



NEON PROTOCOL AND PROCEDURE: SIM - SITE MANAGEMENT AND DISTURBANCE DATA COLLECTION

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	03/10/2017	ECO-04456	Initial release
B	07/15/2018	ECO-05721	<ul style="list-style-type: none"> • Added datasheet • Added table of reporting captured in other protocols • Corrected MOAB domain • Removed Fulcrum app details and transferred to Fulcrum user guide
C	01/13/2020	ECO-06278	<ul style="list-style-type: none"> • Updated tables to reflect Fulcrum app changes and revised data structure • Removed the table of programmatic functions for mappings from Fulcrum fields to Ameriflux BADM
D	01/05/2021	ECO-06516	<ul style="list-style-type: none"> • Converted to OS Protocol template RevK • Added plot saturated, flood damage, and hurricane damage as type choices for event type natural disturbance • Added morphology change as new event type • Added human disturbance-trail as new type choice • Removed instructions to report planned activities after they are complete. • Condensed unplanned and planned event tables into 1 table. • Added Figures 1 and 2 • Added more instruction to SOP C for how to report events that last longer than 30 days and record uncertainty • Removed site specific tables from the Appendix.



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1 OVERVIEW

1.1 Background

NEON has been designed to observe and collect data on ecosystem responses to changes in climate, land-use and invasive species over a thirty-year period. These observations come from 20 different domains, each having sites that experience a range of management activities and stochastic disturbances occurring at varying temporal and spatial scales. Without clear and consistent documentation, many of these activities and perturbations could influence the conclusions that data users draw from patterns these events imprint into NEON published data products. For example, a site may have a history of applying herbicides to control an invasive plant and, during the course of the study, the landowner ceases these activities and the plant begins to recolonize the study area. Without the knowledge of the changes in land-management practices, the data user could make inferences that are incorrect or that do not account for the other variables that may be causing the observed variation. Equally important are the random events that may impact multiple data products across plots and aquatic reaches or within individual plots and transects. Knowledge of burns, wind damage, flooding, erosional processes, and the like are all important to the integrity and utility of NEON data products. This protocol and the associated standard operating procedures provide the means for documenting site-specific management activities and disturbances.

1.2 Scope

This document provides a change-controlled version of Observatory protocols and procedures. Documentation of content changes (i.e. changes in particular tasks or safety practices) will occur via this change-controlled document, not through field manuals or training materials.

1.2.1 NEON Science Requirements and Data Products

This protocol fulfills Observatory science requirements that reside in NEON's Dynamic Object-Oriented Requirements System (DOORS). Copies of approved science requirements have been exported from DOORS and are available in NEON's document repository, or upon request.

Execution of this protocol procures samples and/or generates raw data satisfying NEON Observatory scientific requirements. These data and samples are used to create NEON data products, and are documented in the NEON Level 1, Level 2 and Level 3 Data Products Catalog (RD[03]).



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2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain higher-level information that is implemented in the current document. Examples include designs, plans, or standards.

AD[01]	NEON.DOC.004300	EHS Safety Policy and Program Manual
AD[02]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD[03]	NEON.DOC.000724	Domain Chemical Hygiene Plan and Biosafety Manual
AD[04]	NEON.DOC.001155	NEON Training Plan
AD[05]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD[06]	NEON.DOC.004104	NEON Science Data Quality Plan

2.2 Reference Documents

Reference documents contain information that supports or complements the current document. Examples include related protocols, datasheets, or general-information references.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.002652	NEON Level 1, Level 2 and Level 3 Data Products Catalog
RD[04]	NEON.DOC.001271	AOS/TOS Protocol and Procedure: Data Management
RD[05]	NEON.DOC.002984	NEON Standard Operating Procedure: Minimizing Site Disturbance During Aquatic and Terrestrial Observation System Sampling
RD[06]	NEON.DOC.005247	AOS/TOS Standard Operating Procedure: NEON Aquatic and Terrestrial Site Navigation

2.3 Acronyms

All acronyms used in this document are defined in RD[01].

2.4 Definitions

Event Type: broad category used in this protocol to describe a variety of anticipated planned management activities and unplanned disturbances.

Primary Observation: an observation by NEON domain staff of the implementation or results of site management activities or unplanned disturbances.

Secondary Observation: a report to NEON domain staff by an external party of the occurrence of an event, planned or unplanned, at one or more NEON sampling locations.

Fulcrum: Software tool used to create NEON electronic data entry applications.

ServiceNow: Software tool used for problem/incident tracking and resolution.



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3 METHOD

This protocol provides methods to document ecological and management events that may impact interpretation of NEON data products, including both land management activities (planned) and disturbances (unplanned), which occur within NEON sites. This important information is published via the NEON Data Portal as a data product and is available to the NEON data user. The Standard Operating Procedures (SOPs) described below capture such events across spatial scales: at the site, reach or tower airshed level, at a group of specified plots, or at the level of an individual sampling location.

This protocol is not intended to generate documentation of every event that occurs at a NEON site, but rather, those activities, either planned or unplanned, that likely affect a NEON data product and of which NEON staff are aware, either through direct observation or secondary reports from landowners, site hosts, and other reliable sources. While this reporting is not expected to capture all important activities, it provides a means to capture as much of the useful on-the-ground information as possible, to ultimately provide to the NEON data user. Moreover, some protocols provide a means of reporting some of these impacts as part of the data product, and these impacts are not expected to be reproduced here (**Table 1**). For example, the TOS small mammal sampling data product provides data pertaining to traps disturbed for potential incorporation into mark-recapture models or other analyses. Although the cause of the disturbance – e.g., black bear (*Ursus americanus*) – is not necessarily included in the data product, these disturbance events should not be reported again via this protocol.

The Field Operations Domain Manager (DM) or an appropriate delegate is responsible for gathering required site management data, facilitating data reporting, and ensuring events are not recorded multiple times by different field teams. Domain Managers (or delegated protocol leads) are also responsible for compiling necessary reports, maps, and datasheets for ingest from readily available materials to complete this reporting function. The primary goal is to collect information about activities and disturbances that have the potential to impact or affect data products generated from any NEON sub-system (TIS, TOS, AIS, AOS, and AOP) that is not collected as part of a data product. Given that the scope of significant impacts can be difficult to bound, observations outside permitted site boundaries or those that do not have potential impacts to NEON data products do not need to be collected. Standard Operating Procedures (SOPs), in Section 7 of this document, provide detailed step-by-step directions, contingency plans, sampling tips, and best practices for implementing this reporting procedure.

