Specific Learning Objectives
To introduce camera trap technology including camera types and operational features for use in animal population surveys

Camera Trap Overview, Types & Features

Drs Rajan Amin, Lucy Tallents & Tim Wacher

Intellectual property rights belong to the authors. None of the information contained herein should be used, in whole or in part, for distribution or presentation without prior consent of the authors.

Camera types

- Deer Cam
  - $50-100
  - Film

- Moultrie
  - $65-100
  - Digital

- Reconyx
  - $450-650
  - Digital
  - Wirelessly downloads to base station or laptop

- Buckeye
  - $800-1500
  - Digital

How do they work?

Non-triggered
- Time lapse
- Continuous recording
- Used in:
  - Animal behaviour (e.g. nest ecology)
  - Animals in open spaces
  - Shore birds
  - Grazing animals, water holes
  - Seals, penguins

- Require more power (depending on the application)
  - External power source
  - Solar power
  - Require more storage and processing
  - Lots of images

Triggered
- Different triggers
  - Mechanical
  - Baited traps
  - Weight
  - Infrared
  - Passive
  - Active

- Some commercial cameras can be setup in both operation modes

© ZSL / author
How do they work?

**Passive trigger (PIR)**
- Heat in motion (but reptiles?)

**Active trigger**
- Infrared beam
- Mechanical lever
- Trip wire
- Pressure-activated

**PIR sensor**
- Heat-in-motion detector
- Optimum detection is where the temperature difference between target and background > 2.7 degrees C. and can be unreliable when the ambient temp falls within the temp range of most mammals (31.5-36.5 C)
- Detector can be triggered by the movement of pockets of hot air or by vegetation moving in the detection zone
  - Problem can be limited by avoiding camera pointing to area under sun incidence

**Detection zone**
- Area in which sensor is able to detect the target
- Important feature and not necessarily = camera FOV
- Detection zone varies between camera models (15.6 – 324.1 m²)
- Camera with narrow detection zone usually have fast trigger speeds
- Can be increased to some extent by moving the camera further away from the target which can compensate for slow trigger speed

**Trigger speed**
- Rapidity with which the camera captures an image relative to when the sensor detects the passing target
- Critical feature
  - A “fast” trigger speed (< 1 s) increases recording of targets; slow trigger speed may result in missing targets
  - A slow trigger speed can be compensated for by a wide detection zone
  - A fast trigger speed may be less necessary if target is attracted to a bait / feeding station
**Sensitivity**

- Adjust the heat sensitivity threshold to adapt the sensor’s responsiveness to the target
- Generally high sensitivity is better to detect small-sized animals also in high temperature environments where temperature gradients used to trigger the camera are lower
- However, high sensitivity will increase chance of misfiring particularly by moving vegetation and when sunrays hit the target site

**Infra-red vs white flash**

**Infra-red flash**

- Majority of cameras with IR flash
  - Monochrome pictures at night
    - Usually lower quality and resolution than daytime (species identification sometimes difficult)
  - Use less energy -> longer battery life
  - Faster trigger speed and multiple pictures per trigger
    - No need to recharge as in the case of white flash
  - Minimise spooking of animals and limit risk of theft (covert)

**White flash**

- Full colour at night
  - Fundamental when shard and colour pictures are needed at night
- Can disturb the animals
- Xenon gas flashes not capable of taking photo bursts due to recharge time of flash
- Xenon gas flashes outperform white LED flashes with clear and sharp images
- Consumes more battery power than infrared flash

**Number of photos/videos**

- Most infrared flash cameras are capable of taking bursts of images in rapid sequence or video useful for
  - animal identification
  - behavioural studies and specific research needs
- However for video, data handling is more time consuming, memory cards are filled up faster and power consumption is greater

**Image resolution & clarity**

- Majority of cameras take medium to high resolution images
- But sharpness and clarity of colour images is more important for individual ID and species for some especially sympatric species with similar morphological features
- No of pixels is often larger than real due to pixel interpolation.
- Increase in pixel no is often accompanied by increase in digital noise and chromatic aberrations
- Plus the higher the image true resolution the slower the shutter speed

**Batteries**

**Alkaline**

- Cheaper
- Non-rechargeable
- Start at 1.6V and discharge quicker than Lithium and NiMH batteries
  - Flash strength (and thus detection range) decreases over time
- Negatively affected by cold weather
  - Lose up to half their capacity in <0°C
- Not eco-friendly
## Batteries

### Lithium
- Not so cheap
- Non-rechargeable
- Start at 1.8V, decreases from first use
  - Flash strength (and thus detection range) is higher at first use
- Not negatively affected by cold weather
- Not eco-friendly but most preferred for their high-power output and resilience but most expensive overall

### Nickel Metal Hydride (NiMh)
- Most expensive
- Rechargeable (successor of Ni-Cad)
  - No loss of capacity if fully discharged through 2-3 charging cycles
  - Can be recharged 100’s of times
- Lower voltage than alkaline and lithium batteries (1.2V-1.4V when fully charged)
  - Reduce camera trap run time and might alter camera performance
- Not negatively affected by cold weather
- Most eco-friendly
- Lower battery life

### External power sources
- A number of camera models have an input jack for connecting external batteries or small solar panels
- Higher capacity lead-acid batteries can be used to prolong deployment especially in areas difficult to get to for servicing cameras

### General stuff
- Always use the camera manufacturer recommended battery type
- Never mix battery types in a camera
- Don’t mix used and new batteries in a camera
- Disposal —> take them back with you!!

### Additional features
- Temperature
- Moon phase
- Time-lapse in combination with motion triggered allowing test image to be taken as specified time

## Camera housing
- Water and insect proof features are essential in extreme weather conditions especially in the tropics (high heat and humidity)
- Metal casing with python locks to protect against damage by large animals and theft
- The weight and size of camera can also be important in many deployments
- Housing should allow easy attachment to trees including replacing batteries and cards without having to move camera
Camera failure/poor images

- Usually a combination of weather, user experience and skill (position and programming), damage by animals, theft, poor equipment
- Trigger mechanism malfunctioning
- Pictures don’t contain any animals -> False triggers

Environmental factors

- Rain and humidity can affect functioning of cameras and restrict deployment and servicing of cameras in certain seasons
- Cameras are at risk from animal damage. Insect intrusion can be a problem. Elephants can frequently damage cameras

Social factors

- Human vandalism and theft can be an issue.
- Cameras need to be robust and camera protective cases, use of desiccant sacs, security locking devices, cryptic positioning and camouflaging of cameras are possible countermeasures against these problems
- Agreement and support from local communities is often required to conduct surveys
- Photographic sampling is often required over difficult terrain and large areas. Deploying cameras can demand travel to remote locations and often involving setting up, servicing and retrieving cameras on foot in difficult conditions. Appropriately trained local staff are therefore essential

Choosing a camera

- Huge difference in performance between environmental conditions, so be careful
- Difficult to choose, but many reviews available
- Ask people with experience
  - But not many have experience using many models!

Choosing a camera

- www.trailcampro.com A website devoted to evaluating performance of camera traps
  - Price
  - Trigger time
  - Detection width
  - Recovery time
  - Sensor range
  - Flash range
  - Battery life