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eMammal Tools

eMammal is a set of tools for the collection, storage, and sharing of camera trap data. It is a collaborative effort between scientists at the Smithsonian and partner institutions that is bringing camera trapping and mammal surveys into the era of big data. The eMammal research group has created a package of tools specifically for camera trapping data. These tools solve the pressing issues for camera trapping projects and include custom software for rapidly tagging gigabytes of photos, web tools for managing multiple or large scale projects with multiple inputs, data management of both pictures and project metadata, ensuring accuracy of species identifications, and a standard data structure so that data from different projects can be combined quickly and easily.

eMammal also contains tools specially designed to recruit citizen scientists to survey mammals across large scales, including specialized project management and communication capabilities.

Finally eMammal houses all data in the Smithsonian Data Repository and displays the data at a public site. The repository is a secure storage facility for camera trapping data, and allows project data to be part of larger conservation and research initiatives. All data eventually will be publically available, after an embargo period, and data from multiple projects can be combined for mammal conservation efforts and to study large scale human and climate impacts on mammals.

eMammal Website – Project Management, Data Download, and Public Project Site

The eMammal website is the heart of the eMammal ecosystem and contains tools to manage projects, people, and data, as well as share information about a camera trapping project with the public. The following is a list of benefits afforded to project managers by using eMammal:

Project Management:

- Once you register for account on the website eMammal staff will create page for your project and give you control over your projects. You can assign project manager status to staff who can create and delete content on individual projects
- Manage projects with 2 sub-levels of design (subprojects, treatment) plus fields for designating bait and feature status at the camera level
- Create a project page for each project with a project dashboard that gives you quick access to all the information that you need to manage the project, including a summary of camera deployments, deployment days, species captured, and deployments needing review (Figure 1).
- Generate a species list for each project by location. Species lists are automatically created using a GIS query from IUCN range maps and include common name, scientific name, and the status of species. Easily add any species in the database to projects even if they are not included in the initial query. The species list contains genus or family level designations for hard-to-identify species (e.g. Unknown Canine).
- Display a project map that shows the proposed or actual location of your camera deployments and the status of those deployments (Assigned for Deployment, Partially Uploaded, or Fully Uploaded). Use the map to easily track your project.



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People:

- Communicate with volunteers or staff easily by emailing individuals or groups (i.e. all volunteers within a project). Manage projects spread over large areas or different projects in different areas all from one account
- Assign individuals specific cameras, including the ability to assign proposed camera locations to ensure volunteers or research technicians follow a specific scientific design
- Create a discussion board for use within a project to answer questions from citizen science volunteers or technician. You can make the discussion public or private.

Public Project Web Page:

- Let the public know about [your project](#) with a description and the goals of your project as well as contact information (Figure 2).
- Create a project blog to share news from the project with the public (or keep private for internal project use only)
- Display a photo carousel of all “favorite” photos from your project. Favoriting can occur at both the volunteer/staff level and project manager level.
- [Photos are searchable](#) by species. All favorite photos will be searchable by project, location, and species (Figure 3).
- COMING SOON! Create your own custom themed web portal powered by eMammal (Figure 4).

Download and Share Data:

- Quickly [download all data](#) that has been approved in the Expert Review Tool (see below).
- It’s possible to embargo your project data from public availability for 2 or 3 years after the start date for writing theses or publications. Embargo extensions are available on a case-by-case basis. During the embargo period the favorite photos and project information would still be publically visible.
- Use the eMammal [data analysis page](#) to calculate diversity indices, activity pattern graphs, and species accumulation curves for a quick first look at your data
- Search for other datasets in or near your study areas to extend your research or answer management questions
- Open your data to managers and the public to increase the conservation and educational impacts of your research
- Data download is only possible after agreeing to the data user agreement
- COMING SOON! Download data pre-formatted for occupancy analysis in program PRESENCE, the ‘unmarked’ package in program R, and program MARK.



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Desktop App (aka Leopold) – Camera Trap Data Review and Upload Made Easy

One of the most difficult tasks in modern camera trapping is sorting and organizing large numbers of photos, often including multiple photos for each camera trigger event. eMammal has built the eMammal Desktop App, or Leopold, that makes organizing and classifying photos fast and easy (Figure 5).