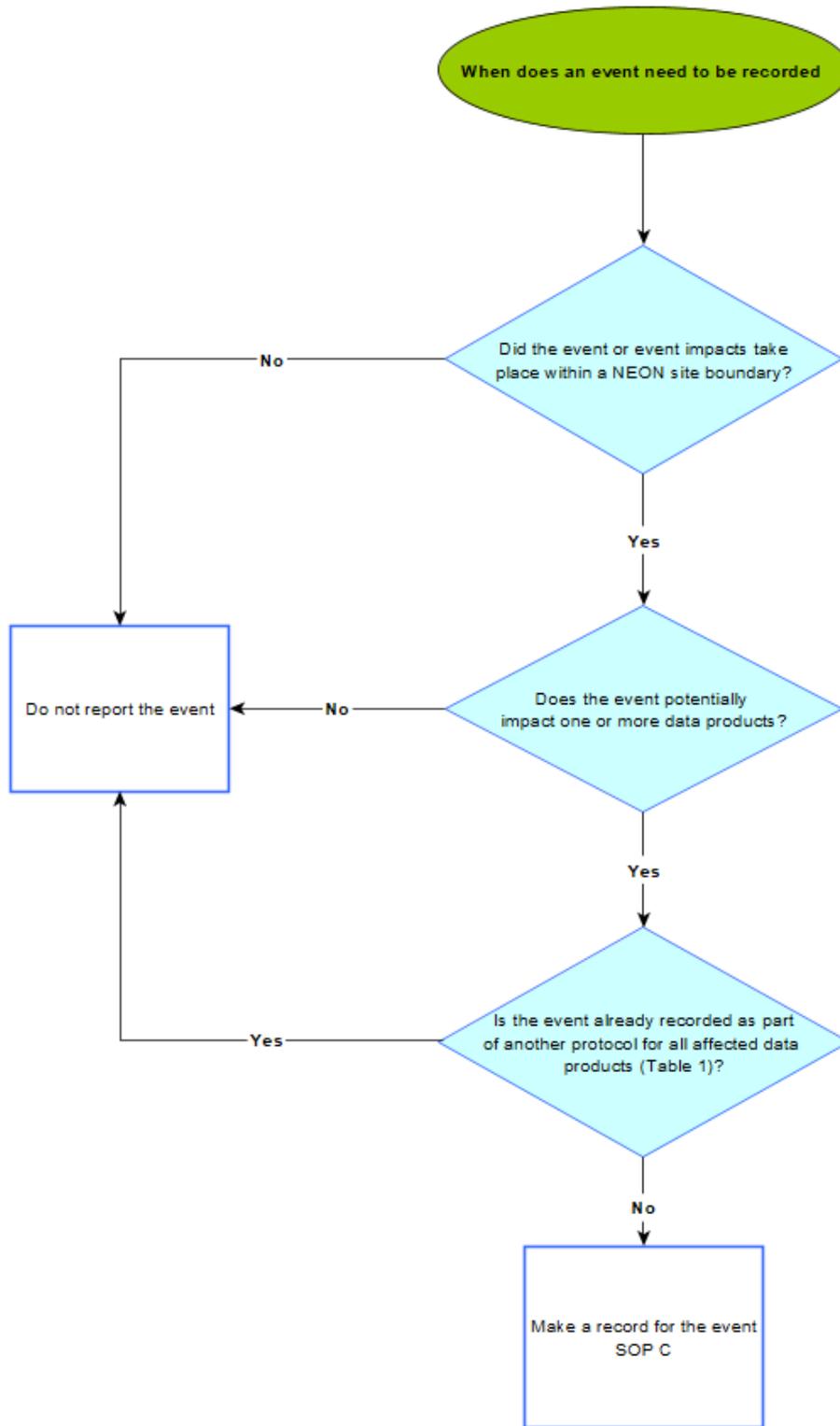


Figure 1. Decision tree to determine if an event needs to be recorded as part of this protocol.



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The value of NEON data hinges on consistent implementation of this protocol across all NEON domains, for the life of the project. It is therefore essential that field personnel carry out this protocol as outlined in this document. In the event that local conditions create uncertainty about carrying out these steps, it is critical that technicians document the problem and enter it in NEON's problem tracking system.

Quality assurance is performed on data collected via these procedures according to the NEON Science Data Quality Plan (AD[06]).



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3.1 Planned Site Management Activities

Long term, planned site management activities pertain to events that are planned and occur regularly as part of the site host's land management plan, including planting schedule, livestock rotation, or other land-use activities. The Domain Manager or protocol lead is responsible for gathering as much information as is reasonably possible from site hosts, farmers, ranchers, and other stakeholders on activities that are planned to occur during the upcoming field season. The reporting level should be to the finest possible spatial scale (such as to plot level, if possible, rather than just site-level reporting). Reporting is expected to occur only after the activity has been started, as the data user is presumed to be not interested in planned activities that did not occur. At a minimum, this report should attempt to (a) quantify the scale of the activities (e.g., square meters, hectares), (b) capture the NEON assets that were impacted (e.g., plot numbers, airshed, stream reach), and (c) record the type of activity.

Examples may include, but are not limited to:

- Grazing regimes (cattle stocking rates, extent, timing)
- Logging/maceration (Logging type, level of disturbance)
- Burning regimes (extent, season, frequency)
- Agricultural practices (planting, fertilizing, pesticide use and application rate)
- Non-NEON research activities (experimental fertilization, biomass removal)

3.2 Unplanned Disturbances

Unplanned disturbances, regardless of the scale of impact, are documented using the procedures outlined in SOP B. For large-scale disturbances involving multiple sampling locations, the Domain Manager, with input from Domain staff, should quantify the extent of each disturbance and the assets that were possibly impacted annually (e.g., at the start of each field season).

Large-scale, unplanned events may include, but are not limited to:

- Wildfire (Location, intensity)
- Flooding event (Extent, effect)
- Blowdown
- Vandalism (Location, type, effect)

Small spatio-temporal scale events typically occur at the plot level for TOS, the transect level for AOS, the sensor location for AIS, and the tower for TIS. Observations should be made each time a new disturbance is discovered during normal scheduled visits to sampling locations. Record only those observations that are likely to have direct impacts on the data products (e.g., wild boar digging up 1m² plant diversity subplot). The nature of the disturbance is chosen from a menu in the mobile application, and then the field staff determine the areal impact as a percentage of the plot area and determine

which sub-plots are most affected. Note that observations recorded as part of this protocol should not include impacts caused by NEON activities (See NEON DOC.002984 – SOP for Site Disturbance, RD[05]).

Small-scale, unplanned events may include, but are not limited to:

- Fallen tree
- Animal disturbance
- Vandalism

Table 1. Descriptions of protocol-specific data product reporting that do not need to be reproduced as part of the site management protocol. The rest of the site management protocol outlines the required event reporting which is not sampling protocol specific.

Protocol	Protocol-Specific Data Product Reporting
Canopy Foliage Sampling	Individual plant status of ‘diseased’ or ‘damaged’; if the individual plant status is part of a larger event affecting multiple plants that are not sampled, the larger scale event should be reported in the site management application.
Soil N-transformations Sampling	Incubation condition captures when an incubated sample was not recovered, because it was missing, destroyed, etc. If this status reflects a larger scale event that impacts the entire plot or more, the larger scale event should be reported in the site management application.
Plant Diversity Sampling	Disturbances are only captured as ‘ remarks ’; it is recommended that disturbances are more formally captured in the site management application.
Riparian Sampling	Captures changes in the riparian area once per year; these do not need to be reproduced as part of the site management application unless the change may affect other data products.
Stream Morphology Sampling	Captures physical characteristics of the stream when performed every 5 years; disturbances (changes to the stream channel, including channel migration or changing habitat (e.g., pools filling in, riffles turning into pools), noticeable changes in bank erosion, newly downed trees (>0.15 m diameter), newly downed colonies of small trees (e.g., a whole stand of small willows), or new noticeable debris dams should be captured in the site management application during years when the protocol is not conducted and if the change may affect other data products during years when the protocol is conducted.



