



**Environmental Analysis Program**

Pomona College  
Biogeochemistry Laboratory

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**SOP-F620**

**Camera Trap Deployment and  
AI-Assisted Image Analysis**

Standard Operating Procedure

|                     |                            |
|---------------------|----------------------------|
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## 1. Purpose

This procedure describes the deployment, retrieval, data management, and AI-assisted image analysis of camera traps (motion-triggered wildlife cameras) used in the EA Program. Camera traps

provide a non-invasive method for documenting wildlife presence, activity patterns, and species richness at field sites (Thornton et al., 2026). The volume of images produced by even a small number of cameras (thousands to tens of thousands per deployment) makes manual review a major bottleneck. This SOP integrates open-source and cloud-based AI tools to automate blank-image filtering and species identification, reducing processing time by an order of magnitude while maintaining scientific rigor through human-in-the-loop verification (Beery et al., 2019; Wildlife Insights, 2026).

The EA Program currently uses the CamPark T20 trail camera, but the deployment and analysis procedures are applicable to other camera trap models with minor adaptations.

## 2. Scope

- **Applies to:** Deployment and image analysis of all EA Program camera traps at field sites, including the Bernard Field Station, Pomona College Farm, the Pit, and restoration areas
- **Does not apply to:** Live-view video surveillance systems; drone imagery (see [SOP-F630](#)); 360-degree cameras; aquatic camera systems
- **Location:** All EA Program field sites (deployment); EA Program laboratory (data analysis)

## 3. Responsibilities

| Role                     | Responsibility                          |
|--------------------------|-----------------------------------------|
| Lab PI                   | Approve deployment plan, oversee data   |
| management               |                                         |
| Field Lead               | Select camera locations, coordinate     |
| deployment and retrieval |                                         |
| Trained Personnel        | Deploy/retrieve cameras, process images |
| New Students             | Complete training before independent    |
| deployment               |                                         |

## 4. Definitions

- **AI confidence score:** A numerical value (0–1 or 0–100%) output by a classification model indicating the model’s certainty in its predicted species identification; predictions below 90% confidence must be manually verified in the EA Program workflow (Beery et al., 2019).
- **Blank image:** A camera trap image with no animal, person, or vehicle visible, typically triggered by vegetation movement or lighting changes; MegaDetector removes these automatically, eliminating the largest portion of review burden.
- **CamPark T20:** The EA Program’s primary trail camera; a 16 MP passive infrared (PIR) triggered camera with infrared night flash; detection range approximately 20 m; 8 AA batteries per deployment (CamPark, 2023).
- **Detection rate:** The number of independent detections of a species per 100 camera-trap-nights; the standard metric for comparing wildlife activity across sites or seasons; depends on both actual animal abundance and camera placement (O’Brien et al., 2010).

- **Human-in-the-loop verification:** A quality control protocol in which a human reviewer examines AI predictions, particularly low-confidence ones, to correct errors before results are used for analysis; essential because AI models fail on rare species, unusual poses, and taxa underrepresented in training data (Thornton et al., 2026).
- **Independent detection event:** A single occurrence of a species at a camera during a defined time window (typically 30 minutes); used to prevent over-counting multiple images of the same individual; defined a priori and reported with any analysis (O'Brien et al., 2010).
- **MegaDetector:** An open-source object detection model (Microsoft/Google) that classifies each camera trap image as containing an animal, a human, a vehicle, or being blank; runs as a pre-processing step before species classification; the current version is MegaDetector v5 (Beery et al., 2019).
- **PIR (passive infrared) sensor:** The motion and heat detection sensor in a trail camera; triggers image capture when it detects a warm moving object within the detection zone; sensitivity and detection range vary with temperature, wind, and vegetation.
- **SpeciesNet:** A deep-learning species classification model developed by Google; trained on over 65 million labeled camera trap images from more than 2,000 species and blank categories; used in both the Wildlife Insights platform and the local CameraTrapAI pipeline (Google Research, 2026; Wildlife Insights, 2026).
- **Trap night (camera trap night):** One camera deployed at one location for one 24-hour period; the standard unit of sampling effort; total trap nights = number of cameras × number of days deployed (O'Brien et al., 2010).
- **Wildlife Insights:** A free cloud-based platform for camera trap data management and AI classification, developed by Google, WWF, Conservation International, the Wildlife Conservation Society, and the Smithsonian (Wildlife Insights, 2026).

## 5. Safety and Hazards

### Hazards

- **Biological:** Tick and insect exposure, poison oak, snakes. Wildlife encounters when checking cameras in remote locations.
- **Physical:** Uneven terrain, climbing to mount cameras on trees or posts.
- **Security:** Cameras left unattended in public areas may be stolen or vandalized.