Features:

- Log in with your eMammal username and password to retrieve a list of all your projects, subprojects, and camera deployments (requires an internet connection).
- Quickly select the appropriate camera deployment, upload photos, and enter critical camera metadata (actual location, detection distance, camera status, and notes)
- The app automatically sorts photos into grouped “sequences” using the timestamp of the photo. All photos that are less than 60 seconds apart are grouped into a single detection event, or sequence.
- The user identifies and counts each species per sequence instead of each photo, and it is easy to tag multiple species per sequence. This alone greatly decreases photo processing time *and* allows researchers to accurately assess group size. COMING SOON! If you would like your detection data in a different interval for occupancy or activity analysis, simply download data through the data download page using the custom download functions
- The species list in the app is managed through the website and is unique for each project. Tags are made using common names, but the scientific name, IUCN Red List numeric ID, and the taxonomic serial number (TSN) are sent with the upload. Sort the list to include a custom list of 15 species in a quick list of buttons for 1-click species tagging, use the search box, or scroll through buttons with all species names.
- Keyboard shortcuts make identifying species fast and efficient
- Our bounding box computer vision technology allows search for cryptic animals within sequence. We have integrated an algorithm that creates a composite background image and puts a box around moving pixels, helping users spot hard to see animals.
- Users can favorite individual photos in the app to easily track and manage the great wildlife photos from your project. The project manager can add or remove the favorite designation in the Expert Review Tool.
- The app is fully usable offline. Users can download all their information, including projects and camera deployments, while connected to the internet. Then take the laptop to remote field sites and tag photos and upload them when you return to an internet connection.



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Expert Review Tool (ERT) – Fast and Effective Quality Control for Camera Trapping Data

It is essential to have quality control measures for data gathered in citizen science projects. In research projects validating species identifications with two observers eliminates ID errors. The Expert Review Tool (ERT) is a web based tool that allows project managers to quickly review and confirm species identifications and track project uploads.

Features:

- Dashboard with summary data for each project, including how many deployments, sequences, and photos are uploaded, reviewed, and rejected (Figure 6).
- Link to all sequences of a specific species across all deployments in a project for ID focused on species rather than deployments
- See all photos that have been marked as a favorite by volunteers or reviewers in the dashboard page, and easily add or remove favorites.
- Quickly assess the review and upload status of all deployments in a map page. Filter deployments by status and change map base layers (image, topography, etc.).
- Easily review and confirm or change species identifications in a user friendly format (Figure 7).
- Quickly reject deployments that do not meet requirements (set too high, low, wrong location, etc.) and keep notes of why deployments were rejected

Smithsonian Data Repository – Data Curation from the World’s Largest Museum and Research Complex

All data entered in eMammal is stored in the Smithsonian Data Repository. This data storage will meet new government agency requirements to store data in a publically accessible site. For the Project Manager it will prevent a mess of spreadsheets and conflicting versions when searching for old projects. Once deposited the project manager can always access their data and be assured that the data is safe and backed up. After your embargo period your data will be public, but all downloads will be monitored as described below.

Features:

- Enterprise level database maintained by the Smithsonian Office of Information
- Industry standard data curation practices (backup, etc.)
- Long-term data curation free of charge (webpage does not have to be maintained)
- All data are made public after an embargo period
- All users downloading data will be required to agree to the data user agreement that requires them to contact the researcher if they plan to reuse the data for analysis or a scientific publication



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Figure 1 – Camera trapping project dashboard. Quickly create deployments, assign deployments to one or many volunteers or technicians, review a deployment status, see new observations or favorite photos, and publish project updates or blog posts.