Protocol	Protocol-Specific Data Product Reporting
Fish Sampling	The fishReachCondition field captures data about flooding on the sampling day.
AOS Protocols	Information captured in the samplingImpractical field or in the AOS Field Metadata and Gage Height Application do not need to be reproduced here. If flooding levels damage infrastructure, or if there are morphology changes due to flooding, the event should be captured in the site management application.
Litterfall, Ground Beetle, Mosquito, and Small Mammal Sampling	Disturbed or damaged traps are captured in respective protocol-specific sampling applications. If trap disturbance or damage reflects a larger scale event that impacts the entire plot or more, the larger scale event should be reported in the site management application.
Vegetation Structure	Disturbances are only captured as ' remarks ' in the <i>VST: Plot Meta-Data</i> application (published in the <i>vst_perplotperyear</i> table); disturbances should be more formally captured in the site management application. Individual plant status is documented in the protocol-specific application and should not be reported as part of this protocol; if the individual plant status is part of a larger event affecting multiple plants, especially at a scale larger than the plot or if new information as to the cause of the status could be provided in the site management application, the larger scale event should be reported in the site management application.

4 SAMPLING SCHEDULE

4.1 Sampling Frequency and Timing

In general, do not schedule site or plot visits for the sole purpose of collecting Site Management and Disturbance observations. Verifying planned activities and documenting unplanned disturbances should occur during routine NEON site visits and sampling.

Planned Site Management: In many domains, timing of implementation of this SOP is dependent on the site host, their land-use plan, and when the desired information becomes available. The Domain Manager should determine sensible start and end dates for each management cycle (e.g., fiscal year, calendar year, beginning of sampling season, beginning of grazing season). Frequency of data collection within the management cycle is at the discretion of the Domain Manager. At a minimum, domain staff should verify that the planned activities have been started and reported accordingly.



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Unplanned Site Disturbances: The Domain Manager should review annually which large-scale disturbances are likely to occur across the sites within each domain and communicate these to the field staff at the beginning of the year or field season (e.g., flooding, wildfire, wind damage). Data recording should take place as soon as the disturbance is observed and it is safe to assess the scale and intensity of the impact, preferably within 10 days of the observation. For small-scale disturbances, observations should be made, as necessary, during each visit to a plot, transect, point or other designated sampling location throughout the sampling season.

All observations for a sampling location are expected to be entered while at the sampling location using the mobile application and to the best, most exact location detail. Domain Managers or delegated protocol leads should review recently recorded disturbance information records to check that they are only reporting new activities or impacts (e.g., dead cow in plot is only reported once). Multiple reports could imply multiple observed impacts if larger area locations are selected (e.g., multiple reports of dead cow at “reach” location would not necessarily be understood as same dead animal reported multiple times.) An optional field datasheet is provided to facilitate recording (Appendix A).

Table 2. When to create a record for Site Management and Disturbance Data Collection procedures per event type.

Event Type	Report Timing	Remarks
Planned Site Management Activities	Create record after activity start has been verified	For example, if you learn in February a prescribed burn is scheduled for March, wait until either the site host confirms it happened or you are able to verify the event in the field.
Unplanned Disturbance Reporting	Create record when the disturbance is first observed or verified	Be sure to check that events are not being reported more than once.

4.2 Estimated Time

The time required to implement a protocol will vary depending on a number of factors, such as skill level, system diversity, environmental conditions, and distance between sample plots. The timeframe provided below is an estimate based on completion of a task by a skilled two-person team (i.e., not the time it takes at the beginning of the field season). Use this estimate as framework for assessing progress. If a task is taking significantly longer than the estimated time, a problem ticket should be submitted.

This protocol is expected to take no more than 6 hours per site per year. Some of the more intensively managed sites may require more time, up to an additional 6 hours per site per year. It is expected that



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set-up for this protocol may take longer at a first-year site. Time should be scheduled to provide quick data processing to accommodate fast turnaround in data availability to the user. Field observation time is not expected to be in addition to relevant subsystem protocol tasking, but rather, an observation completed while executing other protocol efforts. Therefore, the time estimate is for compiling the reports at the domain support facility.

5 SAFETY

This document identifies procedure-specific safety hazards and associated safety requirements. It does not describe general safety practices or site-specific safety practices.

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD[02]) and EHS Safety Policy and Program Manual (AD[01]). Additional safety issues associated with this field procedure are outlined below. The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.



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6 PERSONNEL

6.1 Training Requirements

All technicians must complete required safety training as defined in the NEON Training Plan (AD[04]). Additionally, technicians must complete protocol-specific training for safety and implementation of this protocol as required in Field Operations Job Instruction Training Plan (AD[05]).

Fulcrum application training may also be necessary. The Domain Manager or Field Ecologists should review annually which large-scale disturbances (a) are likely to occur across the sites within each domain and (b) have been reported in the site management application in previous years and communicate these to the field staff as part of training, at the beginning of the year or field season (e.g., flooding, wildfire, wind damage).

6.2 Specialized Skills

Training for this protocol may involve GIS software to delineate site boundaries and affected areas where the skills and resources exist in specific domain support facilities and where that facility deems this tool necessary.



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7 STANDARD OPERATING PROCEDURES

SOP A Preparing for Data Capture

Mobile applications are the preferred mechanism for data entry. Mobile devices should be fully charged at the beginning of each field day, whenever possible.

However, given the potential for mobile devices to fail under field conditions, it is imperative that paper datasheets are always available to record data. Paper datasheets should be carried along with the mobile devices to sampling locations at all times.

A.1 Collecting Data on Planned Site Management Activities

1. Gather NEON site boundaries and sampling locations as provided by the NEON GIS specialist. Examples include:
 - a. Airshed maps
 - b. Plot boundary locations with associated named locations
 - c. Aquatic reach boundary with associated sampling points as named locations
 - d. Extent of permitted area
2. Research management plans for the site at least once annually. Gather as much relevant information as possible on each site management activity (e.g., date, duration, area, amount of fertilizer used, number of cows grazed), using any or all of the following methods:
 - a. Collect spatial data on management activities via maps provided by the site host, the NEON GIS specialist, or satellite imagery, such as that provided by Google Earth.
 - 1) Examples include:
 - a) Site specific land use maps
 - b) Site specific burn maps
 - c) Site specific farming plots
 - b. Request site management plans, if available.
 - c. Request formal or informal communications with site hosts, as appropriate
 - 1) Examples include:
 - a) requesting a phone call of intention to spray herbicides
 - b) requesting the intention to burn schedule
 - d. Participate in annual planning meetings (e.g., land use committee meetings)



Site management data are reported only as high as the site-level and as low as a specific NEON sampling location. There is no requirement to create spatial data layers in a GIS to manage the information, but this approach may be desirable.

3. Determine which NEON sampling locations are planned to be impacted, according to the available spatial information on site management activities.



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- a. Recognize that, depending on the quality and or accuracy of the information, it may be desirable to include those plots that are in the direct path of the management activity rather than trying to resolve if a plot is NOT included in a specific management activity. Examples include:
- 1) Translate site Burn Unit map into TOS plot IDs
 - 2) Translate parcel map of farming plats into TOS plot IDs



Do your best to determine the NEON named location that is influenced by the management activity. Data users will be interested in connecting data collection points to site management activities or disturbance events. It may not always be possible to identify to plot or sample collection point location, so larger areas (e.g. airshed, reach) can be selected. However, more specific named location data produces more robust data linkages.



Do not enter a management activity until it has been confirmed it has started.



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SOP B Reporting on Site Management and Disturbance Events

B.1 Collecting Data

Observations should be made during each visit to a plot, transect, point or other designated sampling location throughout the sampling season. All observations about a site impacting event for a sampling location should be entered into a mobile device or datasheet while at the site, whenever possible.

Confirm the planned management actions were implemented according to plan, as a function of a routine scheduled visit when a different protocol is being executed. In other words, do not schedule site or plot visits for the sole purpose of collecting Site Management and Disturbance observations.

