	Description
Bearing Bearing	Integer (degrees 0 – 359, corrected for local declination)	OPTIONAL. This does not need to be recorded if the coordinates associated with the record indicate flock position (Appendix 2). If the coordinates associated with the record represent the surveyor’s position and not the flock’s position, then recording the compass bearing from the surveyor to the flock (along with “Distance”, above) can allow an estimated flock position to be calculated in post-processing. An alternative is to use the optional “Flock Coordinates” field, below.
Flock Coordinates FlockX, FlockY	Geographical or Projected X and Y coordinates	OPTIONAL. This does not need to be recorded if the coordinates associated with the record already indicate flock position (Appendix 2). If the coordinates associated with the record represent surveyor position (as when conducting point counts) and you are using an electronic field form with a base map (such as ArcGIS Collector or ArcGIS Field Maps), then you can also create ancillary point feature that represents estimate flock location which can later be joined with the surveyor location point feature layer. Alternatively, you can record “Distance” and “Bearing”, above, and calculate an estimated flock location during data post-processing.

Appendix 2. Survey-Level Attributes

Overview. Survey-level attributes describe the properties of each unique survey; that is, each attempt to detect Pinyon Jays within some defined “sample unit” at a given time. These attributes only need to be recorded once per survey, as in the header of a traditional paper data sheet. Table 2 provides details of how survey-level records should be “connected” to sighting-level records in the database structure.

IMPORTANT: When following the PJWG survey protocol, three visits to each plot at 7 – 10 day intervals are recommended where possible to complete a single “survey”. In these cases, each of these three visits, while technically a “sub-survey”, should be recorded in the data system as different surveys, each with one survey-level record. Data from these (sub) surveys are then later assembled into a single set of results or grouped together using a common data field as appropriate for the analytical approach.

Table 2 lists all of the PJWG’s recommended survey-level attributes. These are specifically tailored to the PJWG’s recommended survey protocol, so some of these fields may be irrelevant if non-standard protocols are used. Each attribute is given both a full name (alias) and a shorter database (DB) name that adheres to 8 character limits required in some data systems. For attributes that specify a “Pick List” in the “Field Type and Unit” column, see Appendix 4 for associated pick-list values.

Coordinates. Because survey-level data apply to all sightings within a given survey, the exact location of coordinates associated with the survey-level records is not critical. Because coordinates are automatically recorded in electronic field forms, we assume here that the coordinates of the survey-level record will describe the location of the surveyor when the survey begins. The coordinate system used should be the same as for sighting-level data (Appendix 1).

Table 2. Survey-Level Attributes:

Attribute (Alias) Attribute (Database Name)	Field Type and Unit	Description
GlobalID GlobalID	Alphanumeric, usually system- generated	This is a unique identifier for each survey. This attribute can be generated by the data collection system automatically if using ArcGIS Collector or ArcGIS Field Maps, which uses the system name “GlobalID”. If configured correctly, the value of GlobalID associated with the Start record can automatically populate the “SurveyID” field of all sightings collected during that survey (see Table 1-A). Contact the PJWG for more information on these configuration issues.
Date Date	Date	YYYYMMDD format.
Start Time SttTime	Time	HH:MM format using military (24 hr.) time. Time when the survey begins.
Stop Time StpTime	Time	HH:MM format using military (24 hr.) time. Time when the survey ends. NOTE: Because stop time is not known when the survey-level record is first created, this field is initially be left blank, and then a value will be entered upon completion of the survey.
Observer Observer	Text	Name of the person creating the record.
PlotID PlotID	Alphanumeric with optional Pick List (pick one)	Unique identifier of the plot being surveyed. Each project can create a pick list for its plot names to reduce potential data entry error.
Survey Type SurvType	Text with Pick List (pick one)	This field describes whether the survey is conducted using a PJWG protocol or some other protocol. It further distinguishes between surveys according to the number of <u>pre-planned</u> survey visits. When the value “Other” is chosen, the survey design and purpose should be well-describe in the project-level data (Appendix 3).
Coordinate Type CoType	Text with Pick List (pick one)	This attributes indicates whether the coordinates associated with the <u>sighting-level</u> records for this survey represent surveyor position or estimated flock position. The coordinate system, in contrast, is specified in project-level data.