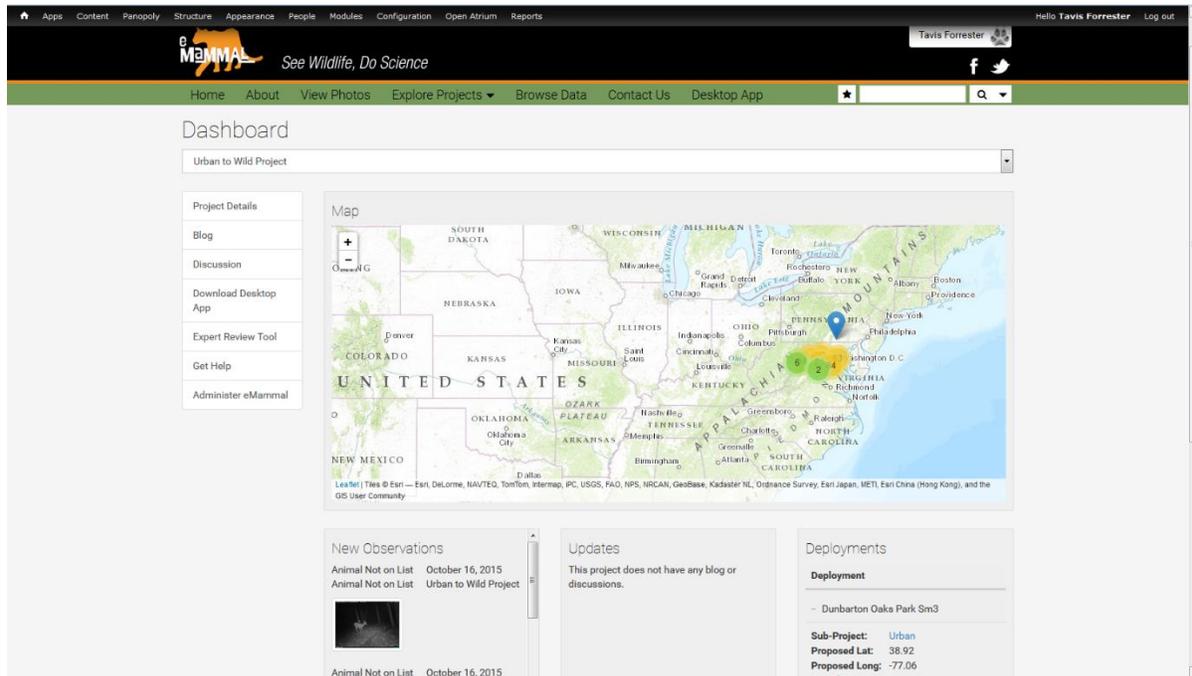
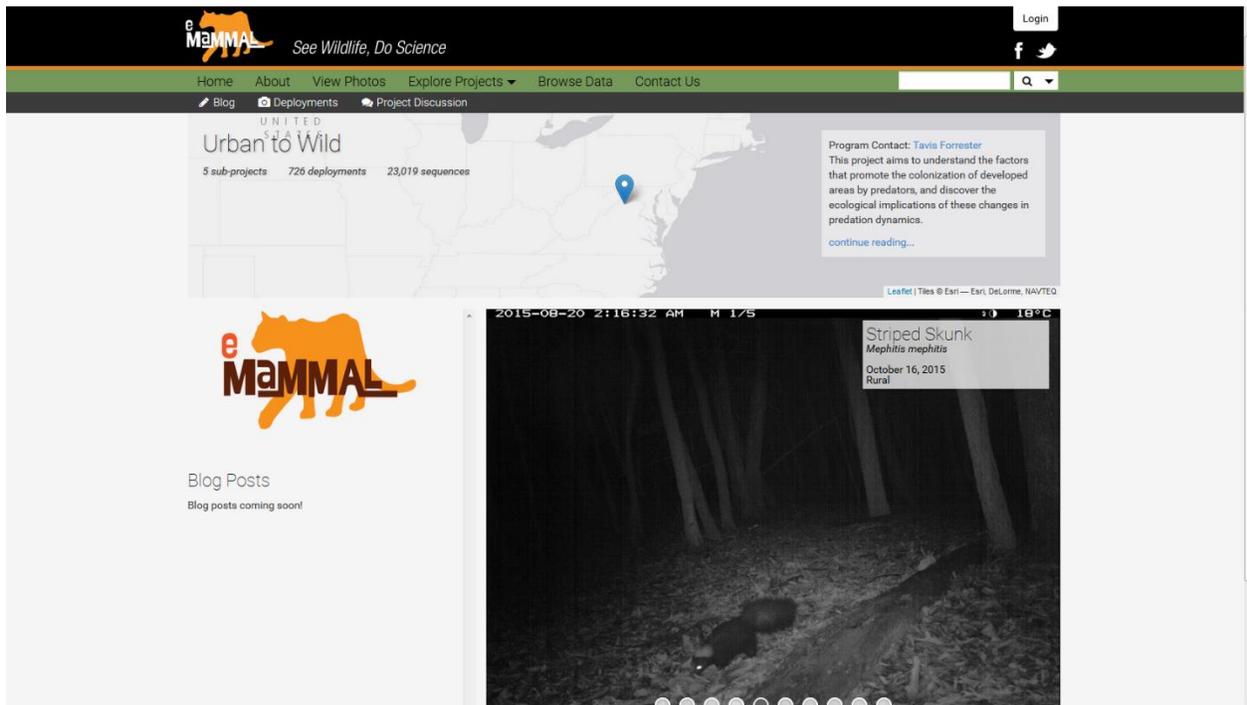


Figure 2 – A public webpage that describes your camera trapping project and includes a slideshow of the best photos from the project, project updates, project information, and an interactive map of camera locations





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Figure 3 – eMAMMAL photo gallery page. Explore the best photos of all projects and search photos by project, date, or species.