1. Compile primary observations by domain staff of management actions at NEON sampling locations.
2. Note any discrepancies between the management plans and direct observations and confirm with site host. Examples include:
 - a. It appears from droppings that livestock were likely present outside planned grazing schedule. Confirm with site host.
 - b. Broad swath of vegetation is found dead; confirm if herbicide was applied, and, if so, the date, chemical composition, etc.



Remind field staff to be on the lookout for management activities when they visit a plot. Have them report observations via the Fulcrum application when they see recent management activities

B.2 Reporting Data

Details to report vary with the activities (referred to herein in as ‘event type’). **Table 3** provides descriptions and general instructions for reporting by event type. **Table 4** provides further guidance on the suggested details to be reported for each event type. Reporting by event type varies across sites based on availability of information. Good faith efforts to acquire the details suggested herein are expected, but successful collection of all of the information in all cases is not.

Table 3. Descriptions of event types and instructions for reporting.

Event type	Description	Reporting instructions	Planned or Unplanned?
ownership Change	Change of legal ownership or lessor of any of NEON’s	An initial record should be created for each site to document the baseline. Thereafter, a record only needs to be created when a change occurs	Planned



Event type	Description	Reporting instructions	Planned or Unplanned?
	permitted terrestrial and aquatic sites		
human Disturbance	Catch-all category for damage to sampling areas due to all remaining human-caused disturbance events not included in other event types	For construction activities, report all construction occurring within 100 m of a NEON sampling location, as well as the approximate distance from the nearest sampling location (rounded to the nearest 10-20 m increment)	Either
fire	Prescribed fire deliberately set as part of management action or wildfire	Report severity class at the reach and individual plot level, if NEON staff visit these sampling locations following a fire and can assess. For fires within an aquatic reach but not near a specific AOS or AIS location a GPS coordinate should be reported in the remarks where the severity assessment was completed. See Appendix C for descriptions of severity classes. Report the full extent of the actual fire within the NEON site boundary, even if it went outside the prescribed area (if applicable). If a fire occurs in the watershed upstream of the permitted reach a record should be created to capture any potential secondary effects on the site. See section C.3 for more information.	Either
grazing	Intentional human introduction of animals to NEON sites or sampling locations as livestock or to control vegetation	For grazing, use the otherScientificName field	Planned
plant Addition	Intentional human introduction of plants to NEON sites or sampling locations	Report only during the initial transplant/seeding event, e.g., annually for planting of annual agricultural crops; only at initial introduction for perennials and/or trees (orchards and plantations). If planting of perennials and/or trees occurred prior to NEON sampling, an initial record should be created to document the baseline. Please be sure to copy and paste scientific	Planned



Event type	Description	Reporting instructions	Planned or Unplanned?
		names (especially for plants) from NEON master taxon lists prior to finalizing record. If a taxon is not in a NEON list, please copy and paste from www.itis.gov .	
chemical Application	Intentional introduction of chemicals to a plot or stream reach	Used for fertilizer, pesticide, herbicide, rodenticide, including experimental manipulations that introduce these elements to NEON sampling areas. For areas that are regularly treated over the course of a growing season, it is adequate to report the approximate start/end of the treatment season and not track down information on each time a chemical is applied/fertilized.	Planned
plant Reduction	Physical removal of plants	Use for harvesting or any other physical plant removal. For chemical removal of plants, use chemicalApplication - herbicide. It is anticipated that, at agricultural sites, data will be entered annually (or more frequently, if there is a winter cover crop or extended growing season). Also, be sure to note each time if the biomass is left in place or removed. Please be sure to copy and paste scientific names into the scientificName field from master taxon lists prior to finalizing record. If a taxon is not in a NEON list, please copy and paste from www.itis.gov . It is encouraged that Field Science do their best to identify the plant species. However, it can be difficult if only stump, cut grass, etc. remains and the species weren't previously identified at the site. If there is no way to identify the species down to family, order, etc., there is the option for "2PLANT" when it can't be identified. If multiple species are affected choose the species with the greatest reduction from the "Plant Name" drop down and list the other species in the remarks field.	Planned
animal Reduction	Physical removal of animals	Use for hunting, trapping, exclosure, or any other physical removal of animals. For chemical removal of animals, use chemicalApplication -	Planned



Event type	Description	Reporting instructions	Planned or Unplanned?
		insecticide/rodenticide. Recreational hunting does not need to be captured. Rather, targeted, large-scale removal of animals that are managed by the site host, other research entities, state or federal agency should be captured. Enclosures installed as part of the core NEON program (e.g., herbaceous clip harvest enclosures) should not be recorded.	
tillage	Tilling of the soil for agricultural purposes		Planned
biocontrol	Intentional human introduction of organisms for biocontrol	Use only when informed by site host or another reliable source that this has occurred. It is not expected that primary observations could reliably deduce this event. Record should capture the organism that has been introduced to the site, rather than the target for biocontrol. Use of large animals such as goats to control brush should be captured under grazing. Use the otherScientificName field to record species name.	Planned
irrigation	Intentional irrigation of NEON sampling areas. This event type also includes intentional drainage of NEON sampling areas.	For areas that are regularly irrigated over the course of a growing season, it is adequate to report the approximate start/end of the treatment season and not track down information on each time irrigated.	Planned
population Spike	Unusual spike in activity of any organism (e.g., invertebrates, pathogens), including the first observations of the presence of an invasive species of particular local concern, sudden population growth of any of these, outbreak	Report based on primary observations or secondary reports from a reliable source (e.g., site host, federal or state agency). For species other than plants, use the otherScientificName field. For plant species, please be sure to copy and paste scientific names into the scientificName field from master taxon lists prior to finalizing record. If a taxon is not in a NEON list, please copy and paste from www.itis.gov .	Unplanned



Event type	Description	Reporting instructions	Planned or Unplanned?
obstruction	Natural or human-made objects of varying size present in plot or stream reach.	Use for trash, old cars, large animal carcasses, and the like that are left in stream reach and/or plot. Use only for in-plot/in-reach objects, not objects that prevent access to the sampling location. Use only when the object impacts sampling or may impact data and is not otherwise reported via established mechanisms in the affected protocol.	Unplanned
otherNatural Disturbance	Catch-all category for damage to sampling areas due to all remaining natural disturbance events not included in other event types, particularly weather-related.	Use to report damage from windthrow, flooding, or other natural disturbances.	Unplanned
morphology Change	Aquatic specific category for changes to a stream, river, or lake.	Use to report deposition, tributary, lake segmentation, or beaver dams changes in between the 5 year stream morphology protocol or when then changes potentially impact other AOS or AIS data products.	Unplanned
wildlife Disturbance	Wildlife-caused damage of NEON sampling areas or equipment	Use professional judgment to attribute the cause of damage to a taxonomic group, if possible, and use additional detail types, such as minQuantity, maxQuantity and remarks to describe the nature of the damage. If data entry mechanisms provided for affected protocols capture the key impacts to the data (e.g., small mammal trap status of 'disturbed'), there is no need to report here.	Unplanned
pollutant	Unusual deposition of pollution from a point source	Do not report ambient pollution from vehicles and nearby urban areas; this category is intended for capturing unusual events. Use for ash deposition in fires where the plot itself didn't burn but deposition from nearby is observable. Ignore smoke.	Unplanned
drought Perceived	Landscape-scale drought conditions reported in the region containing the site	Report when drought conditions are confirmed by National Weather Service or similar, and ability to conduct field work is compromised or	Unplanned



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Event type	Description	Reporting instructions	Planned or Unplanned?
	and causing marked impacts on data quality	bouts are canceled. For example, report if taxonomic identification of plants is inhibited by lack of growth and/or reproductive parts as a result of known drought conditions. No estimation of drought severity is expected.	
iceOn	Ice fully covering sampling locations or infrastructure	Primarily used to report ice-on and ice-off dates for lake sites. This field can also be used for stream sites if the stream is completely iced over at the in-stream sensor locations. Pockets of ice or ice outside of stream do not require reporting via this protocol.	Unplanned
other	Event type to be used when none of the other event types fits your disturbance. Example is fish addition in efforts to restock native population.		Either

Table 4. Suggested details to report for each event type with associated choice lists.

Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
ownership Change	name		University of California, Riverside	part or all of NEON site sold to new manager
fire	severityClass-see Appendix C: Fire Severity Classification	noneOrNegligible		ash in plot, but not burned
		low		low burn severity fire
		medium		medium burn severity fire
		high		high burn severity fire
		unknown		severity unknown
methodTypeChoice	fire-controlledBurn			intentionally set fire as part of a management action. Report the full extent of the actual fire, even if it went outside the prescribed area (if applicable)
	fire-wildfire			fire that results from any cause other than a deliberate management action
grazing	otherScientific Name		<i>Bison bison</i>	presence of bison grazing in vicinity of TOS plots at KONZ
	minQuantity and/or maxQuantity – value(s)		30	



Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
	quantityUnit		head per acre	3 calf cow pairs per acre
plant Addition	methodTypeChoice	livePlants		planting of seedlings or live plants that physically protrude from the soil
		seeds		planting of seeds (no visible plant protruding from the soil)
	scientificName		<i>Zea mays L.</i>	crops planted at STER
chemical Application	methodTypeChoice	chemicalApplication-fertilizer-organic		manure applied
		chemicalApplication-fertilizer-inorganic		N, P, K mix applied
		chemicalApplication-fertilizer-unknown		unknown fertilizer applied
		chemicalApplication-fire retardant		planes dump fire retardant on plots.
		chemicalApplication-pesticide - fungicide		researcher applies fungicide to corner of plot
		chemicalApplication-pesticide - herbicide		roundup for invasive removal
		chemicalApplication-pesticide - insecticide		dumped an entire bottle of DEET in plot
		chemicalApplication-pesticide - rodenticide		dispersing mouse bait
	name (brand name or active chemical ingredient)		MiracleGro	garden tomato plot
	minQuantity and/or maxQuantity (value(s) + units)		1 acre	
other (if only partial details are available)		nitrogen-based	corn field fertilizer	
plant Reduction	scientificName		<i>Zea mays L.</i>	corn harvest
	methodTypeChoice	removal-clearCut		all timber harvest
		removal-cropHarvest		corn harvest
		removal-mowing		mowing with grass left in place
		removal-pruning		lopping branches
		removal-thinning		selective timber harvest
	biomassRemoval	0%		mowing with cut grass left in place; approximately 0% biomass removal
		25%		approximately 1-25% biomass removal



Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
		50%		approximately 26-50% biomass removal
		75%		approximately 51-75% biomass removal
		100%		corn harvest by combine; 75-approximately 100% biomass removal
animal Reduction	otherScientific Name		<i>Rattus rattus</i>	kill-trapping for invasive predator removal in Hawaii
	methodTypeChoice	animalReduction - huntTrapEtc		kill-trapping for invasive predator removal in Hawaii
		animalReduction-exclusion		Permanent enclosure fence installed for deer
	minQuantity and maxQuantity (value(s) + units)		400 trap stations	
tillage	methodTypeChoice	tillage-conservation		any method of soil tilling that leaves crop residue left behind after harvest on the field to reduce soil erosion and runoff
		tillage-conventional		disking, plowing and other methods of tilling that bury crop residue left behind after harvest
		tillage-other		other methods of tilling not covered by above choices
	minQuantity and/or maxQuantity (value(s) + units)		1 acre	
biocontrol	otherScientific Name		<i>Ceutorhynchus litura</i>	stem-mining weevil introduced to control Dalmation toadflax
irrigation	methodTypeChoice	irrigation - flood		
		irrigation - sprinkler		
		irrigation - drainage		
	remarks		Flood irrigated regularly from Jan - October, ground saturated	



Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case	
			during most of that period		
human Disturbance	methodTypeChoice	humanDisturbance-soilDisruption		soil disruption not related to tilling for agriculture, e.g. digging a pit	
		humanDisturbance-vandalism		deliberate damage of NEON sampling areas or equipment, details to be added to the remarks	
		humanDisturbance-construction - structure		land owner builds a small shed in tower airshed	
		humanDisturbance-road - dirt		evidence of a new road that bisects a plot, likely no new material addition but obvious vehicle disturbance of vegetation	
		humanDisturbance-road - asphalt		new road construction, with asphalt as top layer, either poured or recycled	
		humanDisturbance-road - gravel		new road construction, with gravel base as top layer, either compacted or loose, material is foreign to the site	
		humanDisturbance- trail		new trail construction for non-motorized travel; including foot, mountain bike, and horseback trails	
		humanDisturbance-other			
		minQuantity and/or maxQuantity (value(s) + units)		2.7 m	max width of road in reported area
		minQuantity and/or maxQuantity (value(s) + units)		20 percent	percent of instrument hut exterior vandalized
	remarks		distance from nearest plot, transect, infrastructure, etc		
population Spike	methodTypeChoice	populationSpike-animal - invertebrate		widespread defoliation due to unknown insect herbivore	



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Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
		populationSpike-animal - vertebrate		
		populationSpike-plant		
		populationSpike-fungus		
		populationSpike-pathogen		
		populationSpike-firstInvasiveSighting		initial sighting of an invasive species
	populationSpike-other			
	otherScientific Name		<i>Dendroctonus ponderosae</i>	mountain pine beetle infestation
scientificName			populationSpike-plant records	
obstruction	none, just use remarks		large (1m x 1.5m) sheet of rusty metal near point 21 but not covering plant diversity subplots	
other Natural Disturbance	methodTypeChoice	naturalDisturbance-iceDamage		ice storm, floating ice bending infrastructure
		naturalDisturbance-frostDamage		Infrastructure or vegetation damage due to frost
		naturalDisturbance-windDamage		Infrastructure or vegetation damage due to wind
		naturalDisturbance-floodDamage		Infrastructure or vegetation damage during flooding
		naturalDisturbance-hurricaneDamage		Extensive site damage during hurricane
		naturalDisturbance-earthquake		Sensor position changes during earthquake
		naturalDisturbance-plotSaturated		Saturated plot due to flood, unusual heavy rains, etc
	minQuantity and/or maxQuantity (value(s) + units)		32 cm	max depth of flooding in reported area (centimeters preferred)
	minQuantity and/or maxQuantity (value(s) + units)		6.7 magnitude	earthquake



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Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
morphology Change	methodTypeChoice	morphologyChange-sedimentDepositionOrScouring		a singular event causes major deposition or scouring, changing channel morphology
		morphologyChange-tributaryConnectOrDisconnect		a tributary is newly connected or disconnected from the reach
		morphologyChange-LWD-depositionOrMovement		a significant deposition or removal of large woody debris within a water body related to a singular event that may impact OS/IS data products
		morphologyChange-lakeSegmentationOrAddition		when part of a lake is newly segregated or a secondary pond is newly connected at the site
		morphologyChange-beaverDam		new beaver activity is apparent that may impact OS/IS data products
wildlife Disturbance	otherScientificName		<i>Sus scrofa</i>	feral pigs rooting in plot
	minQuantity and/or maxQuantity (value(s) + units)		65 percent	percent of plot disturbed by pigs
pollutant	methodTypeChoice	deposition - spill		spilled antifreeze in plot
		deposition-atmospheric		
		pollutant - ash		volcanic ash in plot
		pollutant - hydrocarbon		oil spill in stream reach
		pollutant - acid		HCl spill in plot
	minQuantity and/or maxQuantity (value(s) + units)		0.5 acres	acres of site estimated to be impacted
	minQuantity and/or maxQuantity (value(s) + units)		25 percent	percent of the plot covered
minQuantity and/or maxQuantity (value(s) + units)		3000 liters	oil estimated to have spilled into stream	



