PROJECT-LEVEL PINYON JAY SURVEY PROTOCOL FOR ARIZONA, NEVADA, CALIFORNIA, AND OREGON

Arizona Game and Fish Department
Western Regional Pinyon Jay Working Group

Photo by Great Basin Bird Observatory

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Introduction

This survey protocol (hereafter, "PLP" for "project-level protocol") is designed to determine with a high level of confidence whether Pinyon Jays are present (i.e., actively using habitat) or absent (not using habitat) within a user-defined project area. The Arizona Game and Fish Department and the Western Regional Pinyon Jay Working Group[1] recommend using this protocol in Arizona, Nevada, Oregon, and California to inform decision-making and to reduce the potential impacts of vegetation management and other disturbances on Pinyon Jays. The PLP is derived from, and in most ways equivalent to, the Pinyon Jay Survey Protocol for Landscape Applications (hereafter, "LLP" for "landscape-level protocol) created by the range-wide Pinyon Jay Working Group (PJWG).[2] The PLP differs from the LLP mainly with respect to the selection and delineation of survey plots. The LLP requires surveys within fixed-size 2.5 x 2.5 km plots that are selected to sample larger study areas (usually > 1,000 ha). In contrast, the PLP allows users to delineate a project area of interest (< 1,000 ha) that can be completely surveyed. Figure 1 compares a typical Pinyon Jay flock's home range, a standard LLP survey plot, and a typical user-defined PLP project area.

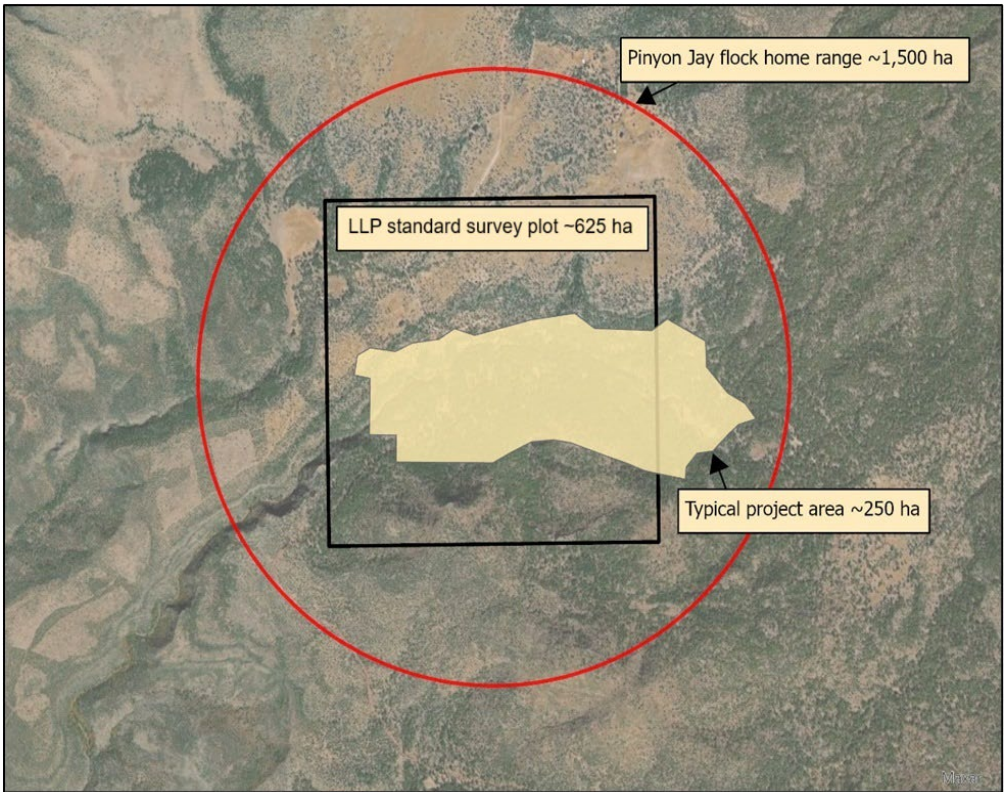

Figure 1. Spatial relationship between the home range of a typical Pinyon Jay flock, a standardized LLP plot, and a typical user-defined PLP project area. Flock home ranges and PLP project areas will vary on a case-by-case basis and may be larger or smaller than what is depicted.

[1] The Western Regional Pinyon Jay Working Group is comprised of representatives from multiple federal agencies, state agencies, and NGO's that are based in Nevada, Oregon, and California.
[2] Additional information on the PJWG and detailed LLP documentation are available at https://partnersinflight.org/resources/pinyon-jay-working-group/ .

The PLP can be used for three distinct applications, as follows:

1) Pinyon Jay Presence Survey: A presence survey is used to **determine whether Pinyon Jays are present or absent within a project area.** It also documents occurrence and habitat use associated with all major facets of Pinyon Jay natural history (e.g., nesting, foraging, caching, etc.). This is the most generalized and flexible application of the PLP because it can be conducted at any time of year to document multiple kinds of habitat use. The comprehensive presence information developed from this application can provide insight into possible impacts of disturbances on Pinyon Jays, determine specific seasonal vulnerabilities to disturbance, identify suitable areas for conservation actions that benefit Pinyon Jays, or monitor Pinyon Jay responses to disturbances over time.

2) Pinyon Jay Clearance Survey: By modifying the methodology for presence surveys (above), the PLP can also be used to accomplish traditional "clearance surveys" to comply with the Migratory Bird Treaty Act (MBTA). **Clearance surveys focus on determining whether Pinyon Jays are breeding in the project area and finding the approximate location of the breeding colony(s)** so that direct impacts to nesting birds can be avoided.[3,4] This application of the PLP is appropriate for minimizing potential impacts of project on breeding colonies, but it may not provide comprehensive occurrence information that encompasses other kinds of habitat use and potential disturbance impacts.

3) Pinyon Jay Breeding Colony and Nest Site Delineation: Clearance surveys (above) are generally adequate for MBTA compliance. If **a more precise delineation of breeding colony extent and/or specific nest locations** is desired, a clearance survey can be supplemented by additional nest searching after young are fledged. Colony and nest site delineation is most likely to be pursued by researchers to document nest colony size, site fidelity and nest success.

These three applications share many methodological elements, and each application in the list is derived from the previous application. For example, to conduct a breeding colony and nest site delineation survey, a user begins by conducting the initial stages of a presence survey. Once breeding presence is confirmed in the presence survey, the user transitions to the clearance survey methodology to confirm breeding and to identify the approximate location of the breeding colony. Finally, after young are fledged, the user conducts additional searches to find nest sites and more precisely delineate the breeding colony, as described in the breeding colony and nest site delineation methodology. In contrast, a user interested only in documenting presence and habitat use patterns would use the presence survey methodology exclusively. This hierarchical approach is critical for understanding the flexible design of the PLP and using it appropriately.

[3] Because Pinyon Jays are year-round residents rather than migratory breeders, avoiding impacts to nesting birds does not – by itself – guarantee that a proposed action will not be detrimental to Pinyon Jays. For example, disturbing or removing pinyon pine stands that provide Pinyon Jays with pine nuts to harvest in the fall and store for winter sustenance may negatively affect a flock even if direct disturbance to its nesting location is avoided.
[4] The "Conservation Strategy for the Pinyon Jay (*Gymnorhinus cyanocephalus*)" (Somershoe et al., 2020) provides recommendations for non-disturbance buffers around Pinyon Jay breeding colonies.

Because of the unique natural history of Pinyon Jays (next section), determining presence or absence with high confidence often requires substantial survey time, including repeated survey visits. We recognize, however, that available time and resources may sometimes be insufficient for an optimized survey effort. Therefore, in addition to presenting a preferred PLP survey methodology for each application, we also present a "minimum acceptable" methodology where possible and appropriate that still produces useful information, although with a reduced level of statistical confidence.

Determining the appropriate PLP application(s) for a given project is the responsibility of the user, depending on the goals and priorities of their project. **It is also the responsibility of the PLP user to determine whether a preferred, minimal, or intermediate approach is appropriate and justified for their situation.** The technical contacts listed at the end of this document can assist PLP users in making these decisions as needed.

Pinyon Jay Natural History

Pinyon Jays are year-round residents in at least 11 western states. In most regions, they are closely associated with pinyon-juniper woodlands, but they are sometimes found in ponderosa and Jeffrey pine forests, limber pine forests, and possibly other coniferous forest types. Pinyon Jays also use grasslands, shrublands, and other non-forested habitat types that are adjacent to woodlands, and they appear to concentrate most of their activity along woodland ecotones. Pinyon Jays have been declining at an annual rate of about 2-3 % in most regions and throughout their range (Boone et al., 2018, Sauer et al., 2019). The reasons for these declines are not definitively known but may include the loss of mixed-age pinyon-juniper woodland mosaics and declines in pine seed crops due to climate change, prolonged drought conditions, and overall aging of woodlands. The Pinyon Jay is considered a Species of Conservation Concern in many states and is currently undergoing a Species Status Review at the U.S. Fish & Wildlife Service for potential listing under the Endangered Species Act.

Pinyon Jays live in highly social flocks (typically 50 – 500 birds) that roam across large home ranges (approx. 15 km^2, but highly variable). A flock breeds in one or more colony locations that contains from 5 to 50 (or more) nests. The breeding season usually runs from about mid-February through the end of May but may begin earlier in unusually warm winters or last longer in unusually cold springs. Data gathered to date suggest that Pinyon Jays use different parts of their home range for different activity types, such as nesting, foraging, seed caching, roosting, etc. (Boone et al., 2021), and activity budgets and local movement patterns are seasonally variable. Due to their wide-ranging movements, Pinyon Jays may be absent from any part of their home range for relatively long time periods. For that reason, substantial observation time is often required to determine whether a given location is part of an active Pinyon Jay home range or not.

Survey Preliminaries

PLP Quality Control Requirements

PLP surveyors must be trained to accurately identify Pinyon Jays by sight and sound; to correctly recognize different Pinyon Jay activity types listed Appendix 1 (Table 4), to record data as required by the PLP, and to thoroughly understand the meaning of the standardized data fields and allowable entries detailed in Appendix 1. These skills are best obtained by attending a PLP protocol training session.[5] Surveyors should always be equipped with binoculars and must never use call broadcast devices. Adherence to these requirements is necessary to correctly perform this protocol and collect high-quality data.

Project Area Delineation

If a proposed project is in an area where Pinyon Jays could potentially occur,[6] each PLP user must begin by delineating one or more polygons defining the project area. For polygons that are less than 1,000 ha, we recommend surveying the entirety of the polygon using the PLP, as detailed below. For larger project areas we recommend either: a) subdividing the project area into smaller, more manageable polygons, each of which is surveyed completely using the PLP, or b) sampling the project area using the LLP with an appropriate sampling design.

Definition of Presence

As used throughout this protocol, "presence" means that Pinyon Jays use the habitat within the project polygon for one or more purposes. Often, the specific type of use (nesting, foraging, caching, roosting, etc.) can be determined by observing bird activity during surveys (see Appendix 1). Pinyon Jays are often observed flying over a location without landing (defined as a "flyover" activity type in Appendix 1); however, **flyover records by themselves are not considered evidence of "presence"** because they do not involve the use of habitat.

[5] Training is offered periodically by Great Basin Bird Observatory and Nevada Department of Wildlife. See the state contacts listed at the end of this document for additional information on available training.

[6] Plausible habitat within the Pinyon Jay's geographical range includes all pinyon-juniper, mountain mahogany, ponderosa pine, Jeffrey pine, and limber pine woodlands and forests, along with any shrubland, grasslands, or Joshua tree habitat that is within 5 km of any of these wooded habitat types. Where pinyon-juniper woodland is available, the likelihood of Pinyon Jay presence in other coniferous forest types appears to be comparatively lower than in areas where pinyon-juniper is absent. It is possible that Pinyon Jays utilize other wooded habitat types in the outlying areas of the species' range in Oregon and California.

Survey Methods

BRIEF OVERVIEW

The PLP has **core requirements** that are relevant for all three applications listed above, and **additional requirements** that are specific to the clearance survey and/or breeding colony and nest site delineation applications.

The **core requirements** serve to determine whether Pinyon Jays are present in the project area, as follows:

1) An area search approach is used to survey the project polygon.
2) Three survey visits (i.e., three separate area searches) on different days with no non-flyover Pinyon Jay detections are required **to confirm Pinyon Jay absence**. In contrast, Pinyon Jay presence is confirmed as soon as a non-flyover detection occurs within a project polygon.
3) A **minimum of four hours** must be spent performing each area search survey regardless of polygon size. Area searches in larger polygons may require more time.
4) All surveys must begin within 30 minutes of sunrise.
5) Data must adhere to the standardized format described in Appendix 1.
6) Surveys should not be conducted during heavy precipitation or when winds are above 38 kph (24 mph) (i.e., conditions in which large branches are in continuous motion).

The **additional requirements** of the PLP for the **clearance survey and / or breeding colony and nest sites delineation** applications are as follows:

1) All area search survey visits must be performed during the Pinyon Jay breeding season (mid-February to late-May). The preferred approach requires these survey visits to extend across a span of at least 45 days to encompass different stages of the breeding season.
2) Once Pinyon Jay presence within the project polygon is confirmed, subsequent survey visits focus on determining the approximate location and extent of the breeding colony(s). In some cases, this may require more than three survey visits.
3) The nest searching required for the breeding colony and nest site delineation application must be conducted after young are fledged.

Detailed methods for each application of the PLP are given below, including a preferred approach and a minimally acceptable approach where applicable. All users should begin by reviewing the methods for the presence surveys which are relevant to all PLP applications.

DETAILED METHODS: PINYON JAY PRESENCE SURVEY

Seasonality: Pinyon Jay home range extent and habitat use patterns may vary seasonally. Therefore, to prevent avoidable harm to a flock due to a planned disturbance event, it is

recommended and preferred that presence surveys are conducted in both the breeding season (~ March – May) and in the food-caching season (~ late August – October) immediately preceding the planned disturbance. This approach provides the most definitive information on Pinyon Jay presence and can also identify the specific portions of the project area where disturbance impacts would be the most problematic. However, surveying during multiple seasons prior to a planned disturbance is not always possible and the presence survey can be utilized in any season(s) depending on the needs, priorities, and timeline of a given project. In contrast, those using the PLP for the clearance survey application are required to conduct surveys during the breeding season preceding the planned disturbance.

Area Searches: To conduct an area search survey, a single surveyor walks through out the project polygon to locate Pinyon Jays and record attributes describing their characteristics and activity types. The surveyor can choose a path through the polygon that takes advantage of good visual scanning and listening points, **but by the end of the area search, they must have come within 500 m of every location in the polygon.** In some areas it may be possible to walk a systematic path within a polygon that adheres to this spacing requirement, but in other areas a more irregular path may be required or advantageous given the local terrain. Figure 2 illustrates a typical area search path that meets the 500 m criterion.