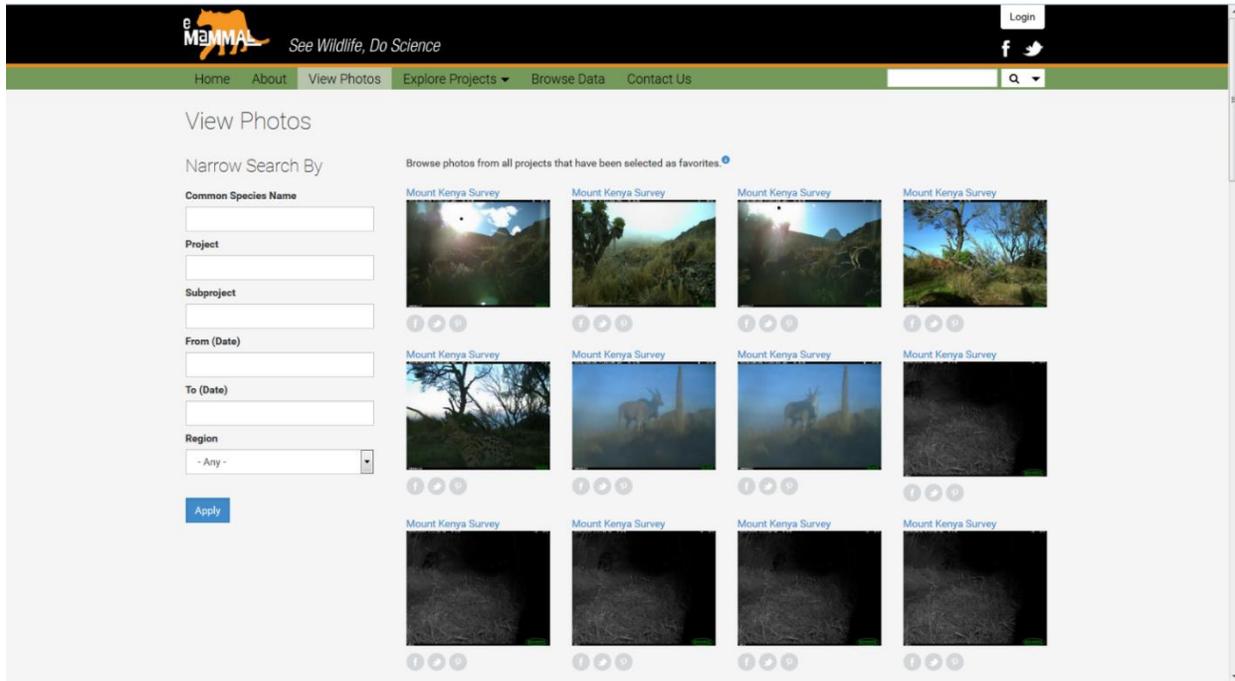


Figure 4 – Custom themed portal for camera trapping projects from your organization. The pages will have the same design but feature your logo.