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Event type	Detail types to report (if possible)	Valid Choices (if applicable)	Example Entry (if not choice list)	Sample Use Case
drought Perceived	none, use remarks			
iceOn	none, use remarks			lake freezes over at sensor locations
other	none, use remarks			



Use your best judgment and *consider both the intensity and duration of the event on each impacted location/group of locations* and what the end user would find ecologically important and balance that with effort. If the event intensity and duration differences are significant across each impacted individual location or groups of locations, the preferred approach is to create multiple event records per impacted location/group of locations. For example, if a prescribed fire varied in severity across multiple plots or the end dates differed across multiple plots, it is recommended that separate records for plots be generated. However, if there are not significant differences and it makes sense to create one single event record for multiple locations, please specify in the remarks any minor differences.



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SOP C Data Entry and Verification

Mobile applications are the preferred mechanism for data entry. Data should be entered into the protocol-specific application as they are being collected, whenever possible, to minimize data transcription and improve data quality. Mobile devices should be synced at the end of each field day, where possible; alternatively, devices should be synced immediately upon return to the Domain Support Facility.

However, given the potential for mobile devices to fail under field conditions, it is imperative that paper datasheets are always available to record data. Paper datasheets should be carried along with the mobile devices to sampling locations at all times. As a best practice, field data collected on paper datasheets should be digitally transcribed within 7 days of collection or the end of a sampling bout (where applicable). However, given logistical constraints, the maximum timeline for entering data is within 14 days of collection or the end of a sampling bout (where applicable). See RD[04] for complete instructions regarding manual data transcription

C.1 Recording Event Length

In order to match the structure of NEON data products and to ensure events are published as quickly as possible, site management and disturbance events are recorded in thirty-day intervals. This means events longer than one month will have multiple records for one event ID. The event ID, which includes the site code, original start date, and event type, will remain the same for all related records. The original start date in the event ID compared to the start date for the record indicates if there are related records for previous months. The “ongoingEvent” field indicates if a record for the next subsequent month is expected. Please see the user manual in the Sampling Support Library for more detailed instructions on using the mobile application.

Table 5. Example records for a grazing event at SITE from 2019-07-19 through 2019-10-10.

eventId	startDate	endDate	ongoingEvent
SITE.20190719.grazing	2019-07-19	2019-08-18	Y
SITE.20190719.grazing	2019-08-18	2019-09-17	Y
SITE.20190719.grazing	2019-09-17	2019-10-10	N

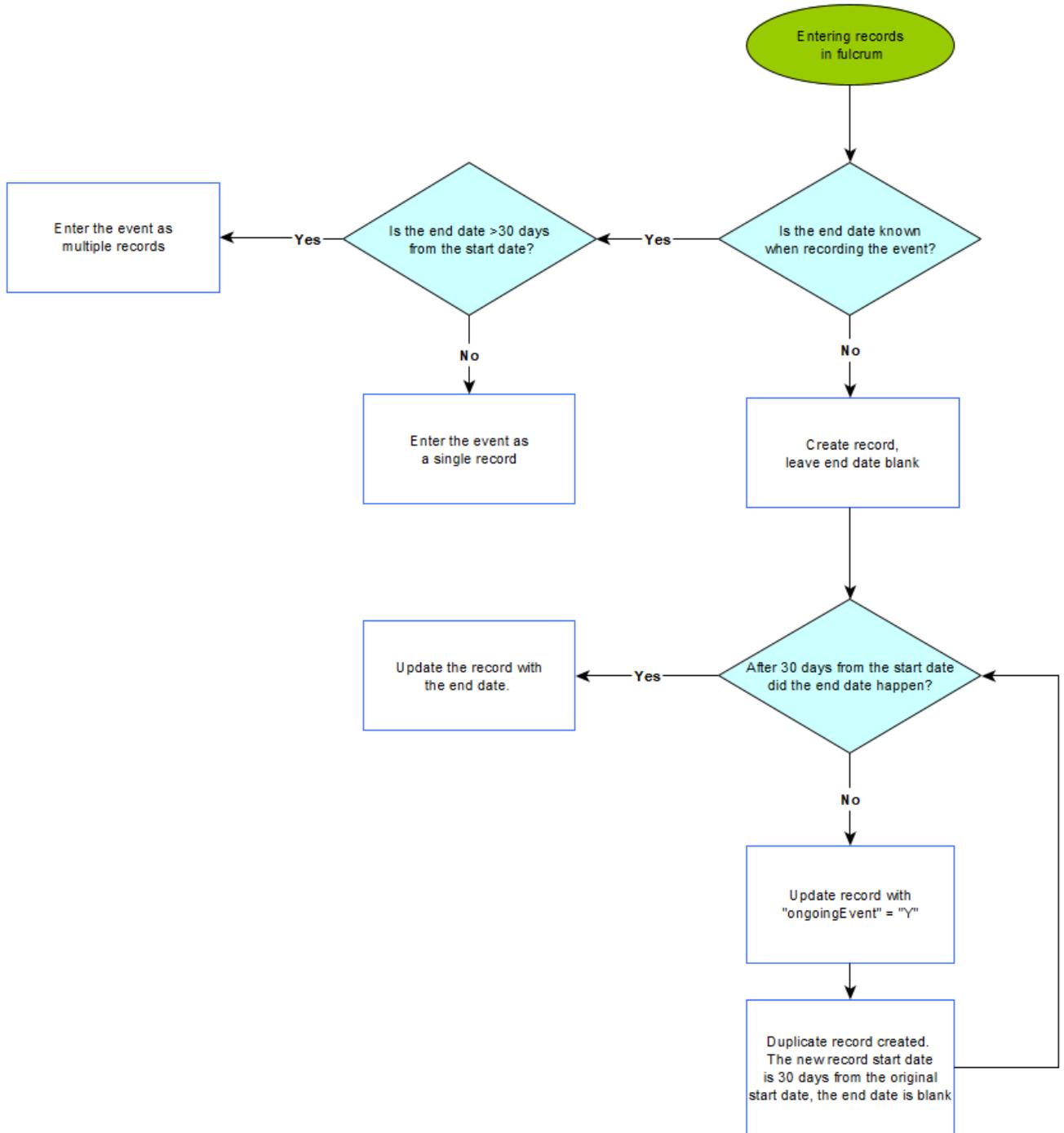


Figure 2. Workflow for how to record Site Management and Disturbance events of various lengths.



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C.2 Recording Date Uncertainty

Date uncertainty is captured in a record’s “estimatedOrActualDate” field. If the date is “estimated” additional comments must be recorded in the “dateRemarks” field. The start and end date range should include any date uncertainty.

For example, if there were cattle in the airshed and the site host couldn’t verify the dates, the start date would be the earliest date grazing could have begun and end date would be the latest date grazing could have stopped. From the example in **Table 6**, if staff were on site the morning of July 19th and there was no grazing and returned August 1st to discover cattle the startDate would be July 19th and dateRemarks would reflect the possible start range. Note that the second record (start date is 2019-08-18) is labeled “actual” since grazing occurred during that record’s entire 30-day span. Please see the user manual in the Sampling Support Library for more detailed instructions on using the mobile application.

