

PINYON JAY COMMUNITY SCIENCE

Pinyon Pine Productivity Assessment

Great Basin Bird Observatory



Introduction and Background

This document provides information on collecting data on pinyon pine productivity in conjunction with Pinyon Jay presence/absence surveys. It is assumed you are familiar with the free Survey123 app, but if you need information on downloading, data collection, and submission, check out the Pinyon Jay Community Science Data Collection Manual <https://pinyon-jay-community-science-gbbo.hub.arcgis.com/documents/pinyon-jay-community-science-survey-manual-part-i/explore>.

If you have been collecting data on Pinyon Jays, you are probably familiar with the population declines the species has undergone in the past 50 years, and the need for a better understanding of Pinyon Jay land use. Pinyon Pine nuts are the primary food source for Pinyon Jays throughout the year, but productivity is variable across the landscape and we have very little information where productive stand occur and how that might influence Pinyon Jay presence. An assessment of cone productivity may help fill these information gaps.

Pinyon pine cones become mature in the fall which is when Pinyon Jays harvest enormous amounts of them and cache most of them in the ground and tree bark for use during the following 12 months until the next pine nut crop is available. Pine seeds only stay edible for 1-2 years after harvest, so Pinyon Jays critically depend on each annual crop of pine nuts to continue to survive. Pinyon Jays harvest pine seeds both in their “unripe” green state and afterwards throughout the fall. Once cached, the birds retrieve them from cache sites year-round as their primary food source.

With your help, we can map productive pinyon stands based on the presence of maturing or recently matured green or light brown cones. These georeferenced locations will help provide answers to some of the lingering questions on how to manage the landscape for Pinyon Jays and other PJ-focused species.

Pine Cone Assessment

Pinyon Pine Productivity Cycle

Pinyon pines develop seeds in cones over a 2.5 year period. Male cones fertilize female cones in spring, and the seeds develop over the course of two years to ripen in August/September of the third year. Therefore, during an August/September assessment, a typical cone-bearing tree has three “generations” of cones, the empty dark-brown cones from previous years, large green cones that are ripe in the current year (or if past green stage, they are a light tan), and small green cones that will ripen the following year. Often, small brown cones are also observed, which represent aborted cones from the current or previous years. See last section on ageing cones for additional information.

Cone Productivity Data Collection

The objective of this mapping effort is to delineate pinyon pine productivity around a georeferenced point according to (a) the number of cone-bearing trees (b) proportion of cone-bearing trees with currently ripe cones and (c) the average number of currently ripe cones per cone-bearing tree in the plot. These two measures best describe the food availability for Pinyon Jays for the following 12 months. For this, the following definitions are important:

Cone-bearing tree: A tree that has any evidence of female cones, regardless of from which year they are, or in what stage they are. So, even if there are no ripe cones, if there is evidence that the tree had cones in previous years (dark brown empty cones on the tree), it is considered a cone-bearing tree. This is going to be most pinyon pines old enough to produce cones.

Ripe cones: Cones that are ready for consumption this season, i.e., green, large cones or light tan, large cones. Note that these are usually intermixed with cones in other stages.

For the mapping project, please pretend that all pinyon trees that are not cone-bearing, as defined here, are absent. That means small or large pinyon pines that either have only pollen cones, or literally no cones, are not part of any average (= assumed to be absent). We are only interested in the trees that have demonstrated the ability to bear cones, and these will be included in the average.

Cone productivity will be documented within 50m of your survey point. You can start a survey point anywhere you are collecting Pinyon Jay presence/absence information. You could collect data each time you document Pinyon Jays, or create points every 100m while you are walking along.

Best practices

Most of the ripe cones will be on the top third of the tree, so stand back far enough to evaluate the crown top. To estimate the average number of cones per tree, choose a tree nearby and roughly count the number ripe cones (these will be the green or light tan cones) on your side of the tree. We recommend the “bird flock size estimation method” of counting 10 or 20 and then visually multiplying that number but the number of similar sized areas with cones that you can see. Use your binoculars as needed. Once you have a good estimate, double the number to account for the cones on the other side

of the tree. Then do the same for a few other trees. Generally, we find that most trees from one stand are in the same basic cone number category and you can come up with an average for your plot without much complication. The way the data will be recorded are **>50, 51-200, 201-400, and <400** ripe cones per cone-bearing tree.

Occasionally, you will find single trees that are loaded down with cones, but do not let these influence the average for the stand if the rest of the trees fall into a lower category. You will get faster at estimating cone numbers once you get a feel for what each category looks like.

After an initial assessment of the cone number category, examine all other cone bearing trees in the stand to confirm or adjust the average cone number for the stand. Remember that only cone-bearing trees count, so all the trees that show no trace of ever having had cones don't factor into the average (pretend they are absent).

Cone producing trees with no mature cones this year would be counted in the >50 category.

Collecting Data in Survey123

[Download the Pinyon Cone Productivity form](#)

Follow the instructions below while your device is connected to the internet (i.e. at home, before you head out to the field).