Attribute (Alias) Attribute (Database Name)	Field Type and Unit	Description
Protocol Replicate ProtRep	Integer	Indicates the first, second, or third visit to a given plot with 7 – 10 day survey intervals. If only one visit per plot is conducted, this value will be “1” for all survey-level records. If more than one visit is conducted for some or all plots, this field, in conjunction with Plot ID and date attributes, identifies a visit “cluster”. This field IS NOT used to indicate repeated visits to a given plot that may occur over more widely spaced survey intervals, as might occur for a monitoring program. To identify longer-term monitoring sequences, you can use the optional “Monitoring Replicate” field (below).
Monitoring Replicate MonRep	Integer	OPTIONAL. If a given plot is surveyed at regular intervals on an ongoing basis for monitoring, the first monitoring period is indicated with a value of “1”, the second with “2”, etc. Note that for each of these values, there may be three component “Protocol Replicate” entries (with values of 1, 2 and 3, see above) if using multiple visits for each survey.
Wind Speed WindSpd	Ordinal with Pick List (pick one)	This field notes the wind speed category at the beginning of the survey. If wind conditions change dramatically over the course of the survey, this can be noted in the “Comments” field.
Sky Conditions SkyCond	Ordinal with Pick List (pick one)	This field notes the sky condition category present at the beginning of the survey. If sky conditions change dramatically over the course of the survey, this can be noted in the “Comments” field.
Jays Present JaysPres	Text with Pick List (Yes or No)	If any non-incident Pinyon Jay sightings were recorded during the survey, enter a “Yes” value. If no non-incident Pinyon Jay sightings were recorded during the survey, enter a “No” value. Because presence of jays is not known when the survey-level record is first created, this field will initially be left blank, and then a value will be entered upon completion of the survey.
Comments Comments	Text	Any additional information relevant to the survey should be recorded in the “Comments” field.

Appendix 3. Project-Level Attributes

Overview. Project-level attributes apply to entire projects. The project-level data shown below in Table 3 should be recorded in project metadata. Metadata are most easily attached to a data set using metadata creation and editing tools in ArcGIS. If another software system is used, this metadata should be clearly and permanently attached to the data set using whatever mechanism is most appropriate.

Coordinates. Project-level data are not spatial, and as such no coordinates are required.

Table 3. Project-Level Data:

Item	Description
Project Contact	Provide a name, email address, and phone number of the project's main point of contact.
Agency	Agency or lead researcher for the project.
Project Purpose	Describe the main purpose of the project. Examples could include collecting presence-absence data, monitoring at a management site, finding Pinyon Jay flocks for nest studies, etc.
Project Description	Describe all of the following that are relevant to the project: sampling frame, sampling design, survey schedule, and any other important features of project design or implementation.
Survey Protocol	Indicate whether the project uses the PJWG recommended survey protocol. If so, describe the protocol used. If the project uses another non-PJWG protocol (i.e., road-survey protocol), describe it in sufficient detail to allow users to understand your critical sampling and protocol characteristics.
Coordinate System	Identify the coordinate system used for all project data, including datum. This information should be implicit in data sets in a GIS format. Because Pinyon Jays occur across a wide area of the western U.S., the PJWG does not specify a required coordinate system, but recognizes that individual projects may use coordinate systems that are most suitable for their region.
Data Set Format	Indicate the software format of your data set. Possibilities include an ArcGIS file geodatabase, an ArcGIS shape file, a relational data base, an excel workbook, or a csv file.
Field Name Map	If you are adhering to PJWG data standards but prefer to use field names different than those shown in Tables 1-A, 1-B, and 2, provide definitions linking your field names to the fields shown in these tables.
Other Comments	Provide any other comments that the PJWG or any partnering agencies might need to understand your data set.

Appendix 4. Pick List Values

Overview. Pick list values are comparable to GIS Domains, and the terms can be used interchangeably. Pick lists provide the allowable values for certain data fields, which can be pre-defined in electronic field forms to speed data entry and reduce data entry error. As with field names, some data systems may require that pick list values adhere to certain character limits or restrictions. If you cannot use the recommended pick list values shown below in your data recording system, please create a table showing how your actual pick list values correspond to the shown in the table below, and include this table in your project-level metadata (Appendix 3).

Table 4. Pick List Values. Attributes are listed in the order in which they are presented in Tables 1-A, 1-B, and 2. Pick lists that involve only “Yes” or “No” values are not shown.

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
Observation Method (Pick One)	Visual	Initial detection visual
	Aural	Initial detection aural
	Visual and Aural	Initial detection both visual and aural
	Absent	<u>Relevant only for the point count approach.</u> No detection occurred at the point.
Observation Type (Pick One)	Protocol	The observation was made while performing the PJWG survey protocol.
	Off-Point	The observation was made inside the plot while performing the PJWG survey protocol using the point count approach, but occurred outside the component point counts.
	Off-Plot	The observation was made outside defined plot boundaries for projects using the PJWG survey protocol.
	Non-Protocol	The observation was made by a surveyor not performing the PJWG protocol.