Table 6. Example records for a grazing event at SITE from 2019-07-19 through 2019-10-10 with date uncertainty fields added.

eventId	startDate	endDate	ongoing Event	estimatedOr ActualDate	dateRemarks
SITE.20190719.grazing	2019-07-19	2019-08-18	Y	Estimated	Grazing started between 20190719 and 20190801
SITE.20190719.grazing	2019-08-18	2019-09-17	Y	Actual	
SITE.20190719.grazing	2019-09-17	2019-10-10	N	Estimated	Grazing ended between 20191001 and 20191010

If the event intensity and duration differences are significant across each impacted individual location or groups of locations, the preferred approach is to create multiple event records per impacted location/group of locations. These records would all have the same event ID but would differ by location types. Please use your best judgment and consider both the intensity and duration severity of the event on each impacted location/group of locations and what the end user would find ecologically important and balance that with effort.

When in doubt, add remarks to help explain the situation to the end user. If during the first visit to a plot in six months a large downed tree is discovered it would be useful to include a date remark “tree fell sometime between the June and December plot visits” to ensure end users know the multiple records are for one tree fall with an uncertain date and not a tree falling each month.



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C.3 Recording Event Uncertainty

Unless specifics about an event are confirmed by the site host or directly observed by the reporter do not assume an event type. Instead, use the “other” category and provide remarks. For example, if there was a suspected herbicide application first try to confirm with the site host if herbicide was applied. If there is no way to confirm the chemical application, you would create an event classified as other and list the details about the broadleaf species dying and showing signs of potential herbicide application in the Remarks field. Think of it as presence/absence data, spraying probably occurred between these dates at these plots. It’s qualitative, so noting that there was a plant die off that might be related to herbicides is probably sufficient. An end user would be able to then interpret the strange absence of oak trees as a human driven process rather than ecosystem driven.

In general, it is better to over report than under report and to add as much information as possible in the remarks. Below is an example of a well detailed remark for a fire that occurred within the watershed, but outside of the reach.

“The Bush Fire started along Highway 87 on June 13th, 2020. On June 15th, 2020, the fire spread north along the highway, and into the area of Sycamore Creek watershed above and to the east of the site. Fire is likely to impact site either directly burning the site, having fire retardant dropped on the site, or will be indirectly impacted once ash and debris moves into the site with a storm event. <https://inciweb.nwcg.gov/incident/6773/>. Update as of 20200618 at 10AM local time, fire is ~115,000 acres. Fire hasn't burned the site, and a line is being maintained just west of the site along state highway 87. As of 20200701, the fire is 98% contained and is only burning within the secured perimeter of the fire. The total acreage is 193,455 acres. SYCA was not burned. Reports of water being used from nearby pond to help control fire over the past few weeks. While we have not been to the site to confirm any impact, we are assuming no areas at the site were impacted by the fire. Once staff return to site, another record will be made if impacts occurred.”

C.4 Data Verification

Domain Managers or delegated protocol leads should review recently recorded disturbance information records to check that they are only reporting new activities or impacts. Records entered without end dates should be updated monthly by either selecting “ongoingRecord” = ‘Y’ or reporting the actual end date. Questions or issues should be communicated to Science through ServiceNow.



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8 REFERENCES

Parson, Annette; Robichaud, Peter R.; Lewis, Sarah A.; Napper, Carolyn; Clark, Jess T. 2010. Field guide for mapping post-fire soil burn severity. Gen. Tech. Rep. RMRS-GTR-243. Fort Collins, CO: U.S.



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APPENDIX A DATASHEET

Observer(s): _____

Date: _____

Plot/Reach ID(s): _____ Plot Type(s): _____

Plot depiction:



Photos? –

Field Phone: _____

Written Description (Include as much detail as you can, include disturbance type and information)



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Common Disturbances

<u>Disturbance Type</u>	<u>Description</u>	<u>Important Information</u>
Fire	Prescribed management fire or wildfire	Fire severity (SOP C)
Grazing	Introduction of animals as livestock or vegetation control	Other scientific name
Plant Addition	Transplant or seeding events	Scientific name
Chemical Application	Fertilizer, pesticide, herbicide, rodenticide, etc.	Chemical used
Plant Reduction	Physical removal of plants	Scientific name Is biomass left or removed?
Animal Reduction	Removal or exclusion of animals	Targeted large scale efforts Not for recreational hunting
Tillage	Tilling for agricultural purposes	
Irrigation	Irrigation or drainage	
Population Spike	Spike in organism, outbreak	Scientific name or other scientific name
Obstruction	Detritus, natural or human made	Use only in plot; not accessing plot
Other Natural Disturbance	Natural events catch-all	Ex. Ice damage, windthrow, flooding
Wildlife Disturbance	Wildlife catch-all	Other scientific name; if known
Pollutant	Unusual deposition of pollution from a point source	Ex. Ash from fire in an area not burned

Refer to protocol Tables 1-4 for more information regarding disturbance types.

Report anything you find to be ecologically relevant, even if it does not fit into a category above



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APPENDIX B QUICK REFERENCES

If Fulcrum is unavailable to record data while at the site, the following can be noted in a field book for addition to the Fulcrum app once available.

1. Site event where event was observed (e.g. Great Smoky National Park)
2. Date and time event observed
3. Type of event observed (e.g., wildfire)
4. Specific location of event (e.g., plot type and number or extent of multiple plots)
5. Severity description (e.g., tree tops burned off, all remaining vegetation is black, understory completely burned, scorched soil, ash present to 3 inches deep)
6. Additional Remarks (e.g., looks like uncontrolled wildfire, not controlled burn, impacts at least ½ of site, possibly more, uniform disturbance)
7. Take pictures with any camera available- iPhones are appropriate to use here!



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APPENDIX C FIRE SEVERITY CLASSIFICATION

Soil Burn Severity is assessed following Parson et al. 2010. **Table 5** can be used as a quick reference, with subsequent tables providing more detailed information and photographs. Please choose the category 'Low', 'Medium' or 'High' that best describes the soil burn severity in the area you are assessing.

Table 7. Summary of Characteristics of Burn Severity Classifications, from Parson et al. 2010.

Factor Considered	Severity Class: Low	Severity Class: Medium	Severity Class: High
Aerial view of canopy	Tree canopy largely unaltered. Shrub canopy intact and patches of scorched leaves not dominant. Ash is spotty.	Tree canopy is scorched over 50% of area. Shrubs mostly charred but difficult to assess fuels from air. Black ash is visually dominant. Gray or white ash may be spotty.	Tree canopy is largely consumed over > 50% of area. Shrubs completely charred but difficult to assess fuels from air. Gray and white ash is visually dominant.
Trees	Nearly all of crown remains "green." Some scorching in understory trees.	High scorch height. Generally, > 50% of crown is scorched. Mostly "brown" crowns with intact needles.	No needles or leaves remaining. Some or many branches may be consumed. Mostly "black" remaining vegetation.
Shrubs	Scorching in canopy but leaves remain mostly green. Limited fire runs with higher scorch. 5 to 30% charred canopy.	30 to 100% charred canopy. Smaller branches < 0.5 inch (1 cm) remain. Shrub density was moderate or high.	90 to 100% charred canopy. Most branches consumed, including fuels < 1 inch (2.5 cm). Skeletons or root crowns remain. Shrub density was moderate or high. Often old growth in character.
Fine fuels (Grassland)	Scorched or partially consumed.	Mostly consumed. Appears black from the air. Small roots and seed bank remain intact and viable	
Ground cover	Generally, > 50% litter cover remains under trees—less under shrub community or where pre- fire cover is sparse.	Generally, 20 to 50% cover remains or will be contributed by scorched leaf fall from trees. Shrub litter will be mostly consumed.	0 to 20% cover remains as burned litter and woody debris under trees. Shrub litter is consumed.
Water repellency	Soils may be naturally water repellent under unburned chaparral. Other soils will infiltrate water drops in less than 10 sec; greater than 8 mL min ⁻¹ with the MDI.	The surface of the mineral soil below the ash layer may be moderately water repellent but water will infiltrate within 10 to 40 sec; 3 to 8 mL min ⁻¹ with the MDI.	Strongly water repellent soils (repels water drops for > 40 seconds; less than 3 mL min ⁻¹ with the MDI) may be present at surface or deeper.