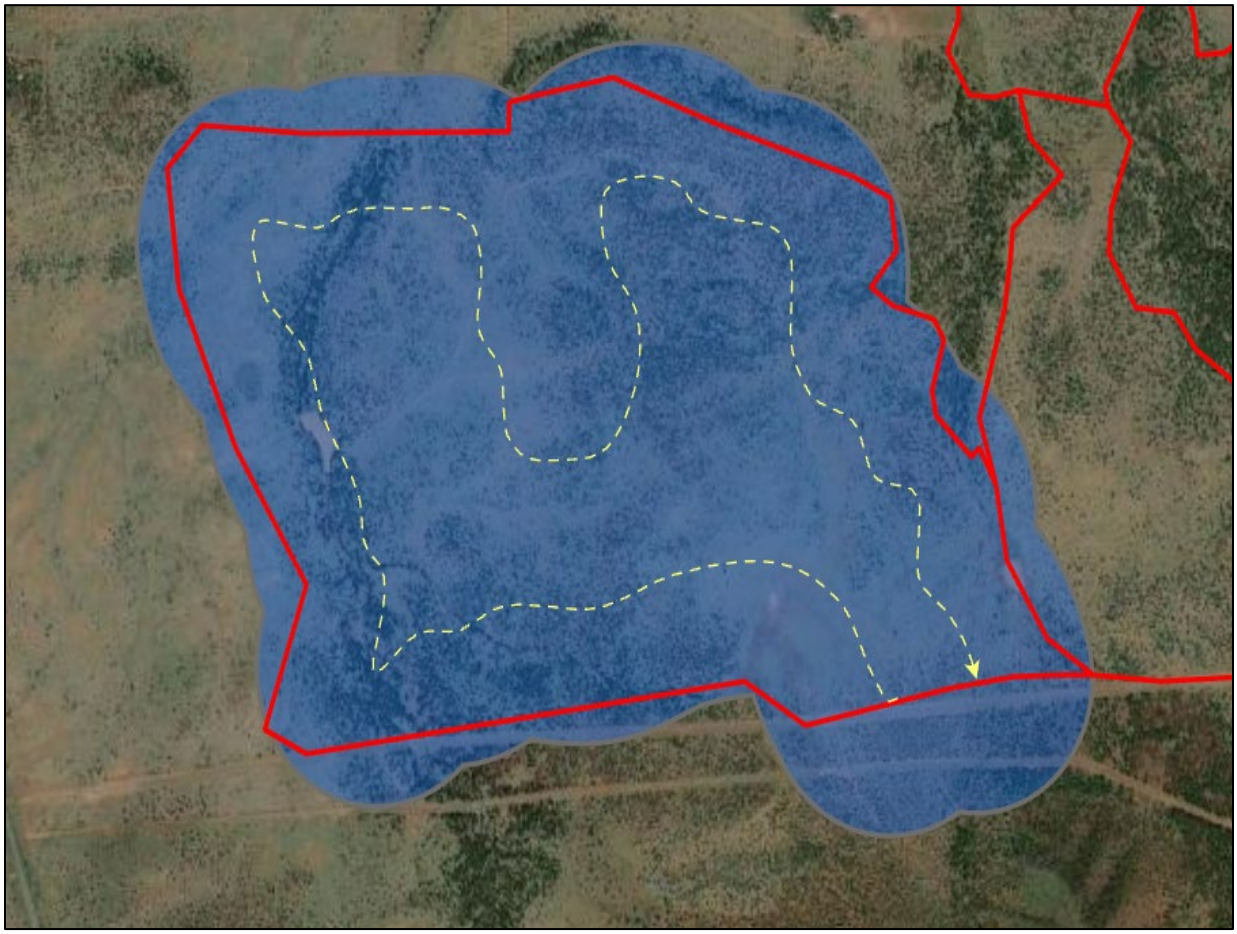

Figure 2. Illustration showing an acceptable area search path (yellow dotted line) in a defined project polygon (red). The blue shaded area lies within 500m of the area search route. Note how the entire project polygon is "covered" by the blue shaded area by adhering to the 500m criterion.

During the area search, the **surveyor should stop frequently at good vantage points** to scan with binoculars and listen for Pinyon Jays. Once an initial detection is made, the surveyor should attempt to obtain an optimal vantage point to visually observe flock activity, though approaching too closely (closer than ~ 100 m) is discouraged because it is likely to cause the flock to move. Once the activity type and attributes of the flock have been documented (which will be possible in some, but not all cases), the surveyor should continue their area search through the project area. **If a Pinyon Jay flock is present in the project polygon, it is typical to see or hear that flock multiple times over the course of an area search.** In these cases, the surveyor should record a new observation if the flock moves more than 100 m from its previous location or changes its activity type (see Appendix 1).

Survey Visit Duration: The time required to conduct one area search (i.e., one survey visit) for a polygon will vary with polygon size, difficulty of terrain, and the frequency of Pinyon Jay sightings. However, **four hours is the minimum amount of time that must be spent in a polygon regardless of its size** to obtain an adequate detection probability. On average, four hours should be sufficient to cover a project polygon ~600 ha in size. Area searches longer than four hours may be needed to fully cover a larger polygon; however, area searches should be truncated if conditions become unfavorable (i.e., high winds or extreme temperatures) or before mid-afternoon.[7] In these circumstances, the survey can be resumed the next day until the polygon is fully covered.

Number of Survey Visits: Three separate survey visits must be conducted within a project polygon with no indications of Pinyon Jay presence (as defined above) to conclude that Pinyon Jays are absent from the polygon.[8] If Pinyon Jay presence is confirmed on the first or second survey visit, additional survey visits can optionally be eliminated. However, these additional survey visits can help to determine the full set of locations used by Pinyon Jays in the polygon for different activity types, information that can be valuable for avoiding negative impacts to flocks. Therefore, the preferred approach is to conduct all three survey visits even if Pinyon Jay presence is confirmed prior to the third survey visit.

Interval Between Survey Visits: **The preferred interval** between sequential survey visits to a polygon for the presence survey application is 5 – 20 days. Maintaining this interval maximizes assures adequate confidence in survey conclusions while still permitting the overall survey to be completed within a reasonable time frame. If the available time before project initiation does not accommodate this interval, reduced intervals between survey visits are acceptable, but may reduce confidence in survey results, especially conclusions of Pinyon Jay absence. **It is important to emphasize that conclusions about Pinyon Jay presence or absence apply to the season during which survey visits are performed. Determining Pinyon Jay presence or absence during a different season requires an additional seasonally-specific survey effort.**

[7] Although Pinyon Jay are more active throughout the mid-day period than many other passerines, activity levels and survey detectability tend to decline during the afternoon.

[8] Based on analysis of data from two years of LLP surveys in Arizona, the risk of incorrectly concluding absence after three survey visits with a 5 – 20 -day interval between survey visits is ~ 5%, which is an acceptable error rate for most purposes. The comparable error rate for project-defined polygons has not yet been analyzed, but is likely similar, especially for larger polygons.

Duration of Survey Results: At present, it is not possible to accurately determine the length of time that a PLP survey result remains valid for project planning and decision making. It is suspected, however, that Pinyon Jays have relatively high home range fidelity. If so, survey results may have a relatively long period of relevance. When additional information becomes available, the PLP will be modified to provide more specific guidelines.

Detailed Methods: Pinyon Jay Clearance Survey

Additional Surveyor Requirements: Because clearance surveys focus on confirming breeding, surveyors must be well-trained to recognize different types of Pinyon Jay breeding evidence, as listed in Appendix 1, Table 4. Surveyors must also be familiar with the phenology of the breeding season and its signs, along with how to avoid unintended nest disturbances, as illustrated in Figure 3 and further described below and in Appendix 2.

Figure 3. Diagram illustrating the stages of Pinyon Jay breeding, the main signs that provide evidence of these stages, and the comparative risk of causing disturbances and potential nest abandonment if proper precautions (as described in Appendix 2) are not observed.

Seasonality: For this protocol, the Pinyon Jay breeding season is defined as 15 February - 31 May. For a PLP clearance survey, all survey effort must occur within this breeding season. The **preferred approach** is to initiate survey effort in the early breeding season (15 February – 31 March) immediately prior to the planned disturbance and distribute subsequent survey effort evenly across the whole breeding season. If project logistics do not accommodate the preferred approach, a **minimally acceptable approach** allows survey effort to extend across a user-selected six-week time span within the breeding season. Users should be aware that delaying initiation of survey effort until April or May and compressing the time frame for survey visits may substantially reduce the chance of detecting breeding and accurately delineating the breeding colony(s) if breeding is occurring.

Area Searches: A PLP clearance survey begins by conducting one or more area searches exactly as described in the Pinyon Jay Presence Survey (above) in all respects except for the interval between survey visits (see below). This initial portion of the clearance survey effort is termed **"presence survey mode."** During these area searches, the surveyor should pay special attention to any evidence of breeding as described in Figure 3 and in Appendix 1, Table 4. If initial evidence of breeding is obtained – whether during a first, second, or third survey visit – the surveyor then shifts from "presence survey mode" into **"clearance survey mode"** to gather further breeding evidence and determine the approximate location of the breeding colony(s). Clearance survey mode is characterized by a modified area search protocol with 300 m or closer spacing (rather than 500 m), more time allocated to observing flock activity, and a focus on the subset of the project polygon where breeding is occurring. By gathering multiple observations of breeding-related activities over one or more survey visits in clearance survey mode, the approximate location and extent of the breeding colony can usually be determined. Surveyors should not enter the colony site during the breeding season, especially in the most sensitive stages (Figure 3). The surveyor should always maintain a distance of at least 100 m from known or suspected nest locations and should rapidly exit the breeding colony if they inadvertently enter it.

Recommendations for effective and safe searching when in clearance survey mode are as follows:

1) Pay special attention to listening, because vocalizations may help identify breeding behaviors and nesting birds may be quieter than non-nesting birds. Examples of the characteristic sounds of breeding Pinyon Jays are available at: https://xeno-canto.org/explore?query=pinyon%20jay
2) Observe any sighted Pinyon Jay closely to see if it is carrying nest material or food in its bill. If so, the travel direction of the bird could provide clues to the breeding colony location.
3) Follow birds showing evidence of breeding activity until they settle in a stand of trees. Watch from a safe distance (>100 m), ideally using blind materials. You may observe other Pinyon Jays arriving at and leaving this location.
4) Initial evidence of a breeding colony may come by unintentionally flushing a bird off the nest. If this occurs, continue walking away from the nest before recording data, and make further observations from a safe distance (100 m or more).

5) Before approaching the potential breeding colony location, ensure that all equipment needed to record data is ready and close at hand so that observations can be recorded with minimal noise and activity.
6) Scan for any predators (ravens or other corvids, primarily) and refrain from approaching the colony location if they are present, since survey activities can alert predators to the presence of nests.
7) Use multiple vantage points around the colony from safe distances (> 100 m) to identify the approximate extent of the breeding colony.

Survey Visit Duration: Duration of survey visits while in presence survey mode is at least four hours, as described above for the presence survey application. Once clearance survey mode is initiated, survey visit duration is at the discretion of the surveyor but in aggregate, survey effort should be sufficient to confirm breeding presence and determine the approximate location and extent of the breeding colony(s).

Number of Survey Visits: **Three survey visits in presence survey mode, with no evidence of breeding, are required before concluding that Pinyon Jays are not breeding in the project polygon.** If initial breeding evidence is obtained on the first, second, or third survey visit, subsequent survey visits in clearance survey mode will generally be required to accurately locate and delineate breeding colony (s). The PLP does not specify the number of survey visits in clearance survey mode required to adequately accomplish this task, which will vary from project to project.

Interval Between Survey Visits: The **preferred interval** between sequential survey visits while in presence survey mode is approximately 30 days. This 30-day interval is intentionally longer than the interval specified for the presence survey application (i.e., 5 – 20 days). This longer interval distributes survey effort evenly across most of the breeding season and thereby reduces the risk of drawing a premature conclusion of "no breeding". For example, if the initial survey visit occurs on 28 February, remaining survey visits on 2 April, and 4 May would adhere to the preferred approach. A **minimally acceptable interval** allows survey visits while in presence survey mode to cover a six-week time window, which equates to an interval between survey visits of approximately 20 days. For example, if surveys are initiated on 10 April, subsequent visits on 30 April and 23 May would adhere to the minimally acceptable approach.

If initial evidence of breeding is detected while in presence survey mode, survey effort shifts to clearance survey mode as previously described, and adherence to the survey intervals described above can be discontinued. The PLP does not specify an interval between successive survey visits while in clearance survey mode. Users should conduct as many of these survey visits as needed at intervals they select to adequately estimate the location and extent of breeding colony(s) in the project area.

Duration of Survey Results: Available evidence suggests that many Pinyon Jay flocks change the location of their breeding colony(s) within their home range annually. For that reason, the results of a given clearance survey may not be relevant for the subsequent breeding season. As additional data become available on breeding colony site fidelity, the PLP may be amended to provide additional recommendations.

DETAILED METHODS: PINYON JAY BREEDING COLONY AND NEST SITE DELINEATION

In most situations, conducting a clearance survey (above) is sufficient for MBTA compliance. However, when a more precise colony delineation and / or identification of nest locations are desired or required, they should be obtained as follows:

1) Do not enter the colony location until either after the breeding season or until evidence of fledging is observed.
2) To locate nests, actively observe trees, looking for nests that resemble those shown in Figure 4.
3) Do not use flagging tape or other visual indicators to mark nests. Pinyon Jays may reuse nest trees in subsequent years, and nest predators may remember locations of flagging tape.
4) Be aware that colony size can range from very small (5 – 10 nests) to very large (many dozens of nests) depending on flock size, region, and year.
5) Be aware that although the data collection template for the PLP (Appendix 1) permits nest locations to be recorded, it does not incorporate various nest site attributes that may be of interest to researchers. Incorporating such attributes in the data collection form is the responsibility of the user.
6) By identifying all or most of the Pinyon Jay nests in a breeding colony, colony extent can be mapped with a relatively high degree of accuracy.

Data Recording

All data collected during PLP surveys must be compatible with the "data dictionary" created originally for the LLP, which is presented in detail in Appendix 1. To ensure this compliance, we strongly recommend that all data be collected using the ArcGIS Field Maps app (hereafter, "Field Maps") and a preconfigured data form.[9] A detailed User Guide and Configuration Guide for Field Maps are available in Appendices 3 and 4. Users of the PLP are responsible for deploying and configuring Field Maps using their own ArcGIS OnLine or ArcGIS Enterprise organizational accounts. However, under certain circumstances, the technical contacts listed below may be able to provide configuration and deployment assistance to PLP users.

Data collected in Field Maps are automatically synced to the user's ArcGIS organizational account once the surveyor has access to internet. Data can then be stored and managed by the account administrator and easily shared using the file geodatabase format.

[9] This data form is "embedded" in a file geodatabase template that is available at https://gbbo.org/s/PIJA-Project-Survey-Protocol_FGDBgdb.zip . See Appendices 3 & 4 for more information.

For organizations that do not wish to use Field Maps to record data, a paper data form that is consistent with the PLP protocol's data dictionary is available in Appendix 5. Users may wish to modify this data sheet template to change layout and formatting or to add attributes.

Figure 3. Photographs of Pinyon Jay nests. All nests are "messy" piles of thin sticks. Older, degraded nests tend to look smaller and less "crisp" than newer, active nests. *Nests are typically about 25 – 30 cm (10 – 12") high and about 30 – 45 cm (12 – 18") wide.*

Protocol Revisions

It is likely that this protocol will be revised from time to time in response to user feedback and growing knowledge about Pinyon Jay ecology and conservation. If you have feedback or suggestions for improving the protocol, please contact one of the individuals listed below.