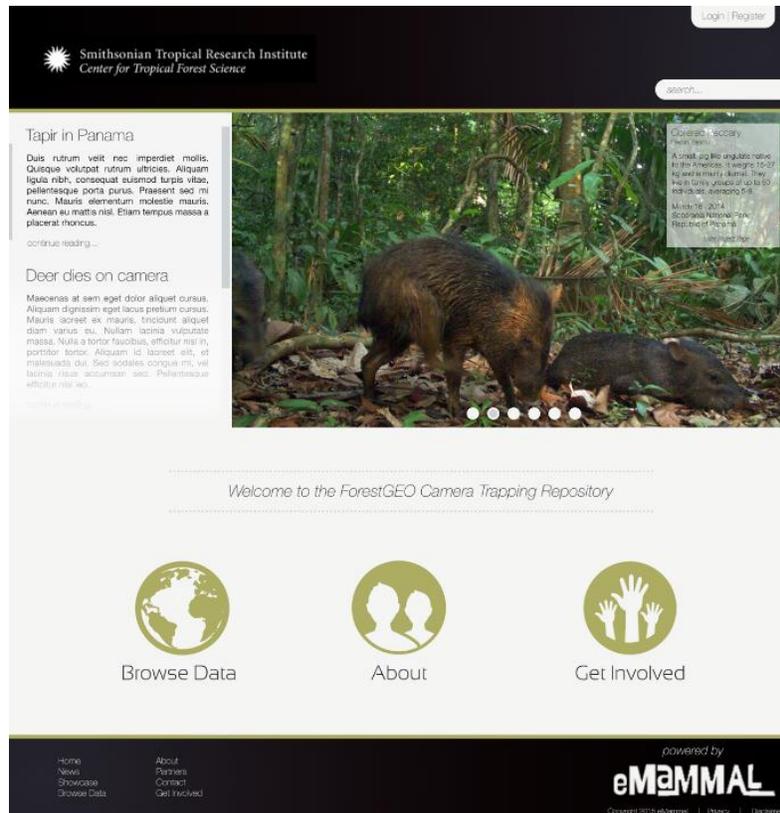


Figure 5 – eMammal Desktop App

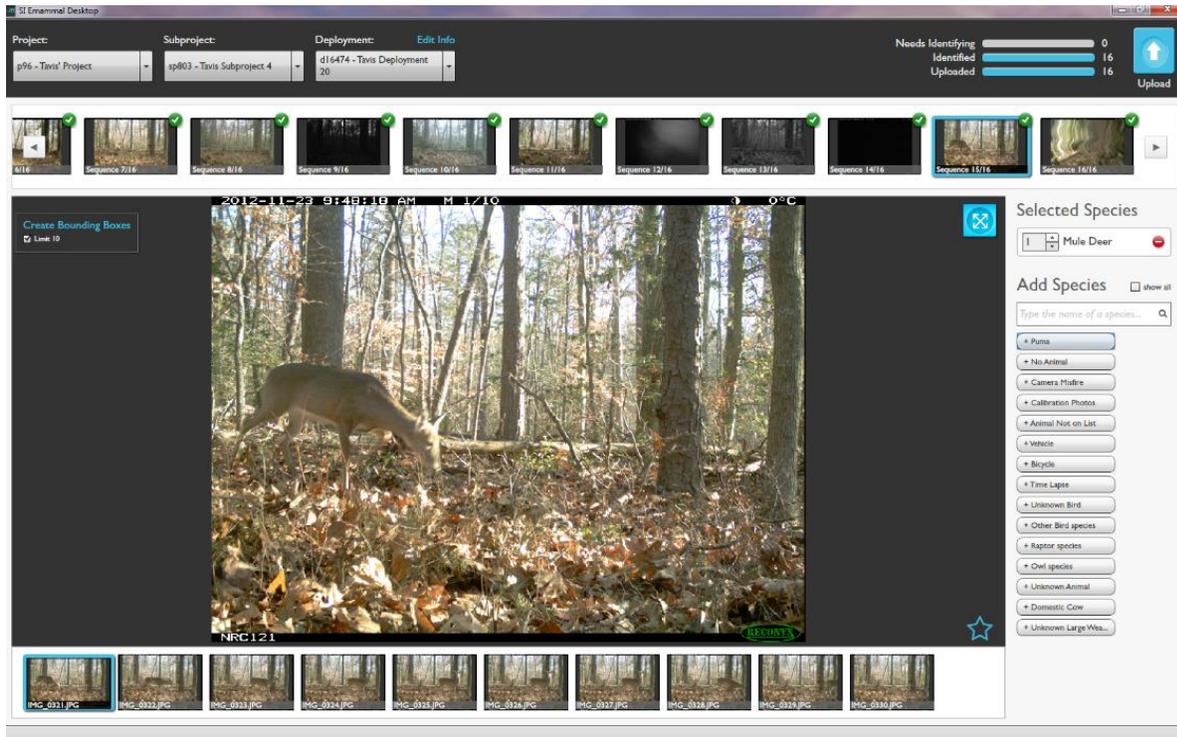


Figure 6 – ERT Dashboard

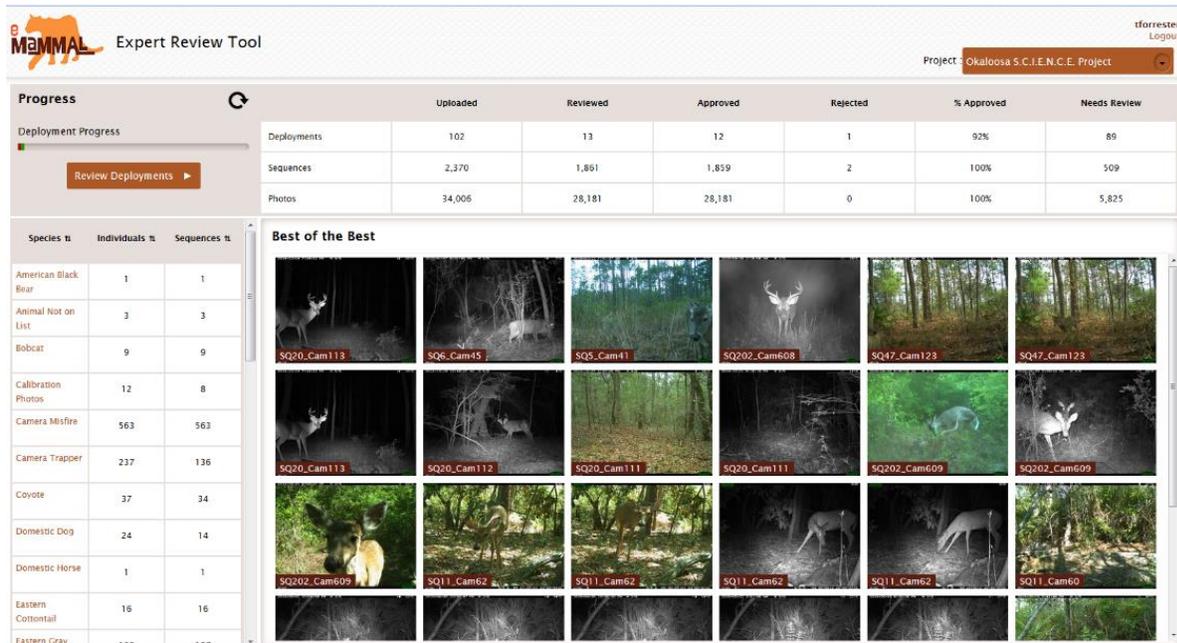


Figure 7 – ERT Species ID Review

The screenshot displays the 'Expert Review Tool' interface. At the top left is the 'eMAMMAL' logo and the text 'Expert Review Tool'. At the top right, the user 'tforrester' is logged in, and the status '28 of 55 Approved' is shown. Below the header, a navigation link reads 'Back to Deployment List / Sequence Preview'. The main area is titled 'SQ20_Cam113, null' and contains a sequence of 11 thumbnail images, each with a timestamp and a green checkmark. The 7th thumbnail is highlighted. Below the thumbnails is a large video player showing a Wild Turkey in a forest. To the right of the video player is a 'Selected Species (1)' panel with a scrollable list of species. The 'Wild Turkey' is selected. At the bottom of the panel are 'Favorite' and 'Approved' buttons.