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Factor Considered	Severity Class: Low	Severity Class: Medium	Severity Class: High
Soil	Original soil structure— fine roots and pores are unaltered.	Original soil structure—roots and pores slightly altered or unaltered. Soil color darkened or charred at surface or just below surface only.	Soil structure to 1 inch is degraded to powdery, single-grained, or loose. Fine roots are charred. Pores are destroyed. Black charred soil color common below thick ash layer. Compare with unburned.



APPENDIX D SOIL CONDITIONS PHOTO SERIES

D.1 Ground Cover: Amount and Condition

	<p>Low soil burn severity</p> <p>Little or no change from pre-fire status. Less than 50% consumption of litter and some char. Needles and leaves mostly intact.</p>
	<p>Moderate soil burn severity</p> <p>Up to 80% consumption of litter and duff, but generally incomplete. Recognizable leaves and needles remain. If more complete consumption occurred, a mitigating factor may be potential for leaf- or needle-cast from scorched canopy to provide ground cover.</p>
	<p>High soil burn severity</p> <p>Little to no effective ground cover remaining after fire (less than 20%) All or most litter and duff has been consumed, only ash or bare soil (ash blown away) remain. Little to no potential for leaf or needle-cast.</p>



D.2 Ash Color and Depth



Low soil burn severity

Ground surface may be black with recognizable fine fuels (needles, grass, and leaves) remaining on surface.



Moderate soil burn severity

Thin layer of black to gray ash with recognizable litter beneath it. Ash layer may be patchy as it is highly moveable by wind and water. Soil heating may have been significant; residence time usually brief. If thicker ash layer is observed, a mitigating factor may be leaf or needle-cast potential from scorched canopy.



High soil burn severity

Thick, 1 to 3 inch (3 to 6 cm or more) layer of powdery gray or white ash covers the ground. Greater than 90% surface organics consumed; significant soil heating has occurred; residence time long. No potential for leaf or needle cast to provide ground cover.

Localized red (oxidized soil) may underlie a thick, powdery layer of gray and white ash- generally found near a burned out stump or log; indicates extreme heating.



D.3 Soil Structure

	<p>Low soil burn severity</p> <p>Structure unchanged. Granular aggregates are not weakened by consumption of organic matter.</p>
	<p>Moderate soil burn severity</p> <p>Structure slightly or not altered. Some consumption of organic matter in the top 0.5 inch (1 cm) of the soil profile.</p>
	<p>High soil burn severity</p> <p>Structural aggregate stability reduced or destroyed. Loose and single-grained soil dominates and is exposed or under ash (up to 5 inches or 10 cm of ash.) Consumption of organic matter in the top 2 inches (5 cm) of the soil profile.</p>



D.4 Roots



Low soil burn severity

Fine roots (~0.2 mm diameter) intact and unchanged



Moderate soil burn severity

Fine roots near surface maybe charred or scorched; large roots intact (~2 mm diameter).



High soil burn severity

Many or most fine roots near surface consumed or charred. Some charring may occur on very large roots (~3 inches or 8 cm diameter).



D.5 Soil Water Repellency



Low soil burn severity

No fire induced water repellency. Water infiltrates immediately; however, some soils exhibit water repellency when unburned.



Moderate soil burn severity

Weak to medium water repellency found at or just below soil surface. Water infiltrates slowly.



High soil burn severity

Strong water repellency found at surface or deeper. Water does not infiltrate. In case of extreme soil heating, soil water repellency may be destroyed or may exist at very deep soil depths (6 inches or 15 cm).



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APPENDIX E MAPPING OF NEON MOBILE APPLICATION RECORDS TO AMERIFLUX BADM

Reporting of site management and disturbance events at NEON sites parallels a similar reporting effort at Ameriflux sites. Given the compatibility of some NEON data products with Ameriflux measurements, and the possibility that NEON sites may attain membership in the Ameriflux network in the future, the following table maps NEON site events reported with the mobile application to the Biological, Ancillary, Disturbance and Metadata (BADM) spreadsheet used to collect similar information at Ameriflux sites.

NEON Site Management and Disturbance Application	Ameriflux Disturbance and Management BADM
<i>Fulcrum App inputs must match all entries specified for each Event type</i>	<i>See functions below for mappings that are the same for all event types</i>
Event type	Variable
ownershipChange	DM_GENERAL
fire	DM_FIRE
fire	DM_FIRE
grazing	DM_GRAZE
plantAddition	DM_PLANTING
plantAddition	DM_PLANTING
chemicalApplication	DM_FERT_O
chemicalApplication	DM_FERT_M
chemicalApplication	DM_FERT_M
chemicalApplication	DM_GENERAL
chemicalApplication	DM_PESTICIDE
plantReduction	DM_FORESTRY
plantReduction	DM_AGRICULTURE
plantReduction	DM_AGRICULTURE



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NEON Site Management and Disturbance Application	Ameriflux Disturbance and Management BADM
<i>Fulcrum App inputs must match all entries specified for each Event type</i>	<i>See functions below for mappings that are the same for all event types</i>
Event type	Variable
plantReduction	DM_FORESTRY
plantReduction	DM_FORESTRY
animalReduction	DM_GENERAL
biocontrol	DM_GENERAL
irrigation	DM_WATER
irrigation	DM_WATER
irrigation	DM_WATER
tillage	DM_TILL
tillage	DM_TILL
tillage	DM_TILL
humanDisturbance	DM_GENERAL
humanDisturbance	DM_GENERAL
humanDisturbance	DM_ENCROACH
humanDisturbance	DM_ENCROACH
humanDisturbance	DM_ENCROACH
humanDisturbance	DM_GENERAL
populationSpike	DM_INS_PATH
populationSpike	DM_ENCROACH
populationSpike	DM_ENCROACH
populationSpike	DM_ENCROACH
populationSpike	DM_INS_PATH



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NEON Site Management and Disturbance Application	Ameriflux Disturbance and Management BADM
<i>Fulcrum App inputs must match all entries specified for each Event type</i>	<i>See functions below for mappings that are the same for all event types</i>
Event type	Variable
populationSpike	DM_INS_PATH
populationSpike	DM_GENERAL
obstruction	DM_GENERAL
otherNaturalDisturbance	DM_EXT_WEATHER
wildlifeDisturbance	DM_GENERAL
pollutant	DM_GENERAL
droughtPerceived	DM_EXT_WEATHER

* "Fulcrum:" designates a field in the Fulcrum mobile application used to report site management and disturbance events observed at NEON sites.



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APPENDIX F EQUIPMENT

All required materials and equipment to implement this protocol are considered standard field and laboratory supplies such as charging stations, first aid kits, tablet, etc. Therefore, this section is intentionally left blank.