Technical Contacts

For questions about technical aspects of this protocol please contact one or more of the following individuals:

Kelly Colegrove, Great Basin Bird Observatory, colegrove@gbbo.org

Michael West, Nevada Department of Wildlife, mwest@ndow.org

John D. Boone, Great Basin Bird Observatory, boone@gbbo.org

State Contacts

For questions or guidance about the appropriate PLP application and methodology for your project, please contact the individual listed for the state in which your project is located:

Nevada: Jess Brooks, Nevada Department of Wildlife, jdbrooks@ndow.org

Arizona: Edwin Juarez, Arizona Game and Fish Department, ejuarez@aagfd.gov

Oregon: Anne Mary Myers, Oregon Department of Fish and Wildlife,
annemary.myers@odfw.oregon.com

California: Dan Applebee, California Department of Fish and Wildlife,
Daniel.Applebe@wildlif.ca.gov

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Appendix 1. Data Dictionary Attributes and Attribute Values

The Data Dictionary provides detailed specifications for all data-recording attributes and attribute values that are associated with the PLP. The Data Dictionary is organized into:

1) Sighting-level data attributes shown in Table 1 that describe each unique Pinyon Jay observation.
2) Visit-level data attributes shown in Table 2 that describe each unique survey visit to a specific polygon.
3) Project-level data attributes shown in Table 3 that describe entire projects or data collection efforts.
4) Pick-list attribute values shown in Table 4 that specify acceptable values for many of the sighting-level and visit-level attributes from Tables 1 and 2.

The distinction between sighting-level and visit-level attributes corresponds to the organization of the familiar paper data sheet, which has a single header section for entering visit-level data and multiple data entry lines for entering sighting-level data. In electronic data collection systems, establishing a link between each visit-level record and its associated sighting-level records requires creating a shared, unique "key", as indicated in Tables 1 and 2.

Important Note: The footnotes in this Appendix that refer to Field Maps assume that your organization used the pre-configured geodatabase template and configuration instructions detailed in the Configuration Guide to prepare and deploy Field Maps. If Field Maps is deployed in any other way, the footnotes may not be accurate.

Table 1. Sighting-level attributes for the PLP. The first column shows attribute names in both a longer descriptive format ("Alias"), and shorter format ("Database") that adheres to the nine-character limit of some database systems. The second column shows the attribute type and indicates whether there is an associated pick list of allowable values in Table 4. The third column provides a description of the attribute. Field data entry is required for all attributes in this table unless they are described as "OPTIONAL" in the third column.

Attribute Name (Alias / Database)	Attribute Type	Description
Date and Time[10] / DateTime	Date	YYYY-MM-DD, HH:MM format
Latitude and Longitude[11] / Lat, Lon	Geographical Coordinates	The geodatabase template is configured with a geographic coordinate system. This can optionally be changed by the user to match the coordinate system used to create the project specific polygon.
Surveyor[12] / Surveyor	Text (Optional User-Created Pick List)	OPTIONAL: Name of the surveyor. Users can create a project-specific pick list or allow free-form data entry.
Observation Method / ObsMethod	Text (Pick List)	Indicates whether the observation is visual, aural, or both.
Observation Type / ObsType	Text (Pick List)	Indicates whether the observation is made while performing the PLP or incidentally.
Flock Size / FlockSize	Integer	Estimated size of the observed flock (# of individuals).
Flock Resight? / FlockRes	Text (Yes-No)	OPTIONAL: "Yes" indicates that in the judgment of the surveyor, the flock being recorded has previously been detected and recorded on the surveyed polygon. "No" indicates the first record for a particular flock.
Flock ID / FlockID	Text	OPTIONAL: Unique alphanumeric identifier for each unique flock.
Flock Activity Type / FlActType	Text (Pick List)	Primary activity type for the flock at the time when the record is made. If the primary activity type changes, a new data record should be made.
Breeding Behaviors / BreedBeh[13]	Text (Pick List)	OPTIONAL: Type(s) of breeding evidence observed.
Comments / Comments	Text	OPTIONAL: Miscellaneous information about the sighting.
Visit ID[14] / VisitID	Alpha-numeric	"Key" that allows matching sighting-level data with associated visit-level data.

[10] Date and time are automatically recorded (as "created_date") in Field Maps.
[11] Coordinates are automatically recorded in Field Maps.
[12] The surveyor's unique username is automatically recorded (as "created_user") in Field Maps.
[13] Because Field Maps only allows single selections to be made from pick lists, this field will recur up to four times in the Field Maps data form if a non-blank value is entered. This allows up to four different breeding behaviors to be recorded for a given sighting-level record.
[14] Visit ID is recorded automatically in Field Maps.

Table 2. Visit-level attributes for the PLP. The first column shows attribute names in both a longer descriptive format ("Alias") and shorter format ("Database") that adheres to the nine-character limit of some database systems. The second column shows the attribute type and indicates whether there is a pick list of allowable values in Table 4. The third column provides a description of the attribute. Field data entry is required for all attributes in this table unless they are described as "OPTIONAL" in the third column.

Attribute Name (Alias / Database)	Attribute Type	Description
Date[15] / Date	Date	YYYY-MM-DD format
Latitude and Longitude[16] / Lat, Lon	Geographical Coordinates	The geodatabase template is configured with a geographic coordinate system. This can optionally be changed by the user to match the coordinate system used to create the project specific polygon.
Survey Type / SurvyType	Text (Pick List)	Indicates whether the survey complies with the PLP or not
Surveyor[17] / Surveyor	Text (Optional Pick List)	OPTIONAL: Name of the surveyor. Users can create a project-specific pick list or allow free-form data entry.
Plot/Polygon ID[18] / PloPolID	Text (Optional Pick List)	OPTIONAL: Unique identifier of the polygon being surveyed. Users can either create a project-specific pick list or allow free-form data entry.
Survey Visit Group Replicate / SVGRep	Ordinal (1, 2, 3)	Indicates the first, second, or third survey visit to the project polygon within the required set of three visits. This set of three survey visits is called a "survey visit group".
Monitoring Replicate / MonitRep	Ordinal (1,2,3, etc.)	OPTIONAL: Identifies a series of sequential survey visit groups to a polygon over time. For example, if a polygon is monitored annually, then each of the three survey visits in the first year's survey visit group would receive a value of "1". All three survey visits during the second year would receive a value of "2", etc. Many project-level applications will not involve monitoring over time, and for these cases this attribute is not relevant.
Wind Speed Category / WindSpeed	Text (Pick List)	Wind speed category at the beginning of the survey visit
Temperature (C) / Temperature	Integer	Temperature in °C
Sky Condition Category / SkyCond	Text (Pick List)	Categories describing amount of cloudiness or precipitation at the beginning of the survey visit
Start Time / StartTime	Time	Time when the survey visit begins in HH:MM 24-hr format

[15] Date is recorded automatically (as "created_date") in Field Maps.
[16] Coordinates are automatically recorded in Field Maps.
[17] The surveyor's unique username is automatically recorded (as "created_user") in Field Maps.
[18] "Plot" is used in the attribute name because this attribute is also used in the PJWGP, which is plot-based.

Attribute Name (Alias / Database)	Attribute Type	Description
Comments[19] / Comments	Text	OPTIONAL attribute to record miscellaneous information about the survey
Stop Time[20] / StopTime	Time	Time when the survey visit ends in HH:MM 24-hr format
Jays Present?[15] / JaysPres	Text (Yes-No)	"Yes" if any Pinyon Jays were present on the plot during the survey (do not treat the "Flyover" Activity Type as an indication of presence); "No" if no jays were present on the plot during the survey
Sighting ID[21] / SightingID	Alpha-numeric	"Key" that allows matching visit-level data with associated sighting-level data

[19] Most visit-level attributes should be recorded at the beginning of the survey visit. However, comments can be entered at the beginning or the end of a survey visit.
[20] Most visit-level attributes should be recorded at the beginning of the survey visit. However, these two attributes must be finalized at the end of the survey visit.
[21] Sighting ID is recorded automatically (as "GlobalID") in Field Maps.

Table 3. Project-level attributes for the PLP. These attributes are not recorded in the field but should be included in project data sets as metadata.

Item	Description
Project Contact	Name, email address, and phone number of the project's main point of contact
Agency	Agency or organization conducting the project
Project Description	Description of project purpose, goals, and schedule
Project Design	Description of the study area and sampling design. If surveys are not fully compliant with the PLP, the discrepancy must be described.
Coordinate System	Coordinate system used for project data.
Data Set Format	Indicate the 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. If using Field Maps, the format is ArcGIS file geodatabase and does not need to be specified.
Other Comments	Additional information needed to fully understand your methods and data set

Table 4. Pick list values for relevant attributes listed in the order presented in Tables 1 and 2. Suggested default values for electronic data collection systems are shown in bold + italic for some attributes.[22] Pick lists with only "Yes" or "No" options (Tables 1 and 2) must be configured but are not shown in this table. Pick lists described as "optional" in Tables 1 and 2 are not shown below but must be configured by the user.

Attribute Name	Pick List Values	Description
Observation Method	Visual	Observation primarily or exclusively visual.
	Aural	Observation primarily or exclusively aural.
	Visual and Aural	Observation both visual and aural.
Observation Type	***PLP Survey Protocol***	Observation made within the surveyed polygon while conducting the PLP. This is the default value for users of the PLP.
	PJWG Survey Protocol[23]	Observation made within the surveyed plot while conducting the PJWGP.
	Incidental	Observation made outside the surveyed polygon or plot and / or not during a formal PLP or PJWGP survey.
Flock Activity Type	Unknown or Other	The main flock activity type cannot be determined or is an unlisted type. This will often be the case for aural detections.
	Flyover	The flock is flying over the polygon but is not landing in trees or on the ground.
	Flying	Most or all of the flock is flying within the polygon and periodically landing on trees or 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	Some of the flock is engaged in nesting-related activities.
	Roosting	Most or all of the flock is roosting for the night.
	Feeder	Most or all of the flock is visiting a feeder.
Breeding Behaviors[24]	Courtship Chasing	Two or more birds engaged in courtship chasing.
	Courtship Behavior	One or more birds engaged in silent sitting, manipulating sticks, or copulation.
	Perching at or Near Nest	One or more birds perched at or near a nest.
	Breeding Vocalizations	One or more birds giving breeding vocalizations (piping rattle, female begging).

[22] These defaults are pre-configured for Field Maps.
[23] This option is included because the Data Dictionary is shared between the PLP and the PJWGP. However, it is not applicable to PLP users.
[24] Users should record as many pick list values as are applicable for a given sighting-level record. Because Field Maps allows only single selections to be made from pick lists, this field and its associated pick list will recur up to four times if a non-blank value is entered. This allows up to four different breeding behaviors to be recorded for the sighting.

Attribute Name	Pick List Values	Description
	Carrying Nest Materials	One or more birds carrying nest materials.
	Constructing Nest	One or more birds constructing a nest.
	Incubating or Brooding	One or more birds on a nest incubating or brooding.
	Feeding Nestlings	Parents feeding young in nest.
	Feeding Fledglings	Parents feeding fledglings outside nest.
Survey Type	***PLP Survey Protocol***	Survey fully adheres to the PLP. This is the default value for PLP users.
	PJWG Survey Protocol – Landscape[25]	Survey fully adheres to the PJWGP for Landscape Applications.
	PJWG Survey Protocol – Project[20]	Survey fully adheres to the PJWGP for Project Applications
	Non-Protocol	Survey uses a non-listed protocol or no protocol
Wind Speed Category[26]	< 2 kph / <1 mph	No wind, smoke rises vertically.
	2–5 kph / 1–3 mph	Very light wind, direction shown by smoke drift.
	6–12 kph / 4–7 mph	Wind felt on face, leaves rustle.
	13–19 kph / 8–12 mph	Leaves, small twigs in constant motion.
	20–29 kph / 13–18 mph	Dust rises, small branches move.
	30–38 kph / 19–24 mph	Small trees in leaf begin to sway.
Sky Conditions	Clear Skies	Clear skies
	Partly Cloudy	Partly cloudy or variably cloudy
	Cloudy	Cloudy or overcast
	Fog or Smoke	Fog or smoke
	Drizzle	Drizzle
	Snow	Snow or flurries
	Shower	Shower

[25] This option is included because the Data Dictionary is shared between the PLP and the PJWGP. However, it is not applicable to PLP users.
[26] The protocol precludes surveying at wind speeds exceeding 38 kph / 24 mph, or during heavy precipitation. Therefore, no categories exist that cover these conditions.

Appendix 2. Avoiding Impacts to Nesting Pinyon Jays

Further suggestions and tips for nest searching and avoiding unintentional impacts on nesting birds are listed below. These are primarily applicable to the Breeding Colony and Nest Site Delineation application of the PLP, but may be applicable to other applications under some circumstances.

1) Observe nests as quickly and quietly as possible. Do not linger at nests, approach more closely than absolutely necessary, talk, or act in any animated fashion. Following these steps reduces the chance that a predator will cue in to the nest location.
2) If possible, walk some distance past the nest after making your observation before stopping to record data.
3) Do not eat any food near a nesting colony because this attracts predators.
4) **Never** leave a "dead-end" scent trail by retreating from a nest the same way you approached it. Predators are tuned into people's scent and follow them in hopes of locating food. When you leave a dead-end trail, they will likely pay close attention to your stopping place and may discover the nearby nest.
5) Similarly, if ravens or crows (or other corvids) are present when you find nests, act casual and uninterested in the nest (this is always a good idea because it also calms down the parent birds), and calmly walk away from the nest area. Corvids are extremely tuned into human behavior and **will** check out any spot for which you show particular interest, just in case there is a food source. Don't approach the colony again until ravens/crows are out of sight and earshot.

More detail about avoiding nest disturbance can be obtain from the PJWG at https://partnersinflight.org/wp-content/uploads/2019/10/Guidelines-to-Minimize-Impacts-of-Data-Gathering-Activities-on-Pinyon-Jays.pdf .

Appendix 3. User Guide for ArcGIS Field Maps

User Guide for ArcGIS Field Maps

Intended Audience and Purpose: This guide is intended for field workers that:

1) Are using the PLP to survey for Pinyon Jays, and
2) Are using the ArcGIS Field Maps app (hereafter, "Field Maps") to record data while conducting surveys.

This guide describes how to use Field Maps to record data using the PLP protocol. It assumes no previous experience with Field Maps, though it is helpful to be comfortable using a smart phone or tablet.

Prerequisites: The following conditions must be met before you begin to use Field Maps for data collection:

1) Your organization's GIS administrator must have provided you with a properly configured ArcGIS Online account, and you must know your username and password for this account.
2) Your admin must have performed all the necessary configuration as detailed in the Configuration Guide.
3) Your admin must have shared a data collection map / form for the PLP with you.
4) You must have a smart device (phone or tablet) with an on-board GPS that is enabled.
Devices may use either the Android or iOS operating system.
5) Before collecting data, you must have received appropriate training to cover:
    a. The survey protocol (PLP) you are using, including all field survey methods and requirements, all data fields, and the definitions and meanings of all allowable data field values.
    b. Pinyon Jay field identification by sight and sound.
    c. Basic natural history of Pinyon Jays and Pinyon Jay habitats.

Notes on the User Guide: This User Guide uses multiple screen shots created on an Android smart phone. The layout of Field Maps can vary with device type (Android vs. iOS; phone vs. tablet) and screen size; therefore, what you see on your device may not correspond exactly to the screen shots below. Additionally, the screen shots were prepared using the PJWGP, and the specific map and data form you will use for your project will be different in some respects. Notable among these differences, the screen shots depict PJWGP square survey plots, whereas PLP users will be creating and viewing project specific polygons.