### 5.1. Required PPE

- ☐ Closed-toed shoes or field boots
- ☐ Long pants (tick and poison oak protection)
- ☐ Sun protection (hat, sunscreen)
- ☐ Tick repellent

Refer to [SOP-F001 Field Safety](#). Cameras may inadvertently photograph people; consult the PI regarding institutional requirements for signage and data handling, and delete identifiable images immediately during initial screening.

## 6. Equipment and Materials

| Item                            | Specifications                                              |
|---------------------------------|-------------------------------------------------------------|
| CamPark T20 trail camera        | 16 MP; detection range 20 m; IR night flash (CamPark, 2023) |
| SD card (Class 10, up to 32 GB) | One per camera                                              |
| AA batteries (8 per camera)     | Lithium recommended for extremes                            |
| Mounting strap or bracket       | Included with camera                                        |
| Cable lock (optional)           | Theft deterrent for public-access sites                     |
| GPS unit or smartphone          | Per <a href="#">SOP-F006</a>                                |
| Field data sheet                | Printed from Appendix A                                     |
| Pruning shears                  | For clearing detection zone                                 |
| Compass                         | For recording camera bearing                                |
| SD card reader (USB)            | For lab image download                                      |
| External hard drive or cloud    | For archiving raw images                                    |

## 7. Procedure – Field Deployment

### 7.1. Camera Setup

1. Install 8 AA batteries and insert a formatted SD card (CamPark, 2023).
2. Power on and enter the settings menu. Configure:

| Setting          | Recommended Value  | Notes                                 |
|------------------|--------------------|---------------------------------------|
| Photo resolution | 16 MP              | Highest available                     |
| Trigger mode     | Photo (burst × 3)  | Burst increases detection probability |
| Trigger interval | 5 seconds          | Balance captures and battery          |
| Time stamp       | ON                 | Required for activity analysis        |
| Date/time        | Current local time | Verify at each deployment             |

3. Take a test photo to verify function and timestamp.

### 7.2. Site Selection and Mounting

1. Select a location based on study objectives (game trails, water sources, habitat edges, or systematic grid points).
2. Record GPS coordinates and camera bearing (compass direction camera faces) (O'Brien et al., 2010).
3. Clear vegetation within the detection zone (approximately 20 m cone in front of the lens) to reduce false triggers.
4. Mount at 30–50 cm above ground for small-to-medium mammals, or 75–100 cm for larger species; angle slightly downward (5–10°).

5. Secure with mounting strap. Apply a cable lock if at a public site.
6. Walk through the detection zone to verify the trigger functions.
7. Record deployment metadata on the field data sheet (Appendix A).

### 7.3. Retrieval and Redeployment

1. Power off before removing the SD card.
2. Replace with a fresh, formatted card; check battery level; replace batteries if below 50%.
3. Power on, verify settings, and take a test photo.
4. Record retrieval date, time, and observations on the field data sheet.

## 8. Procedure – Data Management and AI Analysis

### 8.1. Image Download and Organization

1. Create a folder: `CamTrap_SiteID_CameraID_YYYYMMDD-YYYYMMDD`.
2. Copy all images from the SD card.
3. Back up immediately to external hard drive or cloud storage.
4. Do not delete images from the SD card until the backup is verified.

### 8.2. AI-Assisted Analysis Pipeline

The EA Program uses a two-stage AI pipeline following the approach used by Wildlife Insights and the Google CameraTrapAI project (Google Research, 2026; Wildlife Insights, 2026):

**Stage 1: Detection (MegaDetector).** Identifies whether each image contains an animal, human, vehicle, or is blank; eliminates 50–90% of false-trigger images (Beery et al., 2019).

**Stage 2: Classification (SpeciesNet or similar).** Identifies detected animals to the lowest possible taxonomic level, trained on over 65 million labeled camera trap images.

**Option A: Wildlife Insights (cloud-based).** Upload images to [wildlifeinsights.org](https://wildlifeinsights.org), which runs both stages automatically (Wildlife Insights, 2026). Review AI predictions and export verified data as CSV.

**Option B: Local pipeline (Python).** For offline or large-volume processing, use the open-source CameraTrapAI package from [github.com/google/cameratrapai](https://github.com/google/cameratrapai) (Beery et al., 2019; Google Research, 2026).

### 8.3. Human Verification

1. Sort AI output by confidence score (ascending).
2. Manually verify all predictions below 90% confidence (Thornton et al., 2026).
3. Spot-check a random 10% of predictions above 90% confidence.
4. Correct misclassifications and record reviewer name, date, and total corrections.