Expert Review Tool

tforrester
Logout
28 of 55 Approved

Back to Deployment List / Sequence Preview

SQ20_Cam113, null

1/55 1 Eastern Gray Squirrel SQ20_Cam113, ✓
2/55 1 White-tailed Deer SQ20_Cam113, ✓
3/55 1 White-tailed Deer SQ20_Cam113, ✓
4/55 1 White-tailed Deer SQ20_Cam113, ✓
5/55 1 Eastern Gray Squirrel SQ20_Cam113, ✓
6/55 2 White-tailed Deer SQ20_Cam113, ✓
7/55 1 Wild Turkey SQ20_Cam113, ✓
8/55 4 Wild Turkey SQ20_Cam113, ✓
9/55 1 Eastern Gray Squirrel SQ20_Cam113, ✓
10/55 1 White-tailed Deer SQ20_Cam113, ✓
11/55 1 White-tailed Deer SQ20_Cam113, ✓

Selected Species (1)

1 ▲ Wild Turkey

- American Beaver
- American Black Bear
- American Mink
- Animal Not on List
- Bicycle
- Bobcat
- Calibration Photos
- Camera Misfire
- Camera Trapper
- Coyote
- Domestic Cow
- Domestic Dog
- Domestic Horse
- Eastern Cottontail
- Eastern Fox Squirrel

Favorite Approved ✓