Getting Help: For questions about using Field Maps, to report errors in this User Guide, or to suggest improvements, contact John D. Boone (boone@gbb.org).

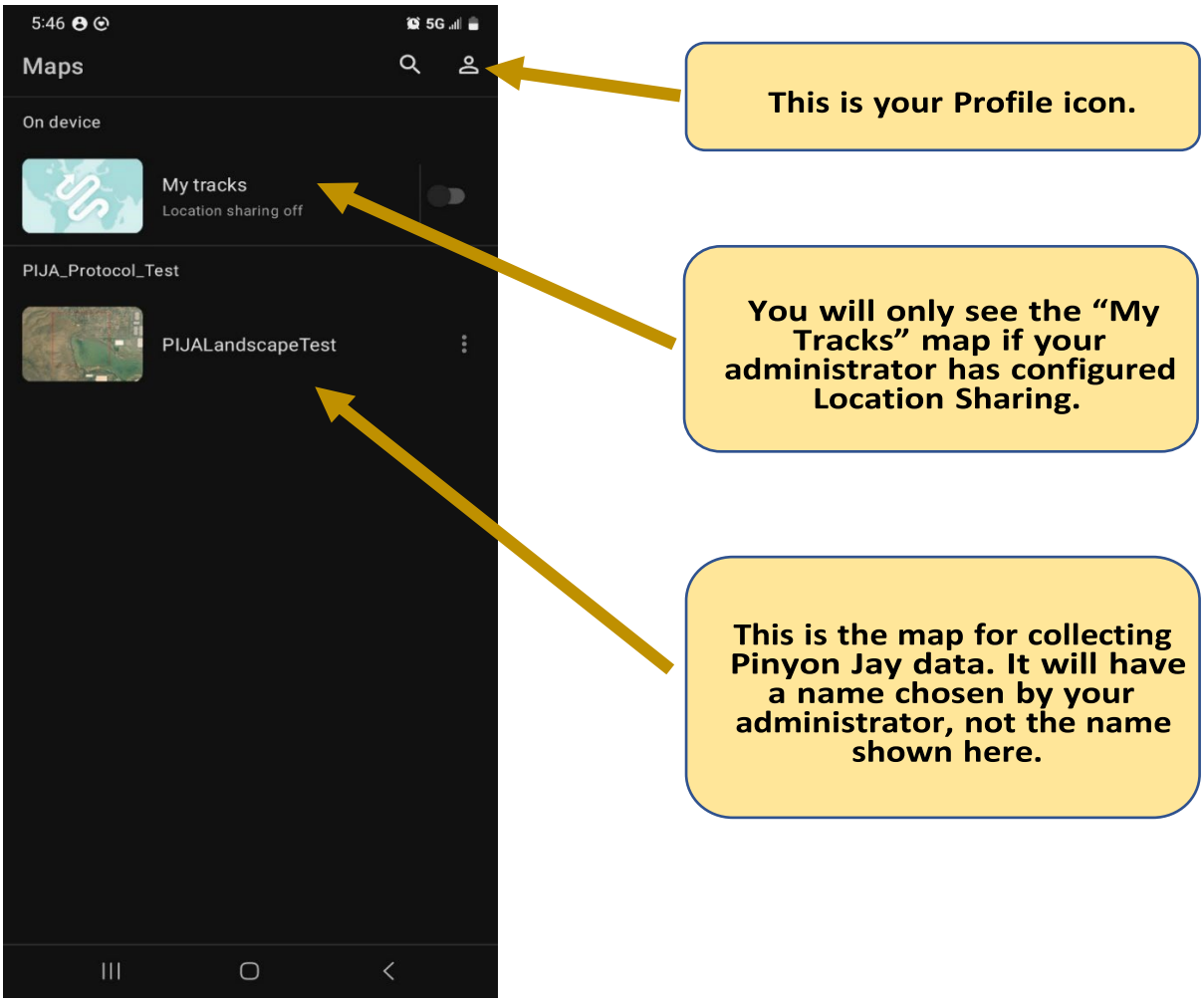
Preparing Field Maps (Require Internet Connection):

STEP 1: Install Field Maps on Device

1) On your device open the Play Store app (for Android) or Apple Store app (for iOS).
2) Search for "ArcGIS Field Maps".
3) Install the app.

STEP 2: Log In

1) Open the Field Maps app on your device.
2) Choose "Sign in with ArcGIS Online". Do not sign in with ArcGIS Enterprise unless your admin specifically instructs you to do so.
3) Sign in using your ArcGIS Online username and password. Normally you will remain logged in on this device in the future, but occasionally you may need to log in again.
4) You should now see a screen similar to the one below, called the "Maps Page".

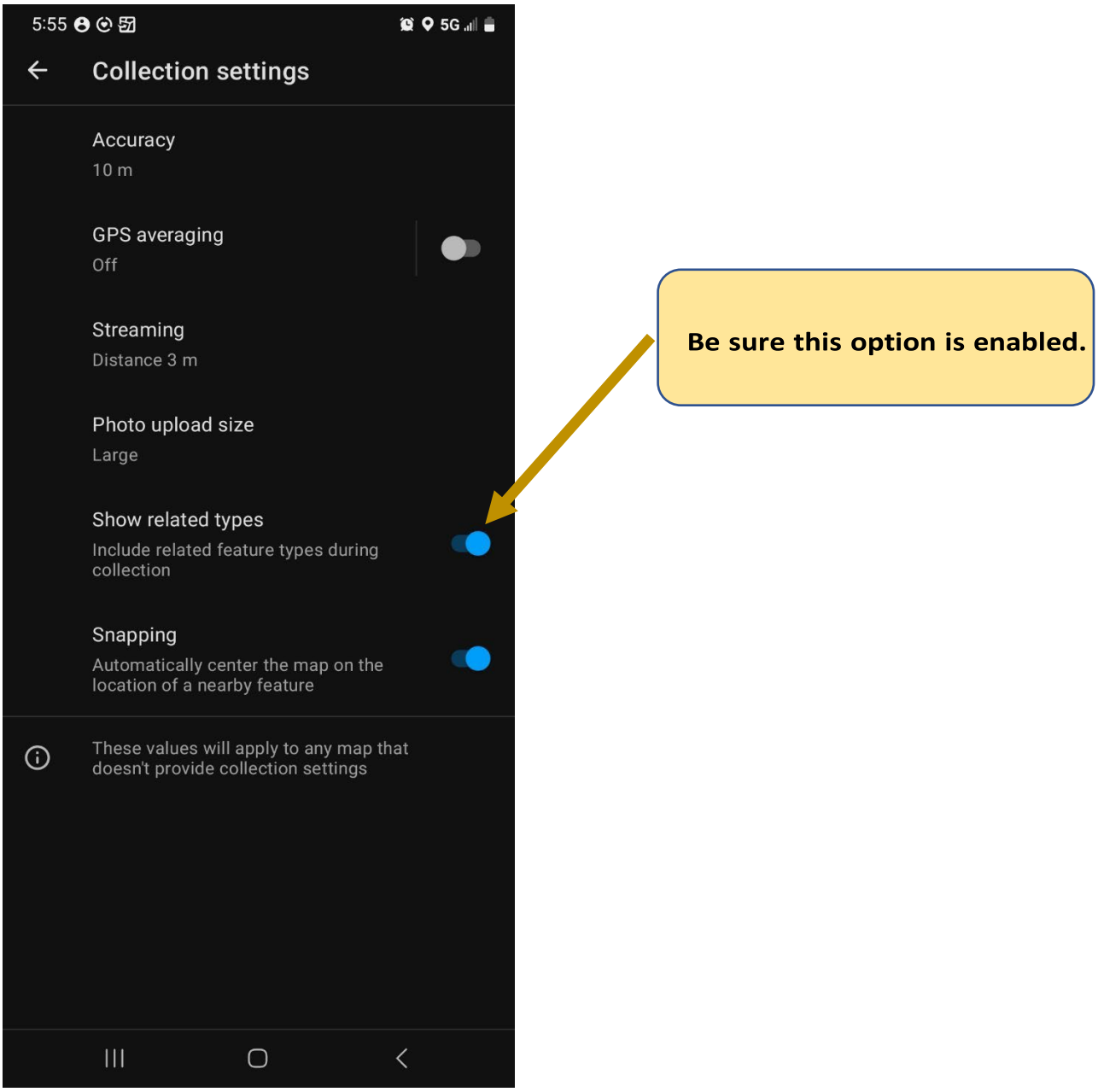


STEP 3: Field Maps App Configuration

1) Click the "Profile" icon (screen shot above).

2) On the Profile Page, it is recommended that you enable the "Auto-Sync" option. Otherwise, you can keep the defaults on this page unless advised to do otherwise by your administrator.

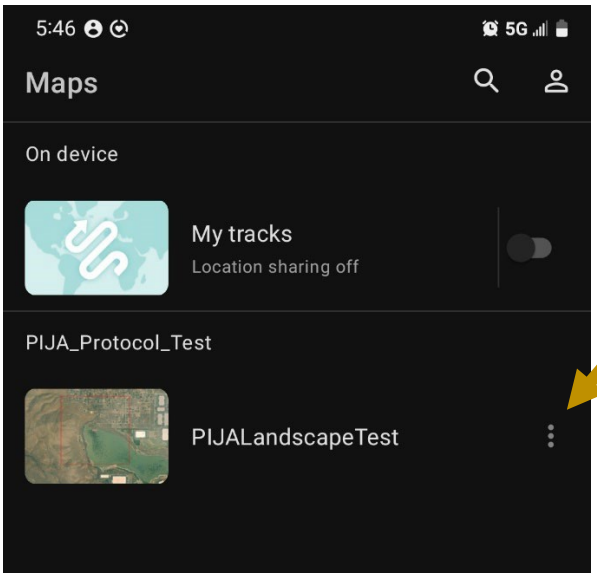
3) On the Profile Page, click "Collection settings". Then, enable the "Show related types" option. ***This is critically important*** (see screen shot below).



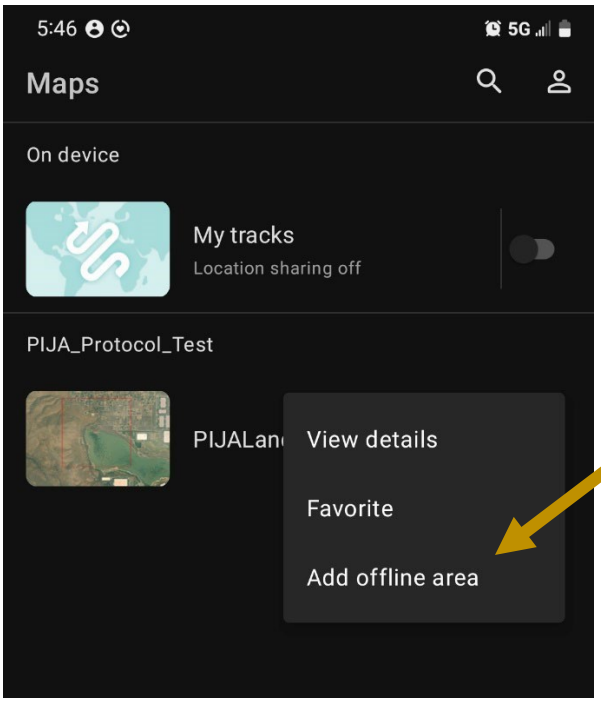
4) Back out of the Collection Settings Page and the Profile Page to return to the Map Page.

STEP 4: Add Offline Areas

Field Maps is designed to work when you do not have an internet connection. In order to do this, you must download one or more "Offline Area(s)" to your device, covering the locations where you will be surveying. It is possible that your administrator has already configured offline areas for you. If so, follow his or her instructions. Otherwise, download Offline Areas as described in the following screenshots. ***This must be done while you have a reliable internet connection for your device, either through Wi-Fi or LTE, before you head out to the field.***



Click the three dots here.



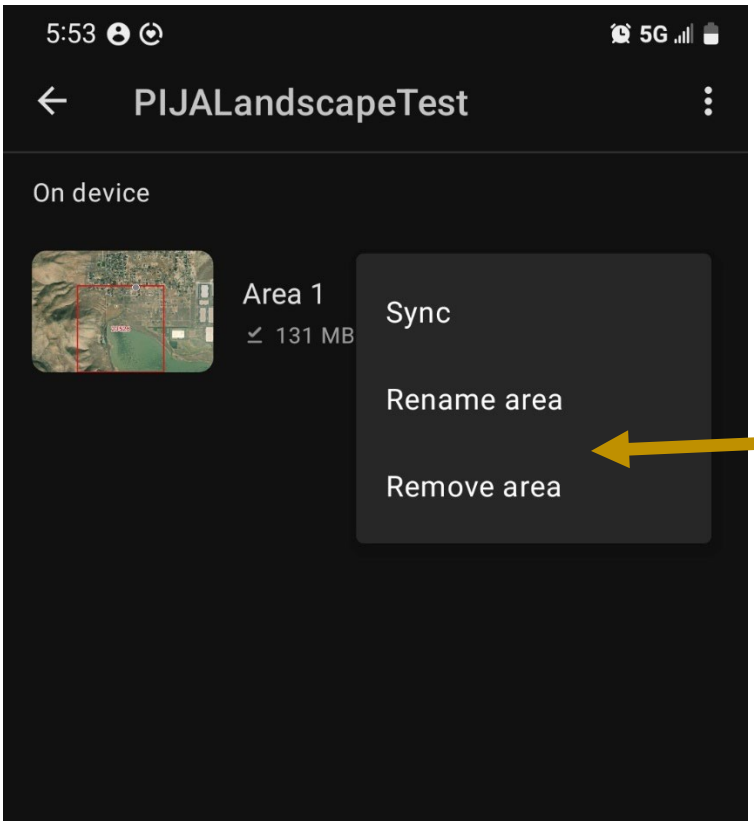
Choose this option.

Pan and zoom to define the Offline Area where you will be working. Depending on how far your current location is from your work area, you may have to pan a long way. Depending on the size of the area you need to download you may need to change the "Level of Detail" setting. Field Maps and your device will put limits on the size of the download.

This frame defines the Offline Area.

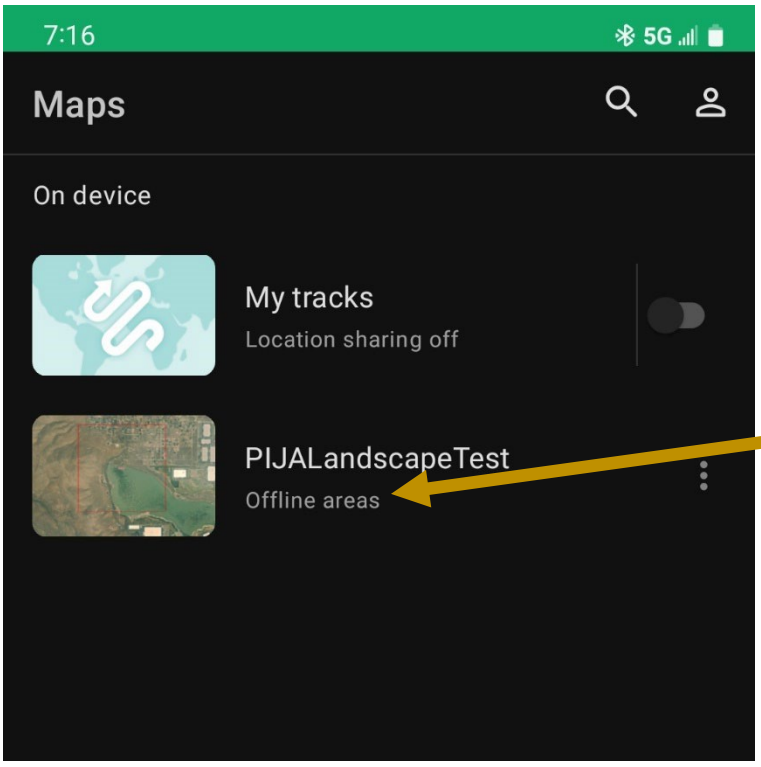
This is a 2.5 x 2.5 km Pinyon Jay survey plot. Your map may or may not have something similar shown.

