WATER LEVEL MONITORING

TRAIL CAMERA

PACIFIC SALMON FOUNDATION

Water level monitoring in streams is the process of regularly measuring the height of the water surface compared to a fixed reference point. It is often implemented using a staff gauge and/or automated level logger (see related summaries); however, an alternative approach is to photograph water levels at a preset time interval (e.g., daily) using a trail camera. The photos can capture the water level on a staff gauge (replacing a level logger), dewatering of a thermistor, or the overall distribution of water within a stream reach for assessing aquatic ecosystem connectivity. This summary focusses on the latter example (connectivity). Trail cameras are simple and inexpensive to implement, and can provide helpful information for monitoring drought, managing water resources, and protecting ecosystems.

SUMMARY OF METHOD

There are five main steps involved with monitoring using a trail camera for assessing connectivity:

1. **Site selection:** Selecting a good stream reach is critical for obtaining useful data. The ideal reach has varying hydrologic connectivity (presence/absence of water linking channel features) so the camera can document changes in streamflow continuity over time.
2. **Installation:** Position the camera where it can be mounted securely (e.g., on a post or tree) and is unlikely to be moved by high flows, debris, or people. This consistency is important for comparing connectivity over time.
3. **Referencing:** Incorporate a reference object (e.g., staff gauge, rock, or marked feature) in the frame so observers can link image observations of water presence/absence or depth to actual conditions along the stream.
4. **Recording:** Program the camera to take images at a regular time interval (e.g., hourly, daily).
5. **Data processing:** Images are periodically retrieved and reviewed to identify changes in streamflow, presence/absence of flowing water, and conditions that allow or restrict movement of aquatic organisms.

Photo credit: Brittany Crossman

IMPORTANT CONSIDERATIONS

Select sites where visual monitoring can reliably detect changes in hydrologic connectivity, from dry/disconnected conditions to fully connected flows. The camera should have a stable and unobstructed line of sight to the streambed, water surface, and channel margins so that connectivity can be observed clearly in each image without obstruction from vegetation, debris, shadows, or sun glare. It is also important to select a site that is unlikely to experience sediment infilling, erosion, or bank collapse.

Since the method is intended to be low-cost, site access and ease of periodic maintenance (e.g., battery and data card changes) are important factors in selecting a site, while minimizing the risk of theft, vandalism, or disturbance.

For long-term connectivity monitoring at remote sites, cellular trail cameras with strong power management (consider pairing with solar power) and a weatherproof design are most useful for obtaining clear, consistent visual data and minimizing the frequency of site visits.

STREAM CHARACTERISTICS

- Well suited to reaches with an intermittent flow regime, well-defined channel geometry, and shallow to moderate depth
- Reach should reflect typical conditions of the stream segment or watershed
- May be problematic for streams with frequent channel changes (unstable bed or banks)
- Clear water conditions and aquatic vegetation may reduce visibility of water surface

MEASUREMENT CHARACTERISTICS

- Automated data acquisition
- Data frequency set during camera programming
- Integrated measurement along stream reach within camera frame
- Point measurement along stream network

SITE ACCESSIBILITY FACTORS

- Suitable for remote foot access
- Can avoid entering stream
- Initial set up involves small or medium-sized equipment (e.g., trail camera, ladder, saw)
- Ongoing monitoring involves small equipment (e.g., downloading console, batteries)

SCALE OF EFFORT: INITIAL SET UP

Equipment cost: very low
Field time: low; <0.5 day
Field expertise: low; requires basic training

SCALE OF EFFORT: ONGOING MONITORING

Equipment cost: very low
Field time: very low; <15 minutes
Field expertise: low; requires basic training
Analysis time: low; ~5–30 seconds per image
Analysis expertise: low; requires basic training

PRODUCTS TO CONSIDER

Trail camera: Moultrie EDGE 2 Cellular, Spy point Flex-S Solar Cellular, Spy point Flex-M Cellular, Spy point Force-Pro, XTU Solar

ADDITIONAL RESOURCES

Becker et al., 2025
Bellucci et al., 2020
Gilmore et al., 2026