1. Find the icon for the Survey 123 app on your device, and click it to open the app.
2. You should be prompted to log in. Log in using your ESRI Hub username and password. In most cases, once you have logged in the first time to the app, you'll never have to log in again on that device. However, on rare occasions, you might be prompted to log in again. If so, just repeat the login process.
3. After logging in you will be at the App Home Page. You can always recognize the App Home Page because it says "My Survey 123" in the green bar at the top. You should see your Pinyon Jay Community Science form here. There should be a search bar at the top of the screen where you can search "Pinyon Cone Productivity". Your page will likely say "no results found", but give you the option to "Download surveys". This takes you to the Download page of the app.
4. On the Download page of the app, you should see a tile that says "Pinyon Cone Productivity". It has a little drawing of a cloud with a down-arrow beside it, which means that the survey form is currently "in the cloud" and available for download to your device. Click this down arrow and the survey form should download to your device. This may take a few moments.
- 6) Now, at the top left side of your screen, click the back arrow (i.e. left-pointing arrow on the left side of the green bar) to take you from the Download page back to the App Home Page.
- 7) On the App Home Page, you should now see a tile for the pine cone survey, indicating that the data form has been downloaded to your device.
- 8) To begin a survey click "Collect" at the bottom of your screen.

[Filling out the survey form](#)

Fill out the following fields to record cone productivity.

1. Date and Time are entered automatically, based on your device's calendar and clock. You can change the default values if your device's calendar and clock are set incorrectly.

2. Surveyor(s) Surveyor name or username

3. Number of cone producing pinyon pines in your plot. You should be able to easily count the number of pinyon pines with new or old cones within 50m. If you are in a particularly dense area, you can estimate to the nearest ten trees. Pinyon pines that do not fit in this category will typically be too young to produce cones.

4. Number of cone producing trees with mature cones this season. Even if there is only one fresh cone on a tree, it would be counted. Be careful to not count trees with old cones from the previous year, or small conelets that will be mature the following year. See last section on ageing cones for reference.
5. Average number of cones per tree. Estimate the average number of cones for all the trees with mature cones in the plot. Cone producing trees with no cones for the current year would be counted in the >50 category.

6. Comments. Any additional information you would like to include about your 50m-radius survey plot.

7. Were Pinyon Jays observed? Please record if you saw Pinyon Jays while you were conducting the pine cone assessment. You should still fill out a Pinyon Jay Community Science Field Survey

[Switching between Pinyon Jay community Science Field Survey and the Cone Productivity Assessment Forms](#)

It is easy to switch between forms, even when you are in the process of collecting data.

If you are doing an ongoing field survey for Pinyon Jays, and want to collect cone productivity data, simply hit the "X" in the upper left corner of the survey form. This will prompt a "close survey" window that gives you the options to close and lose changes, continue this survey, or save in drafts.

Select "Save in Drafts" and navigate back (back arrow in the upper left) to the App home page.

Start a new Pinyon Cone Productivity form. If you don't see your other forms displayed make sure your search bar at the top of your home page is cleared. Once you are finished and you have submitted it, return to the Pinyon Jay Community Science Field Survey form.

Select the orange "Drafts" tab at the bottom. From here you can complete your survey.

To submit completed surveys, click the check mark on the bottom right corner of your screen. You will have the options to send now, continue this survey, or save in Outbox. If you are in a location with no service, your survey will be saved to your Outbox. Once you are back in service be sure to open your Pinyon Cone Productivity form. If you have any unsubmitted surveys an "Outbox" button will appear at the bottom of your screen. Hit "Outbox" then click "send" at the bottom right corner of your screen. You can click on your survey to edit before sending.

Ageing cones

Non-cone producing trees:

These trees are not included in the percentage of cone bearing trees and do not influence the average number of cones.

- Pinyon Pines that are too young, too old, or for whatever reason show absolutely no evidence of bearing cones in any years
- Species other than Pinyon Pine



Figure 1. Trees that do not influence the proportion of cone producing trees. Either too young (front and center) or different species.

Cones that will be mature next season or aborted cones:

Mostly small (≤ 1 in. diameter “conelets”), but sometimes large closed brown cones with no yellow/green coloration. Conelets meeting this description and observed in the fall and winter months are likely aborted. Larger aborted cones will differ from viable cones by having all brown coloration, closed or nearly closed scales, and will be generally smaller than viable cones on the same tree, which are larger, are green/yellow in their coloration, and/or will have open scales and seeds. Old cones that remain on the tree from past masting events will differ from aborted cones in color (old cones being more grey and decayed), and degree of scale opening (old viable cones fully open and potentially containing undispersed/uneaten seeds). If the cones have turned brown and look too small to produce viable seeds, they are likely aborted and do not count as mature cones for this year.



Figure 2. Small developing cones or aborted cones

Old cones:

Open, empty (dark brown or grey) cone(s) with no sap or seeds present (previous years' cones). Often found in early spring – summer. Brown, open cones found still attached to tree in mid-fall – early winter should be scrutinized for seed presence, sap presence, light shade of brown and/or green coloring. Those diagnostics indicate current years' cones late in the season rather than last years' cones. Presence of these cones indicates you are looking at a cone-bearing tree, but it may not have cones maturing for the current year.



Figure 3. Cones remaining on tree from previous years are open and typically dark brown.

Mature cones for this season:

Large GREEN cone(s) with sap AND/OR seeds present (this years' cones). Cones can be open or closed, depending on time of site visit. Size of green cone will depend on time of year the plot visit occurs, with sizes growing larger as visits occur later in the growing season. Amount of GREEN color on cones also increases until cones open in fall. In late fall to early winter, some large cones will be mostly light brown with some green on scale edges or with sap and maybe seeds still present. You may be able to cue in on fresh cones by a "glisten" produced by sap in the sunlight.





Fresh green cones

Previous years cones