Click here to download the Offline Area once it is framed correctly. The download may take several minutes, and it may fail. If so, just try again and eventually it will work.



Once the Offline Area is downloaded, you will see this screen that lists the Offline Area(s) that are stored on your device.

You can click the three dots to the right of the Offline Area and rename it or remove it once you are finished using it to save device storage space.



When you return to the main Map Page, you'll see that your map now notes that Offline Areas are available for the map. Clicking the map returns you to the Offline Areas Page .

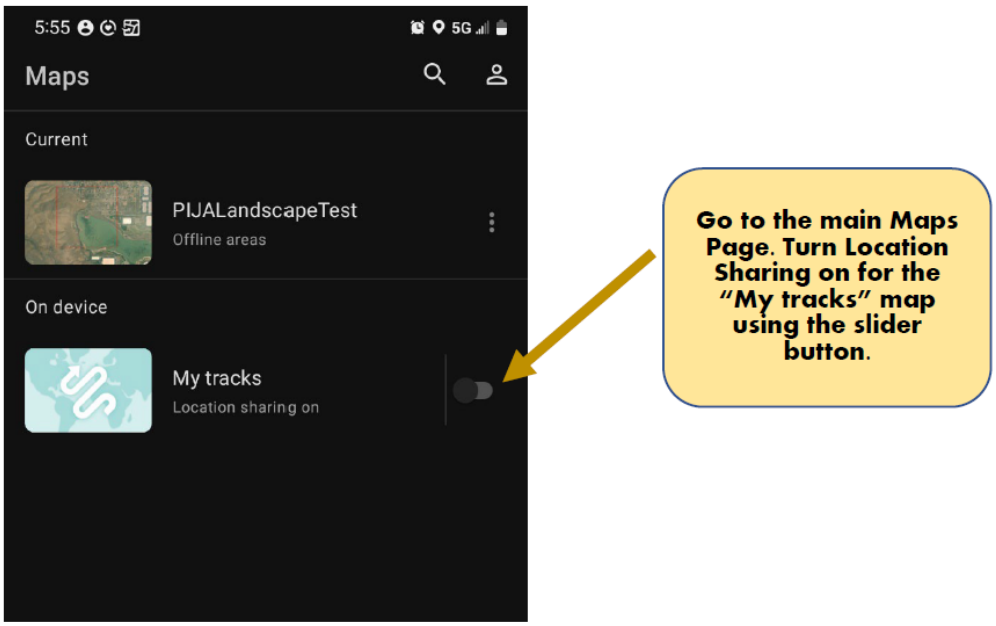
Collecting Data with Field Maps (Step 1 Requires Internet Connection – Remaining Steps Are Done Offline):

STEP 1: Before Leaving for the Field

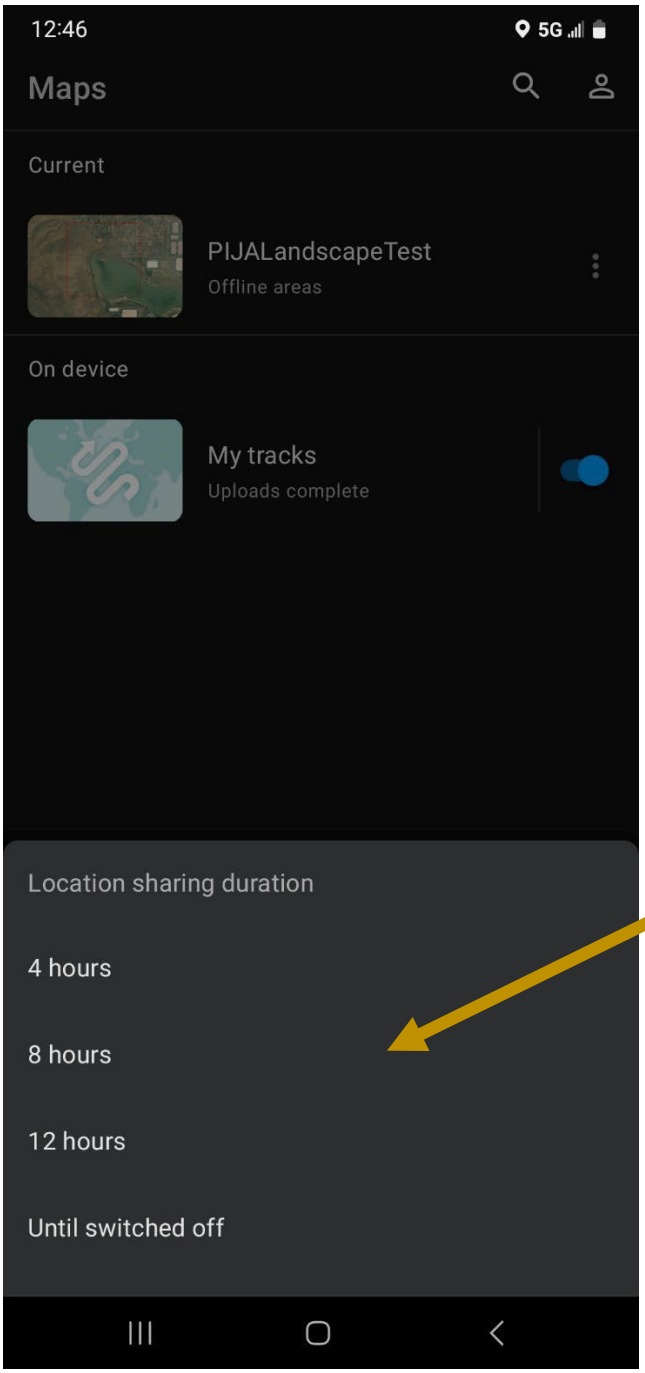
1) Make sure you have downloaded any Offline Areas you will need during your field session. You will not be able to download them without an internet connection.
2) If you have not enabled Auto-Sync, go to the Offline Areas Page, click its three-dot icon, and choose "Sync". This will ensure that any changes in the map or data set that your administrator or other surveyors have made is synced to your device. If you have enabled Auto-Sync, necessary syncing should happen periodically and automatically.

STEP 2: Just Before Starting the Survey, Enable Location Sharing and Tracks (if applicable)

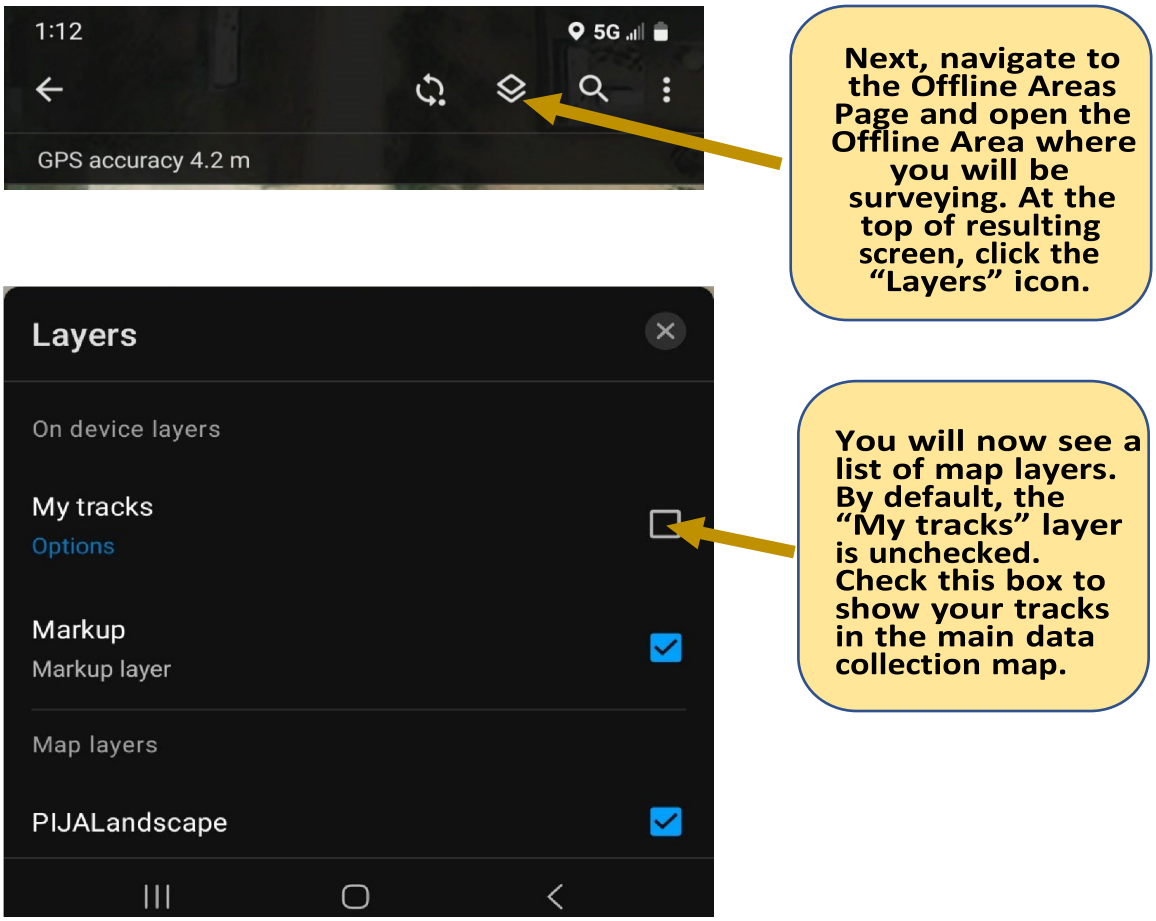
Location Sharing is a capability of Field Maps that allows you (or others) to visualize your track on a map. Seeing your track as you perform an area search under the PLP can help you to cover your assigned plot or polygon thoroughly. Whether or not you use Location Sharing for your surveys is up to your administrator. They will inform you about the relevant details,[27] but you may need to follow the instructions shown in the screen shots below after you arrive at the survey location, but just before you actually start to survey.



[27] Some of the steps illustrated here can potentially be automated by your administrator. Ask your administrator for details about your organization's approach to Location Sharing if you are unsure.



Once you do this, you will be prompted to select the duration of Location Sharing. Any option is okay, but we recommend the "Until switched off" option to limit the amount of extraneous tracking data that are recorded. However, choosing this option means you will must remember to turn off Location Sharing in Field Maps after your survey is done; otherwise, location will be tracked on an ongoing basis, which drains your device battery unnecessarily. If you think you may forget to turn off location sharing, select one of the timed options.



STEP 3: Collecting Data While Surveying

Once you have performed the previous steps and are at your survey area, you are ready to start surveying and collecting data! As described in the PLP documentation, there are two kinds of data you will be recording: Visit-level data that describe each unique survey, and Sighting-level data that describe the Pinyon Jay observations you make during each survey. Proceed as follows:

1) Open your data collection map by clicking on the Offline Survey area that corresponds to your current survey location.
2) As soon as you start each survey ***ALWAYS record a Visit-level record***,[28] as shown below:

[28] Under the default configuration, you must create a Visit-level record before you can record an incidental (i.e., non-survey) Pinyon Jay Sighting-level record. Do this to the best of your ability, recognizing that Visit-level records may not be relevant to incidental records.

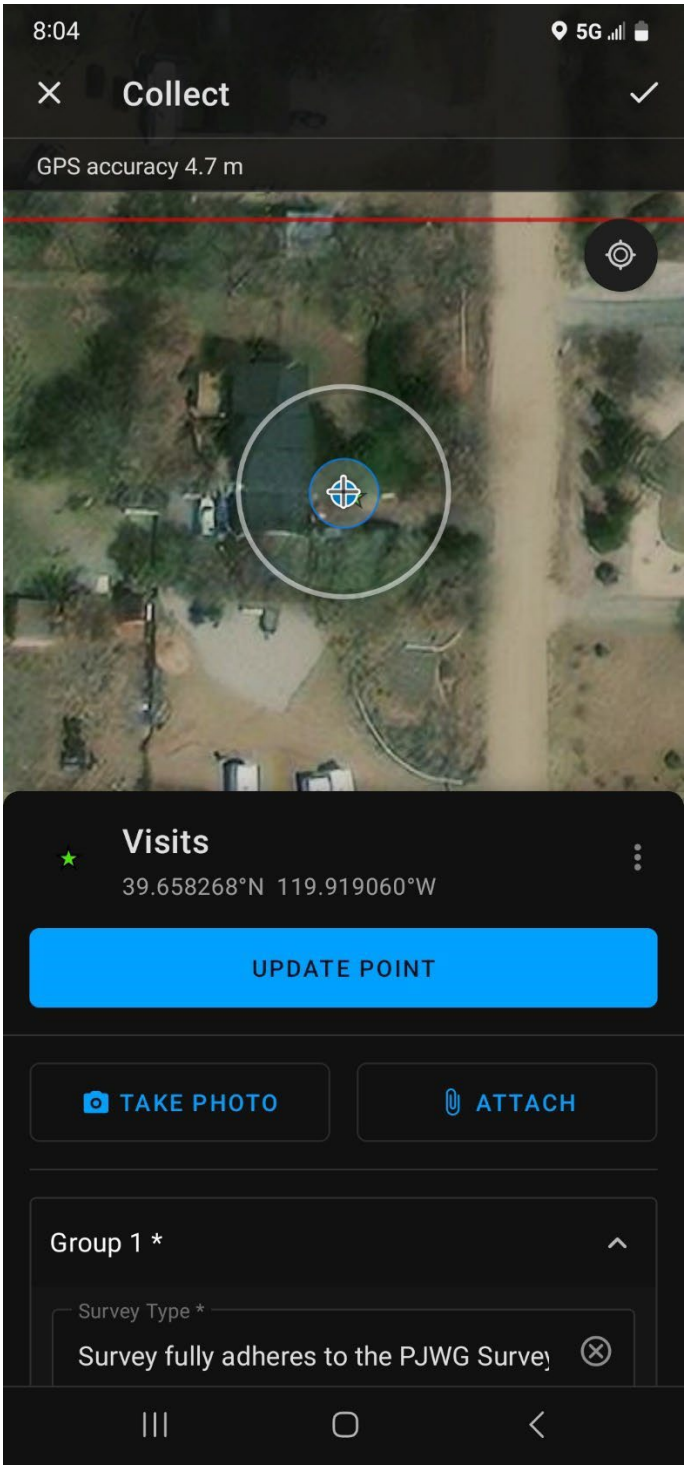
You will begin in "Navigation" view, which shows your current location, an imagery base map, and the boundary of your assigned plot or polygon if your administrator has included it in your map. If you are using Location Sharing, you will also see your track as proceed. You can zoom and pan around the map in the usual way.

Click here to center the map on your location.