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
Site Type (Pick One)	Roosting Site	Detection occurs in an area used mainly for roosting
	Nesting Colony Site	Detection occurs in an area used mainly for a nesting colony
	Flyover Only	Detections in this site involved only flyovers, with no ground or tree based activity
	Foraging Site	Detection occurs in an area used mainly for foraging
	Caching Site	Detection occurs in an area used mainly for caching
	Unknown	The type of site is not known
	Not applicable	The site is used for multiple activities
Flock Activity Type (Pick One)	Flyover	Most or all of the flock is flying over the site, without landing in trees or on the ground
	Foraging on Ground	Most or all of the flock is foraging on the ground
	Foraging in Trees	Most or all of the flock is foraging in trees
	Caching	Most or all of the flock is caching or retrieving caches
	Perching	Most or all of the flock is perched, but not actively foraging
	Nesting	Most or all of the flock is in the nesting colony engaged in nesting-related activities
	Roosting	Most or all of the flock is roosting for the night
	Unknown or Other	The main flock activity type cannot be determined or is or a different type (describe in comments).

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
Other Behaviors (Pick None, One, or Multiple)	Perching at/near Nest	One or more birds is perched at or near a nest
	Eating	One or more birds is actively eating (i.e., swallowing food, not just gathering it)
	Vocalizing	One or more birds is actively vocalizing
	Carrying Nest Materials	One or more birds is carrying nest materials
	Courtship Behavior	One or more birds is engaged in courtship behavior
	Feeding Young	One or more birds is feeding young
Distance Category (Pick One)	1	0 – 24 m
	2	25 – 49 m
	3	50 – 99 m
	4	100 – 199 m
	5	200 – 400 m
	6	> 400 m
Time Category (Pick One)	1	0 – 1 min
	2	1 – 2 min
	3	2 – 3 min
	4	3 – 4 min
	5	4 – 5 min
	6	5 – 6 min

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
Survey Type (Pick One)	PJWG Protocol Area Search Approach, Three Visits (short name = FBAS3)	The survey is the PJWG survey using the area search approach, with three visits (determined in advance) to be made to each plot.
	PJWG Protocol Point Count Approach, Three Visits (short name = FBPC3)	The survey is a PJWG survey using the point count approach, with three visits (determined in advance) to be made to each plot.
	PJWG Protocol Area Search Approach, One Visit (short name = FBAS1)	The survey is a PJWG survey using the area search approach, with one visit (determined in advance) to be made to each plot.
	PJWG Protocol Point Count Approach, One Visit (short name = FBPC1)	The survey is a PJWG survey using the point count approach, with one visit (determined in advance) to be made to each plot.
	PJWG Protocol Area Search Approach, Variable Visits (short name = FBASV)	The survey is a PJWG survey using the area search approach, with number of visits either determined over the course of the survey, or to exceed three visits. This option might be chosen if survey visits will be discontinued upon first Pinyon Jay detection.
	PJWG Protocol Point Count Approach, Variable Visits (short name = FBPCV)	The survey is a PJWG survey using the point count approach, with number of visits either determined over the course of the survey, or to exceed three visits. This option might be chosen if survey visits will be discontinued upon first Pinyon Jay detection.
	Road-Based Point Counts, Three Visits (short name = RBPC3)	The survey is a road-based point count with three visits (determined in advance) to be made to each plot / route.
	Road-Based Point Count, One Visit (short name = RBPC1)	The survey is a road-based protocol with one visit (determined in advance) to be made to each plot / route.

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
	Road-Based Point Count, Variable Visits (short name = RBPCV)	The survey is a road-based point count protocol with number of visits to each plot / route either determined over the course of the survey, or to exceed three visits. This option might be chosen if survey visits will be discontinued upon first Pinyon Jay detection.
	Other Plot Survey Protocol (short name = OthPlot)	Any other plot-based survey protocol. Details should be described in project-level data (Appendix 3).
	Other Point Count (short name = OthPoint)	Any other point-count protocol. Details should be described in project-level data (Appendix 3).
	Incidental	An incidental or opportunistic sighting made outside of any formal survey protocol.
	Other	Any other situation not adequately described with the defined options. Details should be provided in project-level metadata (Appendix 3)
Coordinate Type (Pick One)	Surveyor Location	The coordinates associated with sighting-level records during this survey represent the location of the surveyor.
	Flock Location	The coordinates associated with sighting-level records during this survey represent the estimated location of the flock.
Wind Speed	0	Smoke rises vertically (< 1 mph, < 2 kph)
	1	Wind direction shown by smoke drift (1 – 3 mph, 2 – 5 kph)
	2	Wind felt on face, leaves rustle (4 – 7 mph, 6 – 12 kph)
	3	Leaves, small twigs in constant motion (8 – 12 mph, 13 – 19 kph)
	4	Dust rises, small branches move (13 – 18 mph, 20 – 29 kph)
	5	Small trees in leaf begin to sway (19 – 24 mph, 30 – 38 kph)

Attribute Name (Alias) (Pick List Type)	Pick List Values	Definition / Description
Sky Conditions	1	Partly cloudy (scattered) or variable sky
	2	Cloudy (broken) or overcast
	4	Fog or smoke
	5	Drizzle
	7	Snow
	8	Shower