A guide to photo-monitoring for landowners

Photo monitoring is an effective method for documenting environmental changes over time. By capturing a series of systematic photographs, it tracks changes in vegetation, wildlife habitats, erosion, and more. These photos serve as reference points that can be analyzed to identify ecosystem changes through techniques ranging from simple visual inspections to use of advanced image processing software for quantitative assessments. The method described here can be used to document and provide context for various ecological phenomena, including the impact of management practices. Understanding the history and context of a landscape or property via photographs supports informed decision-making.

Define the Objectives

Clearly defining objectives is essential for successful photo point monitoring. Objectives may include tracking shifts in plant communities, assessing the effectiveness of management treatments (e.g., mastication), evaluating soil conditions post-wildfire, monitoring reforestation, and more. Obtaining relevant and accurate information relies on considering these specific objectives before establishing photo points. For more information, see UCANR Photo-Monitoring for Better Land Use Planning and Assessment.

Create a standardized photo protocol

A standardized protocol is essential for ensuring consistency, repeatability, and clear documentation in photo monitoring. Determine when to photograph, how frequently to take photos, the duration of monitoring, and the appropriate times of year for photography. Record this protocol and maintain consistent equipment usage throughout the monitoring period. For instance, use a tripod to position the camera at a set height.

Establishing Photo and Camera Points

A **camera point** marks a location where a camera is set up and can be a place where multiple photo points are taken. A **photo point** is an established location that **defines the orientation** of a camera located at a camera point. Care should be taken when establishing photo and camera points to ensure that the chosen points address the objectives. The following steps outline items for consideration and procedures for establishing photo points in areas selected for monitoring (Hall, 2002).

1. **Identify a suitable site.** Identify elements in the landscape that are most critical to document in order to achieve the project objectives. For example, a hillside with a drainage to evaluate soil erosion. Find a **witness element,** like a unique tree, fence post, building, etc., that serves to (1) quickly locate the monitoring area, (2) as a reference point from which the camera and photo points can be located, and (3) as a way to document changes (See Image 1). It is helpful to note the distance and direction from the witness element to the camera points.

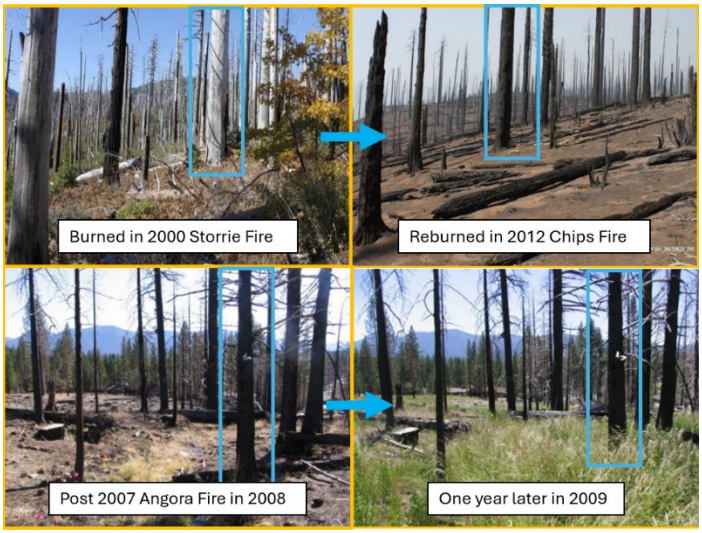

Image 1: From top left to bottom right. Blue boxes highlights a witness element for reference in each image. First row documents the vegetation change and burn severity following the Chips Fire in 2012. Second row captures changes in riparian vegetation in a drainage following the Angora fire [Credit: Ryan Tompkins and Daylin Wade]

2. **Establish camera points, and orient photo points**. Select camera points from which multiple photo points, i.e. angles, can be photographed without obstruction. Choose camera points that reflect the scope of the monitoring area. Consider limiting bias, by taking a photo point in specific orientations, like a cardinal direction or set azimuth.
3. **Mark photo and camera points**. Photo and camera points should be marked by both or with a physical marker (rebar, plot pole) and GPS location for future relocation (See UCANR Mapping Forest Features for more info.

Data Processing and Analysis

Implement a systematic approach for organizing and storing images and their associated metadata to facilitate easy access during analysis. If using a tablet or smartphone, consider using an application such as Survey123 or Avenza Maps, as an effective tool for photo-monitoring. These applications allow users to create custom surveys or maps that integrate photos with GPS data, and annotations from specific locations. Depending on the selected methodology (*see the table below*), change detection in photo-monitoring can be performed by comparing images taken at different times or by using image processing software to analyze differences.

Recording Photo-point Metadata

1. Standardized naming conventions for location and photo
2. Orientation of photo – azimuth
3. Height of camera
4. Timestamp (YYYYMMDD)
5. Weather/Time of Day
6. Description
    a. Species present, treatment type, notable observations etc.
7. Photo taken by __
8. Any notes on methodology changes

Considerations

Photos can be leveraged as a powerful tool for communicating impacts to a wider audience. Findings should be reported in a clear and accessible way using visuals to enhance understanding while providing insights and actionable recommendations based on the analysis.

Works Cited

Hall, F. C. (2002). Ground-based photographic monitoring. Gen. Tech. Rep. PNW-GTR-503. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

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Photo-monitoring Methodologies

Method	Overview	Applications	Advantages	Considerations
Traditional DSLR Cameras	Offers high-resolution images and greater control over photo settings such as aperture, shutter speed, and ISO	Suitable for detailed studies requiring high image quality	Superior image quality and versatility; able to use interchangeable lenses	Bulkier and requires knowledge of manual settings to maximize potential
Smartphone/ Tablet Cameras	High accessibility, convenience, and improving image quality depending on device	Suitable for quick documentation, accessibility to applications	Easy to use, and capable of capturing high-quality images; equipped with GPS for precise location tagging	Limited battery life, storage capacity, and weather conditions; images may have lower resolutions
Cameras that produce 360 degree-Photos	Captures panoramic images that cover the entire surrounding area from a single point	Monitoring large areas such as forests or open fields	Provides a holistic view, offering more context than traditional photos	Requires specialized cameras, may involve more complex data processing and storage
UAV (Unmanned Arieal Vehicle) Imagery	Utilizes drones equipped with cameras to capture images from above, covering larger areas quickly and efficiently.	Ideal for monitoring landscapes, useful for areas that are difficult to reach on foot	Provides high-resolution, creates imagery for geospatial analysis	Requires investment in equipment and expertise in drone operation; regulatory compliance