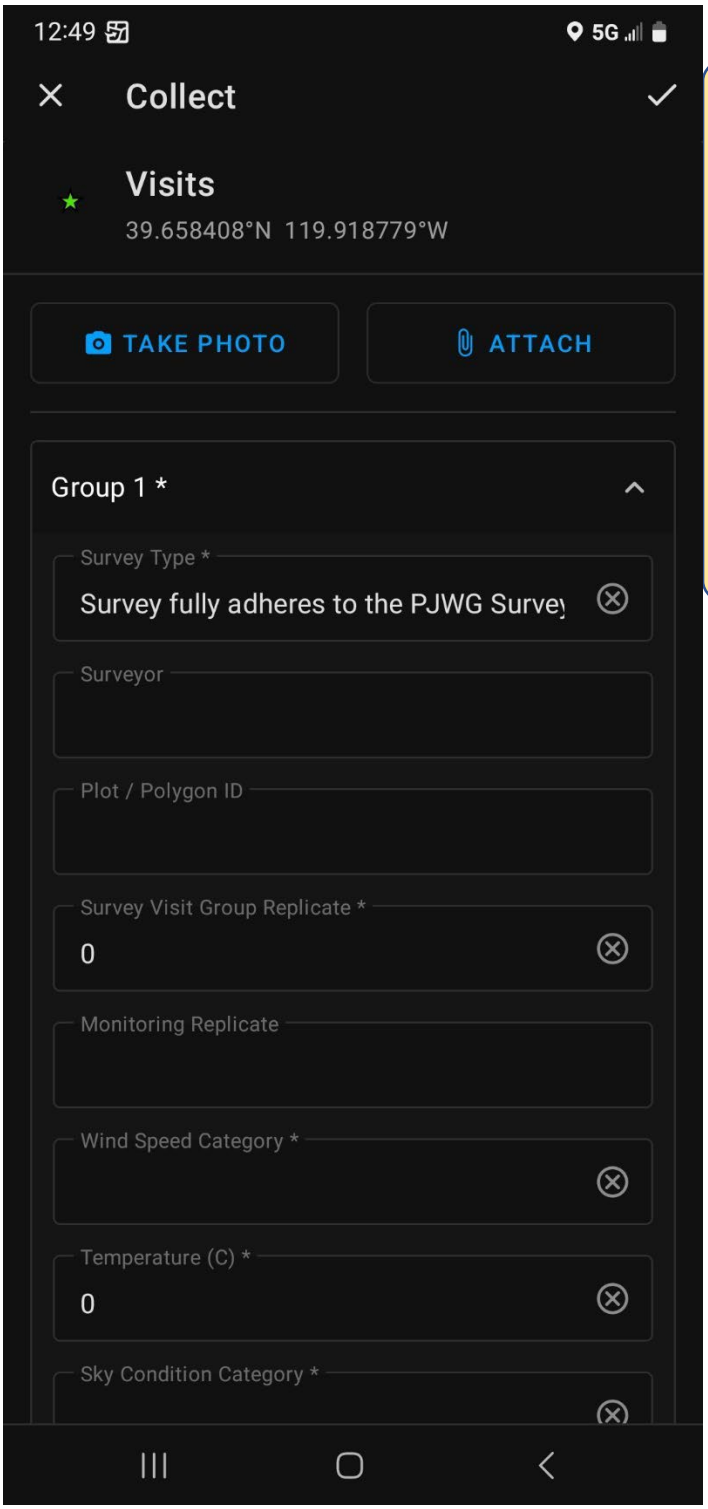
Plot boundary.

Your current location.

Now click the "+" icon to record your Visit-level data.



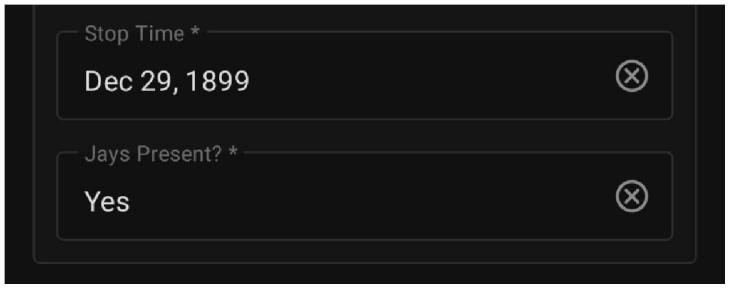
After clicking the "+", you'll see a screen like this. Be sure it refers to "Visits" because you must record the Visit-level record first. The crosshairs inside the big circle indicate the location of the data point you are about to record. By default, this location coincides with your current location, but you can pan the map around to change the location of the data point, and then click "Update Point". For the Visit-level record, it is fine to accept the default location. Note that you can take one or more photos of the general location to attach to the record.

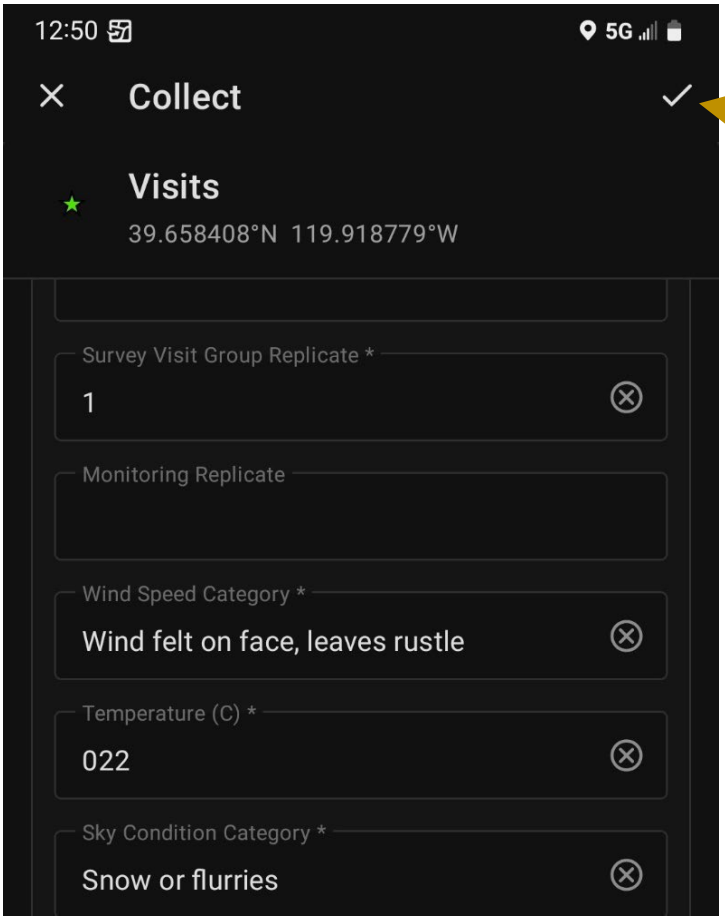


Now continue to scroll down the data collection screen. Click on each field in turn, select the correct value from the drop-down (if available) or enter it manually if there is no dropdown. Some fields are required (those with an asterisk), and others can be left blank if appropriate, as described in the PLP documentation. Be sure to scroll all the way to the bottom to address all of the data fields.

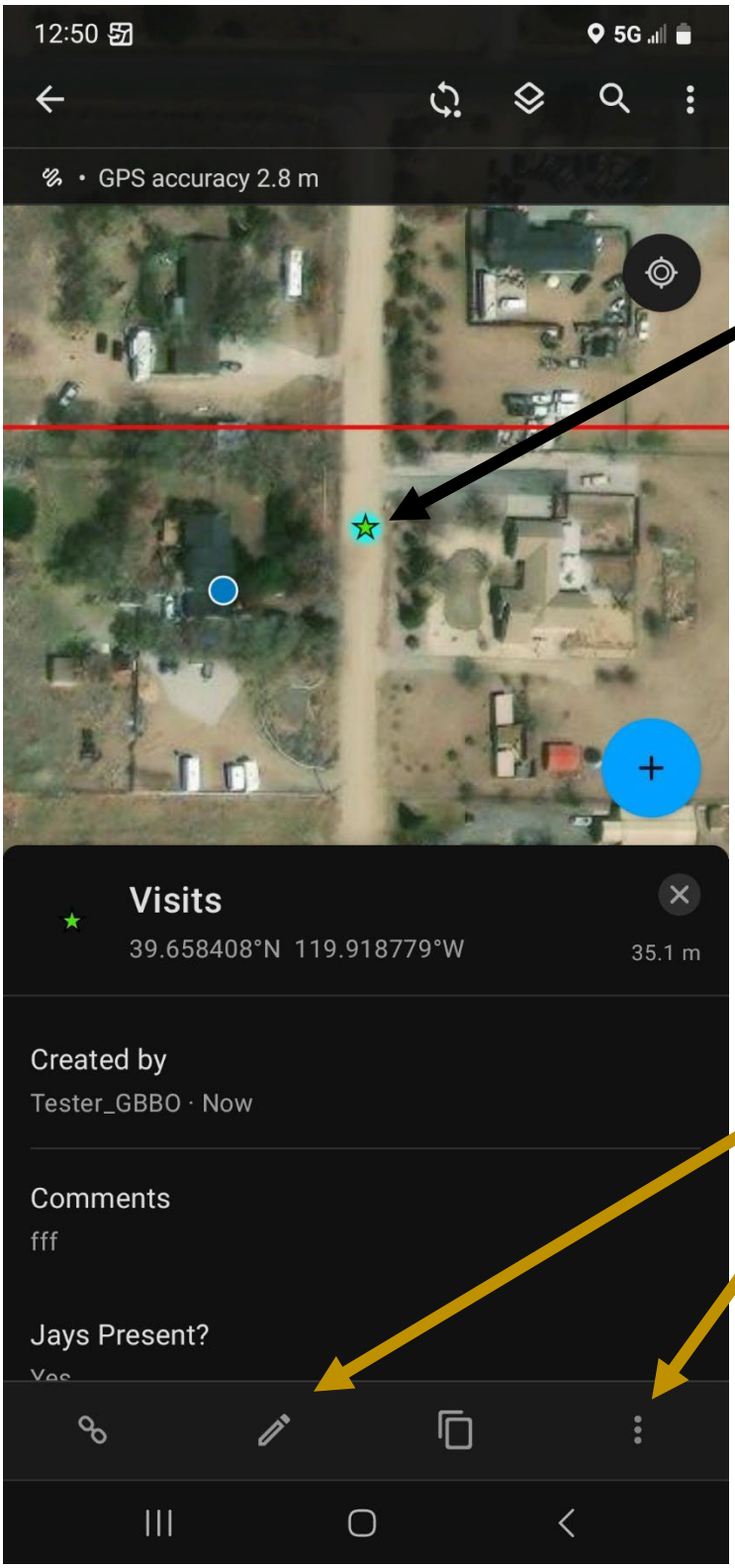
When you get to the "Start Time" field, click it and then select "Today". Then click the small clock icon in the upper right. On the next screen, select "Now". Then click "Okay" to return to the data collection form. Be sure your device's calendar and clock are set correctly! Note that the time may not show in this field after you record the data point, but it is stored in the underlying database.

Because the "Stop Time" and "Jays Present?" fields are required, you must fill them out to proceed with the survey, even though you can't know the correct values for these fields until the Survey is completed. The solution is to fill them out now, and then go back and change them once you finish the survey.





When you have completed all the fields, click the check mark icon to record the Visit-level data point. <u>If you don't do this, all your data entry will be lost.</u>

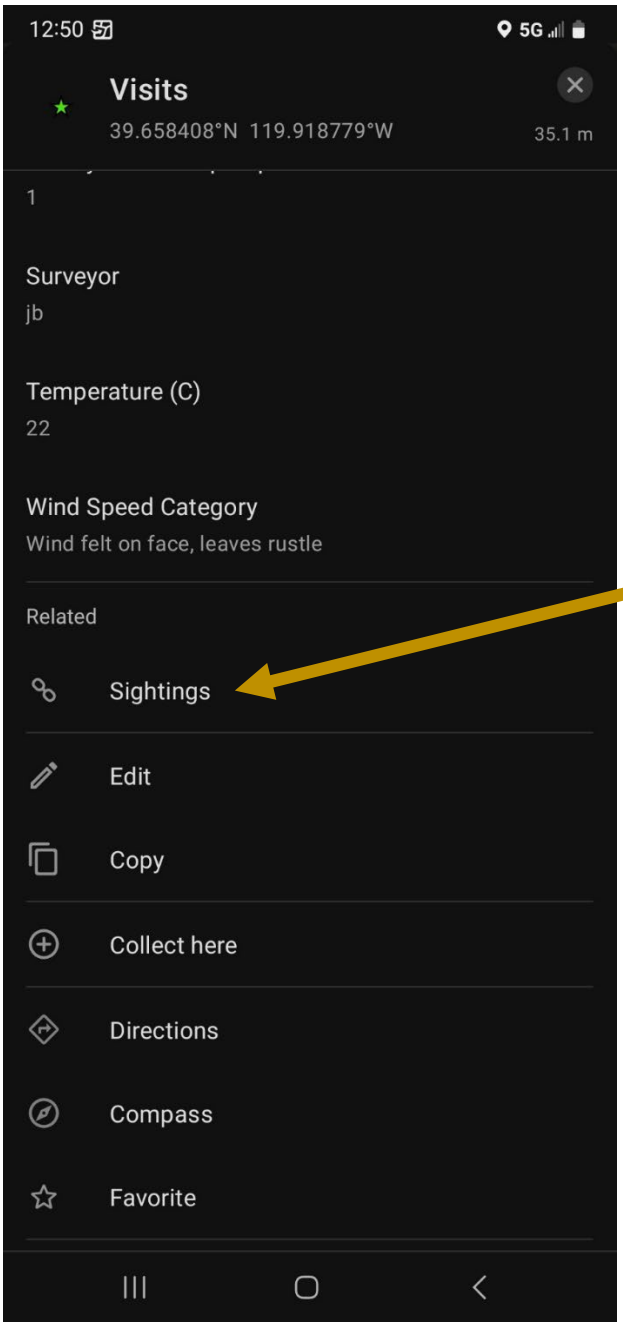


Now you will see your new Visit-level data point on the map. The blue "halo" indicates that the point is currently selected. You can select or unselect the point by touching it.