## 8.4. Data Analysis in R

```
library(tidyverse)
library(lubridate)
library(camtrapR) # Niedballa et al. 2016

detections <- read_csv("classifications_verified.csv") %>%
  mutate(datetime = ymd_hms(timestamp),
         date = as_date(datetime),
         hour = hour(datetime))

# Independent events (30-min threshold)
independent <- detections %>%
  filter(category == "animal") %>%
  arrange(camera_id, species, datetime) %>%
  group_by(camera_id, species) %>%
  mutate(
    time_diff_min = as.numeric(difftime(datetime, lag(datetime),
                                         units = "mins")),
    independent = is.na(time_diff_min) | time_diff_min >= 30
  ) %>%
  filter(independent) %>%
  ungroup()

# Trap-nights per camera
trap_nights <- detections %>%
  distinct(camera_id, date) %>%
  count(camera_id, name = "trap_nights")

# Detection rate (events per 100 trap-nights)
det_rate <- independent %>%
  count(camera_id, species) %>%
  left_join(trap_nights, by = "camera_id") %>%
  mutate(rate_per_100tn = (n / trap_nights) * 100)

print(det_rate)
```

(Niedballa et al., 2016)

## 9. Quality Control

- Test-fire each camera before leaving the deployment site.
- Record all deployment metadata on the field data sheet.
- Check cameras every 2–4 weeks to replace batteries and SD cards.
- Report the AI model version, confidence threshold, verification protocol, and correction rate in any publication (Thornton et al., 2026).

## 10. References

- CamPark (2023)
- Beery et al. (2019)
- Wildlife Insights (2026)
- Google Research (2026)
- Thornton et al. (2026)
- Niedballa et al. (2016)
- O'Brien et al. (2010)

Beery, S., Morris, D., & Yang, S. (2019). Efficient pipeline for camera trap image review. *arXiv Preprint arXiv:1907.06772*.

CamPark. (2023). *T20 mini trail camera: User's manual*. <https://www.campark.net/pages/t20-trail-camera>

Google Research. (2026). *Where wild things roam: Identifying wildlife with SpeciesNet*. <https://research.google/blog/where-wild-things-roam-identifying-wildlife-with-speciesnet/>

Niedballa, J., Sollmann, R., Courtiol, A., & Wilting, A. (2016). camtrapR: An R package for efficient camera trap data management. *Methods in Ecology and Evolution*, 7(12), 1457–1462. <https://doi.org/10.1111/2041-210X.12600>

O'Brien, T. G., Baillie, J. E. M., Krueger, L., & Cuke, M. (2010). The wildlife picture index: Monitoring top trophic levels. *Animal Conservation*, 13(4), 335–343. <https://doi.org/10.1111/j.1469-1795.2010.00357.x>

Thornton, S. A. et al. (2026). Identification of camera trap images by artificial intelligence and human experts produces similar multi-species occupancy models. *Journal of Applied Ecology*. <https://doi.org/10.1111/1365-2664.14862>

Wildlife Insights. (2026). *Wildlife insights: About AI*. <https://www.wildlifeinsights.org/about-wildlife-insights-ai>

## 11. Related SOPs

| SOP                  | Title                   | Relationship                      |
|----------------------|-------------------------|-----------------------------------|
| <a href="#">F001</a> | Field Safety            | Required prerequisite             |
| <a href="#">F006</a> | GPS and Site Navigation | Camera deployment coordinates     |
| <a href="#">F602</a> | iNaturalist             | Photo-based species documentation |
| <a href="#">F630</a> | Drone Operations        | Complementary remote sensing      |
| <a href="#">L801</a> | RStudio and GitHub      | Data version control              |

## 12. Training Record

Before deploying camera traps independently, personnel must:

1. Read this SOP and [SOP-F001](#) in full

2. Demonstrate camera setup under supervision
3. Deploy and retrieve at least one camera with proper metadata recording
4. Process one SD card through the full AI pipeline (download, MegaDetector, SpeciesNet or Wildlife Insights, verification)
5. Produce a verified species list with activity pattern summary
6. Be signed off by the PI or field lead

### 13. Appendix A: Field Data Sheet

| Field              | Deployment | Retrieval |
|--------------------|------------|-----------|
| Date               |            |           |
| Time               |            |           |
| Site ID            |            | —         |
| Camera serial no.  |            | —         |
| SD card no.        |            |           |
| GPS coordinates    |            | —         |
| Camera bearing (°) |            | —         |
| Camera height (cm) |            | —         |
| Batteries          | Fresh      | _____ %   |
| Test photo taken   | Y / N      | —         |
| Notes              |            |           |