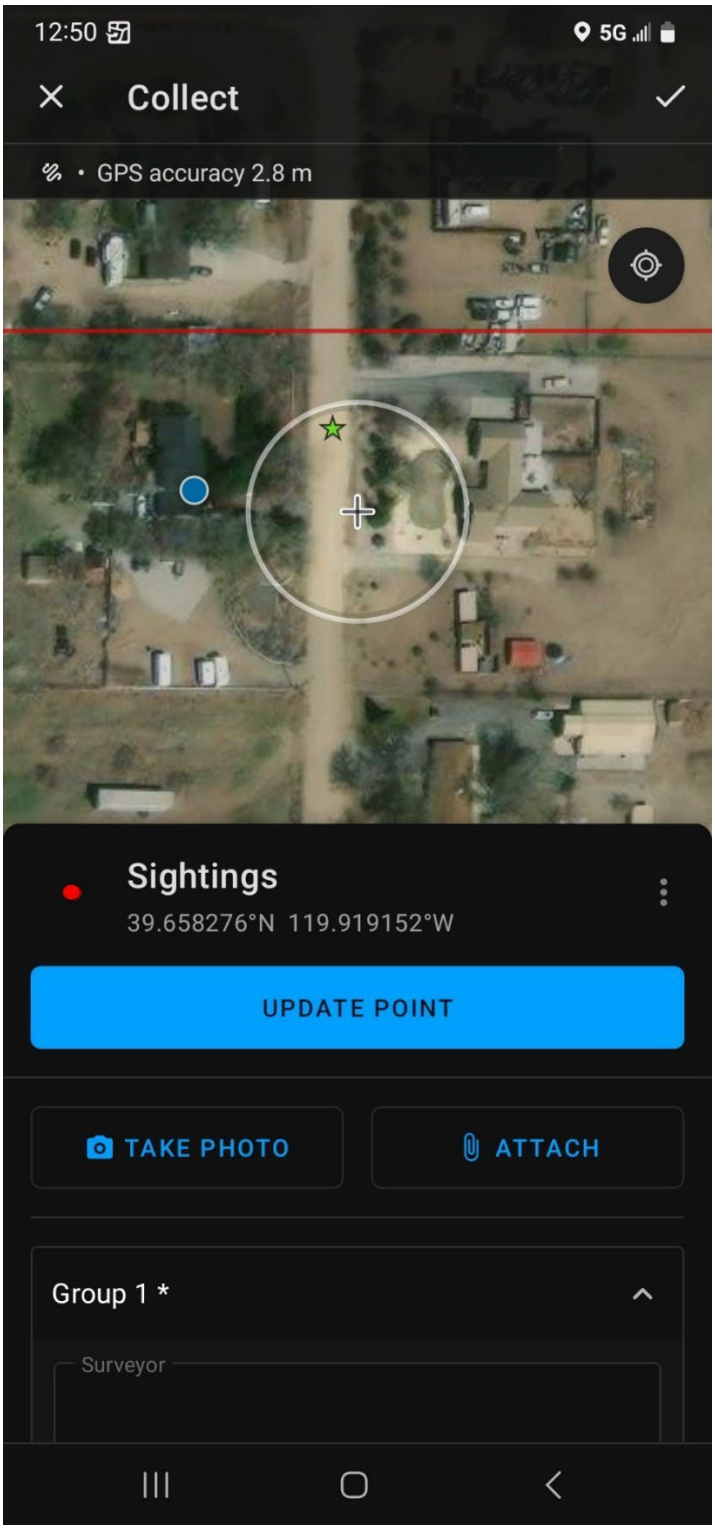
When the point is selected, you will see this "Options Bar". Click the pencil icon if you need to edit any of the data fields (and then make sure to save the changes using the check mark). Click the three dots for an option to delete the record if you need to.

3) Now begin your survey using the area search method, as described in the PLP documentation. If you have enabled Location Sharing, you will see your track lengthen as you proceed. You may want to unselect the Visit-level record so you can see more of the map as you navigate.

4) When you need to record a sighting, first find and re-select the Visit-level point if you unselected it earlier. ***This is critical***. Then do the following:

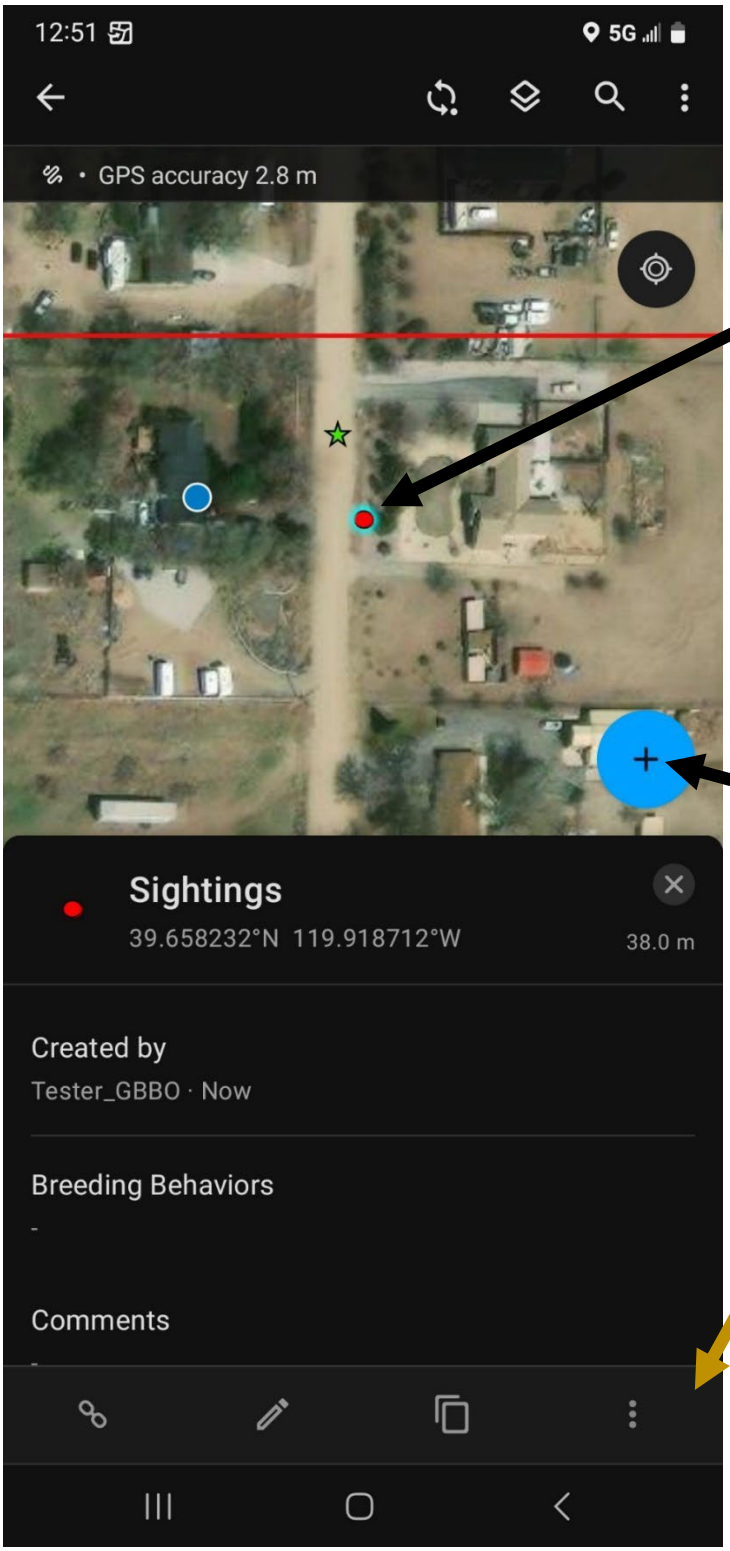


With the Visit-level point selected, scroll down past the data fields until you reach the "Related" heading. Then click "Sightings" to record a Pinyon Jay sighting record, and then click "Add" on the next screen. Recording the sighting-level data this way preserves the database relationship between the Visit-level record and the Sighting-level record, which is why it is so important.



After clicking "Add", you will position the Sighting-level point and record data using the same steps as you used previously for the Visit-level record. Be sure to position the data point to reflect where the Pinyon Jay flock is located on the landscape, not where you are located. Remember to fill in all the required fields (scroll all the way to the bottom), and to click the check mark when done entering data to finalize the record.

Repeat these steps for every additional Sighting-level record during the course of the survey. Always begin with the Visit-level record selected, and always record the Sighting-level record using the option under the "Related" heading, as shown before.



When the Sighting-level record is selected on the map (notice the blue halo), you can use the Options Bar to edit the point later or delete it as previously described.

This will return you to the screen with the Visit-level point selected. From here you can scroll down to "Related" and "Sightings", as previously shown.

Options Bar for the selected Sighting-level record.

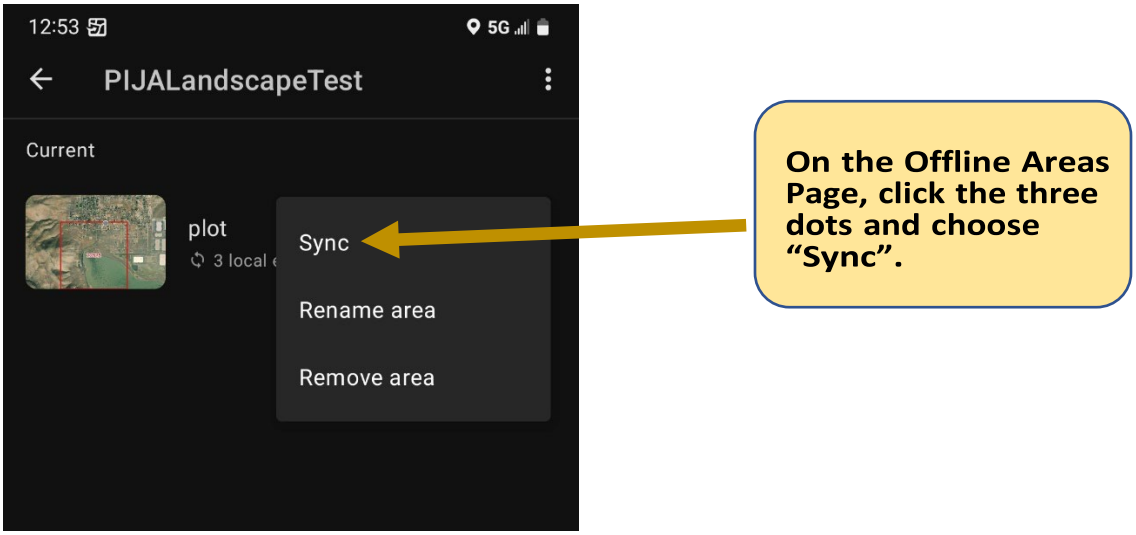
5) When done with the survey, select your Visit-level record on the map, click the edit icon on the Options Bar, and change the values for "Stop Time" and "Jays Present?" to the correct values. Then click the check mark to finalize these edits.

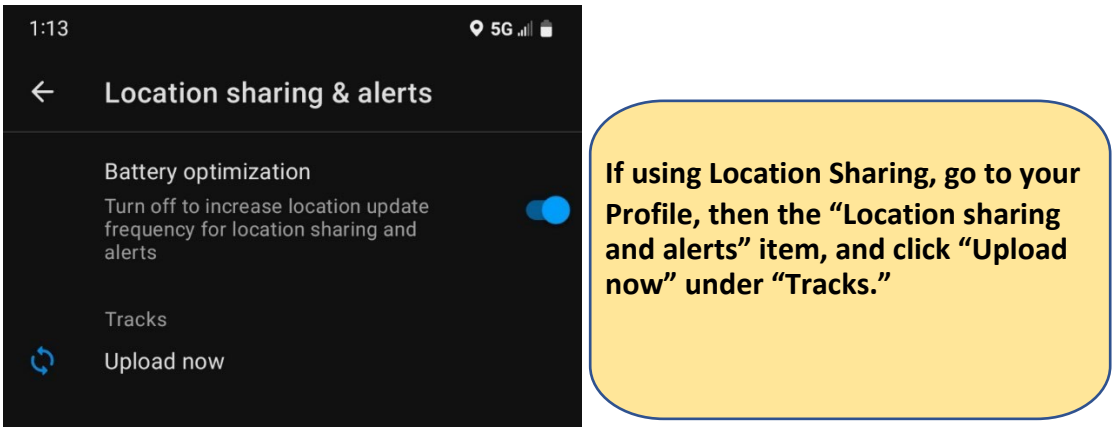
STEP 4: Immediately After Completing the Survey

If you are using Location Sharing, always return to your main Map Page and turn off the "My Tracks" map immediately after concluding the survey. If your administrator automated Location Sharing, you may not need to perform this manual step.

After the Survey

When you return from the field and have an internet connection, you will need to sync so that the data you collected are sent to the cloud-based dataset. This is done automatically if you have enabled Auto-sync, as described on page 2. Otherwise, sync manually as follows:





Be aware that once in a while, Field Maps will crash when attempting to sync data. The solution is usually just to try again. If that doesn't work, close the Field Map app on your device, restart it, and then try to sync. The data stored on your device will not be lost by restarting the app. These steps are usually sufficient to successfully sync, but if you continue to have issues, contact your administrator.

That's it! For the next survey, just start with a NEW Visit-level point and proceed as previously described.

Your administrator may choose to share maps and aggregated data produced by your team's data collection effort through ArcGIS Online. This provides an efficient way to review data for quality control purposes. Contact your administrator for details.

Appendix 4. Configuration Guide for ArcGIS

Configuration Guide for ArcGIS Field Maps

Intended Audience and Purpose: This guide is intended for organizations that:

1) Are using PLP to survey for Pinyon Jays, and
2) Are using the ArcGIS Field Maps app to record field survey data under the PLP.

This guide describes how to perform necessary configuration steps for this data collection system in the ArcGIS Online (AGOL) environment.[29] This configuration must be performed before field workers can use Field Maps for data collection. Once configuration is completed, field workers should consult the User Guide for detailed instructions about how to use the Field Maps app to record survey data.

Configuration is a somewhat technical task best undertaken by the GIS specialists that support their organizations. This guide therefore assumes familiarity with GIS terminology and processes, but it does not assume prior experience with configuration for Field Maps. It also assumes that the individual responsible for performing configuration has administrative privileges within their organization's ESRI organizational account (see below).

Getting Help: For questions or help with configuration, contact John D. Boone (boone@gbb.org).

Prerequisites: The following prerequisites must be satisfied before proceeding with the configuration process described in this document:

1) Your organization must have an organizational (not personal) ESRI account. There is an annual subscription cost associated with maintaining this account, which varies according to organization type, size, and licensing specifics.
2) Each field worker must have an AGOL user account with the "Creator" user type or higher.[30]
3) If your organization wants to record and view the tracks traveled by field workers as they conduct surveys using the area search approach, a location sharing solution for Field Maps must be implemented as described in detail here. We recommend that you use

[29] AGOL is a web-based GIS that stores and manages the data collected with Field Maps. ArcGIS Enterprise is an alternative to AGOL that may be more appropriate for some organizations, but it is not explicitly covered in this guide. The workflows described in the guide are conceptually applicable to configuring Field Maps under ArcGIS Enterprise although the specifics may vary.

[30] Organizations may opt to have multiple field workers share a smaller number of user accounts to reduce costs, but this is not recommended.

location sharing to facilitate, evaluate, and document appropriate survey coverage within selected plots or project polygons, but it is not required.

Brief Overview of the Configuration Process: The Field Maps app is an interface for adding and editing features to an editable feature layer within a web map hosted on AGOL. In addition to depicting the editable feature layer, the web map can also depict one or more noneditable feature layers (e.g., survey plot or survey polygon boundaries) and a base map (usually imagery) that helps the field worker navigate and orient to their surroundings. The configuration process consists of gathering these layers, adjusting their settings, creating and sharing the web map, and preparing the Field Maps app itself.

Preconfigured File Geodatabase: Data collected using Field Maps are stored in the file geodatabase (FGDB) format. To simplify the configuration of Field Maps, we have prepared a FGDB template for the PLP that is available at https://gbbo.org/s/PIJA-Project-Survey-Protocol_FGDBgdb.zip. This template has the following preconfigured characteristics:

1) All non-optional domains and domain pick-list values shown in Table 4 have been created
2) Two feature classes ("Visits" and "Sightings") with the attributes shown in Tables 1 and 2 have been created, with additional configuration as follows:
    a. Default attribute values are set for some domains, as shown in Table 4.
    b. Allowability of "null" (i.e., "blank") values are set as indicated in Tables 1 and 2 (i.e., attributes defined as "optional" in these tables are set to allow null values; other attributes are set to disallow null values).
    c. Automatic **Global ID** generation is enabled for both feature classes.
    d. **Editor Tracking** is enabled for both feature classes.
    e. **Attachments** are enabled for both feature classes.
    f. A **Visit ID** attribute created for the Sightings feature class is in GUID format.[31]
3) A one-to-many relationship class has been created between the Visits feature class (the "origin") and the Sightings feature class (the "destination"). This is based on using the Global ID attribute from the Visits feature layer as a primary key and the Visit ID attribute from the Sightings feature layer as a foreign key.

By using these templates, you can avoid having to configure all of these items from scratch and ensure compatibility with the PLP Data Dictionary.

Configuration

Step 1: Download FGDB and Open in Desktop GIS

First, download the FGDB template to your computer from https://gbbo.org/s/PIJA-Project-Survey-Protocol_FGDBgdb.zip. Unzip it into a folder. You should select a descriptive name for

[31] This is necessary to create a "key" for the relationship class between the Visits and Sightings feature classes.

the folder, but the folder name must end with the ".gdb" suffix (minus the quotation marks). Open your preferred desktop GIS software (ArcGIS Pro or ArcMap), select **Add Data**, and add the Visits and the Sightings feature classes from the FGDB to a new blank map.

Step 2: Additional FGDB Configuration (if applicable)

While it is open in desktop GIS software, you may wish to perform additional configuration on the FGDB template. Examples of additional configuration could include creating new project-specific attributes or creating new project-specific domains.[32] If additional configuration is contemplated, it is important to note that some changes to FGDB's can be made only within desktop GIS software before publishing the FGDB to AGOL as a hosted feature layer (see Step 3). Examples of changes that must be made in desktop software include:

1) Changing the fundamental database ordering of attributes in the feature classes.
2) Changing / creating different default values for attributes.
3) Changing whether a given attribute allows null values or not.

If necessary, other changes can be made to the FGBD later, after it is published to AGOL as a hosted feature layer, including:

1) Adding new attributes.
2) Creating or editing domains.[33]
3) Changing aliases of attributes.

However, we recommended that to the extent possible, all changes to the FGDB template be made in in desktop software before publishing to AGOL, and that changes to the hosted feature layers in AGOL be avoided or minimized to maintain compatibility with the PL
P Data Dictionary.

Step 3: Publish the FGDB to AGOL as a Hosted Feature Layer

To function with Field Maps, the configured FGDB must be published to AGOL as a hosted feature layer. Although this process can be initiated from within AGOL, we recommend that it be initiated from within ArcGIS Pro or ArcMap.

To publish from ArcGIS Pro:

1) Open the two feature classes from the FGDB into a blank map as described above.
2) Choose **Share – Web Layer – Publish Web Layer.**
3) In the resulting dialogue box, accept defaults except as follows:
   a. Under **General**, complete the **Item Details** as needed.

[32] The most likely project-specific domains will include pick lists for surveyor identities and ID numbers for the plots or polygons that will be surveyed.

[33] Note however that if domain values are changed after data collection has begun, manual editing of older data may be needed to change previous domain values to new domain values.

b. **Sharing** can either be configured at this point or deferred until later.
c. Under **Configuration**, click the **Configure Layers** button and then:
i. Select **Enable editing and allow editors to:** and then select the **Add, update, and delete features** button. ii. Select **Enable Sync** and **Export Data.**
iii. Select **Preserve editor tracking info**.
d. Under **Configuration**, click the **Configure Parameters** button, and then:
i. If the data collection will all occur in one time zone, the time zone in the **Date Fields** section. Otherwise, it can be left blank and managed by the field data collection devices.
ii. De-select the **Ensure map is set to allow assignment of unique IDs** setting.

4) Click **Analyze**; This may return some "medium" or "low" severity messages, which can be ignored. "High" severity messages however must be resolved before proceeding.
5) Click **Publish**; some processing will occur but eventually a success message should display.
6) NOTE: The resulting Hosted Feature Layer will be stored in your default folder in AGOL. It will consist of two items: the hosted feature layer and service definition with the same name. These items can be moved to a different folder in AGOL if desired.

To publish from ArcMap:

1) Open the two feature classes from the FGDB into a blank map as described above.
2) Make sure you are signed in (see **File** menu) to your AGOL account.
3) Choose **File - Share As - Service**, click **Publish a Service**, and then **Next**.
4) Select the **My Hosted Services** connection, pick a name for your service, and then **Continue**.
5) Work through the full dialogue box, accepting defaults except for:
a. Under **Capabilities-Feature Access**, click all five check boxes (**create**, **delete**, **query**, **sync**, and **update**).
b. Fill out the **Item Description.**
c. For now, choosing **Sharing** options can be deferred.
6) Click **Preview**; This will likely return a few "medium" or "low" severity messages, which can be ignored. "High" severity messages however must be resolved before proceeding.
7) Click **Publish**; some processing will occur but eventually a success message should display.
8) NOTE: The resulting Hosted Feature Layer will be stored in your default folder in AGOL. It will consist of two items: the hosted feature layer and service definition with the same name. These items can be moved to a different folder in AGOL if desired.

Step 4: Log in to AGOL

Subsequent steps are completed in AGOL. Navigate to your organizational AGOL page and log in with your administrator credentials.

Step 5: Complete Metadata

Click **Content**, navigate to the location of your newly published hosted feature layer, and click the feature layer name, which opens the item's **Overview** page. This is where you should enter the metadata required by the PLP Data Dictionary by editing **Add an in-depth description of the item.** Be sure to include all required information as described in Table 3 of the Protocol.

Step 6: Create Group(s)

Groups are defined sets of AGOL users with which specific content can be shared. It is recommended that you create a group in AGOL specifically for field workers who will be using Field Maps for PLP Pinyon Jay surveys. Optionally, you may wish to create additional group(s) tasked with project management or administration.

To create a field work group:

1) Click **Group** – **Create Group.**
2) Fill in the **Group overview** section, including a descriptive name for the group.
3) Under **Group membership**, select the following options:
    a. **Only group members**.
    b. **My organization's members only** (unless you wish to include surveyors from other AGOL organizations in your data collection effort).
    c. **All group members**.
    d. Either option is acceptable for the last item.
4) In most circumstances, you should enable the **Shared update** option under **Group designations**.
5) Click **Save**
6) Click **Invite Users** and follow the prompts to add your field workers to the group based on their AGOL usernames.

Follow similar steps to create additional group(s) if desired.

Step 7: Configure Editable Feature Layers

The only editable feature layer required for the PLP is the hosted feature layer created by publishing the FGDB template. This must be configured in AGOL with the proper settings to function correctly, as follows:

1) Click **Content**, navigate to the location of your hosted feature layer, and click on that item to open its Overview page.
2) Click on the **Visualization** button. Use the resulting map-viewer interface to define symbology (i.e., "Styles") and the pop ups for features within the Sightings and

Visits feature classes. Note that by default, popup configuration (which fields are visible, and the order in which they are shown) defines the data collection forms in Field Maps, so consider it carefully. More specifically, by default the attributes in a feature class are listed in alphabetical order within a popup, rather than in their underlying database order. We recommend that you reorder the visible attributes in a sequence that will make logical sense in the field, ideally in the same order used for Tables 1 and 2.

3) Click the **Settings** button. Settings that are recommended or critical in terms of Field Maps functionality are:

a. Enabling **Delete Protection**.

b. Under **Editing**, **Enable editing**, the **Keep track of who edited the data**, and **Enable Sync** options must be checked.

c. Under **What kind of editing is allowed**, the **Add**, **Delete**, and **Update** options must be checked, and the Attributes and Geometry button selected.

d. Under **What features can editors see?** you must determine if you want field workers to be able to see only the features they create, or all features when using Field Maps (or AGOL).

e. Under **What features can editors edit?** you must determine if you want field workers to be able to edit only the features they create, or all features when using Field Maps (or AGOL).

f. Under **What Access to anonymous editors have?** we recommend limiting this to the **Only add new features** option.

g. If you want your field workers to be able to export accumulated data to other formats (Excel, CSV, etc.), check the box under **Export Data**.

h. Be sure to save all changes, noting that different parts of the Settings page have their own **Save** buttons.

NOTE: Under some circumstances, it is a good practice to create a hosted view layer from the editable hosted feature layer and using the hosted view layer to build the web map viewed in Field Maps. We suggest that you consider the potential benefits of this approach, but we do not provide the relevant details in this document.

Step 8: Prepare, Publish, and Configure Non-Editable Layers

Most users will wish to prepare a layer showing the polygons within which PLP surveys must be conducted. Visualizing this layer in Field Maps will assist field workers as they navigate through assigned polygons conducting area searches. Once the relevant layer has been prepared and published to AGOL, you should uncheck the setting for **Enable editing** on the item's **Settings**, but the **Enable Sync** option must remain checked to use the layer in Field Maps.

Step 9: Create, Configure, and Share Web Map

Map building in AGOL is done in Map Viewer, which is activated by clicking the **Map** button. If you are unfamiliar with the organization and functionality of the AGOL Map Viewer, we recommend that you review the self-learning material here before proceeding.

The steps necessary to create a map appropriate for data collection with Field Maps are as follows:

1) Add the editable hosted feature layer to the map. For each of its two feature classes (Visits and Sightings), do the following:
   a. Confirm the **Enable editing** is activated.
   b. Review and adjust its **Style** as needed.
   c. Double-check that the attributes and ordering in the **Pop-ups** are configured as previously described.
   d. Set a display **Filter** if desired. For example, you may wish to ensure that field workers conducting a survey visit to a plot cannot see data previously collected on the plot.
   e. Explore other map options if / as needed.
2) Add your polygon layer to map. Configure as follows:
   a. Ensure that **Enable editing** is deactivated.
   b. Deactivating **Pop-Ups** is recommended.
   c. Enable **Labels** and set a **Label class** expression to display the Plot ID or Polygon ID.
3) Add a Basemap. Imagery is recommended for most applications.
4) If desired, add the **Location Sharing** layer to the map, with settings appropriate for field workers as described in the Location Sharing documentation.
5) **Save** the map with an appropriate name.
6) Find the web map you just created in your **Content** window. Click the item name and then the **Sharing** button. Select the **Edit Group Sharing** option and share the map with the field worker group that you created earlier. You will be prompted to "Update Sharing" for the map layers and should accept this option.
7) Click on **Settings** button for the map item. Configure **Settings** as follows:
   a. Ensure that the **Enable offline mode** option is enabled.
   b. Ensure that the **Use in ArcGIS Field Maps Mobile** option is checked.
   c. Optionally, create Offline Map Areas to facilitate use of Field Maps in situations where internet connectivity is or may be absent. Alternatively, each field worker can download offline map areas prior to field outings, as described in the User Guide.
   d. Other Settings options may be configured according to your preference.

Step 10: Final Configuration in Field Maps Web App

In the upper right corner of the AGOL window, click the nine-dot app launcher icon. Find the Field Maps app and open it. You will first see a window showing the web maps you have created that are enabled for Field Maps. Click on the web map you just created. Then do as follows:

1) Click on **Forms**. You need to click the expand arrow by the main editable layer to show both the Visits and Sightings feature classes. For each of the feature classes in the editable feature layer in turn, choose to **Convert the Pop-Up** option. This will use the previously configured pop-up as a template for the data collection form that displays in Field Maps. Ensure that all the options associated with the form for each feature class are

correct. For the Visits feature layer, click on the Start Time field, and in the **Properties** panel to the right, click the dropdown for **Input Type** and change this to **Date and time**. Do the same for the Stop Time field. After performing all of these steps, Make sure to click the small **Save** icon (which looks like an old floppy disk) at the upper right after making any changes; it is easy to overlook. If you don't click this icon, none of the settings you changed in this step will be saved.

2) The **Geofences** button enables you to define a project area, and alert field workers when they enter or leave the area. It can also be useful as a way to automatically turn Location Sharing on and off without manual toggling by field workers. Depending on the extent and geometry of your project area, geofences can be helpful.

3) The **Offline** button provides you with additional options for creating offline **Map Areas**. The **Offline** toggle switch must remain enabled.

4) The **App Settings** button provides many settings to fine tune how Field Maps work. Most can be left in their default settings. However, it is critical to ensure that under the **Collection** settings, the toggle for **Show related types** is enabled. If it is not enabled, the preconfigured relationship class between the Visits and Sightings feature classes will not be recognized in Field Maps. Additionally, if you have opted to utilize **Location Sharing**, the **Required** toggle switch must be enabled. Make sure to click the small **Save** icon at the upper right after making any changes; it is easy to overlook.

5) The **Sharing** button provides an alternative location to ensure that your map is shared with the appropriate group(s).

Step 11: Set Up Mobile Devices

A few basic set-up procedures are needed to prepare mobile devices for collecting data in the field using Field Maps. These can be performed centrally by the organization, or individually by each field worker. The steps required to configure devices are described in the User Guide.

Data Management in AGOL: Data collected in Field Maps by multiple users are synced to the AGOL-based hosted feature layer. This Guide does not provide any instructions for using AGOL for data management, visualization, and analysis, but many online resources exist.

Appendix 5. Paper Data sheet

A paper data sheet is available to print on the next page.

Surveyor: _____ Project / Polygon ID[1]_____

Date:_____ Sky[2]:_____ Wind[3]:____ Temp:_____ Survey type_____

Survey start time:_____ Survey visit rep # _____ Monitoring visit rep #*_____

Survey end time: _____ Jays Present?[4]_____

Sighting 1:

Time: _____ Lat:_____ Long:_____ Comments:

Observation method: *Aural* *Visual* *Both*

Observation type: *AZP Protocol* *Incidental*

Flock size: _____

Flock activity type: _____ Resight?_____

Breeding behaviors*: _____ Flock ID* _____

Sighting 2:

Time: _____ Lat:_____ Long:_____ Comments:

Observation method: *Aural* *Visual* *Both*

Observation type: *AZP Protocol* *Incidental*

Flock size: _____

Flock activity type: _____ Resight?_____

Breeding behaviors*: _____ Flock ID* _____

Sighting 3:

Time: _____ Lat:_____ Long:_____ Comments:

Observation method: *Aural* *Visual* *Both*

Observation type: *AZP Protocol* *Incidental*

Flock size: _____

Flock activity type: _____ Resight?_____

Breeding behaviors*: _____ Flock ID* _____

Sighting 4:

Time: _____ Lat:_____ Long:_____ Comments:

Observation method: *Aural* *Visual* *Both*

Observation type: *AZP Protocol* *Incidental*

Flock size: _____

Flock activity type: _____ Resight?_____

Breeding behaviors*: _____ Flock ID* _____

[1] Or location coordinates at the start of survey if more appropriate

[2] Clear, Partly Cloudy, Cloudy, Fog or Smoke, Drizzle, Snow, Shower

[2] < 2 kph, 2–5 kph, 6–12 kph, 13–19 kph, 20–29 kph, 30–38 kph

[4] do not treat the "Flyover" Activity Type as an indication of presence

[5] Unknown or Other, Flyover, Flying, Foraging on Ground, Foraging in Trees, Caching, Perching, Nesting, Roosting, Feeder

[6] Courtship Chasing, Courtship Behavior, Near Nest, Breeding Vocals, Carrying Nest Mats, Constructing Nest, Incubating or Brooding, Feeding Nestlings, Feeding Fledglings

* optional information