



Open Vegetation Survey Protocol

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Apr 02, 2020

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In Development

[dx.doi.org/10.17504/protocols.io.3ebgjan](https://doi.org/10.17504/protocols.io.3ebgjan)

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ABSTRACT

Here we describe the standardised protocol used by the [Canadian Airborne Biodiversity Observatory](#) (CABO) to survey open vegetation (i.e., vegetation without tree cover) at the Cowichan Garry Oak Preserve (British Columbia), Mer Bleue Bog (Ontario) and Parc national des Îles-de-Boucherville (Québec) sites. Surveys were conducted in 3x3m square plots, with each plot containing nine 1x1m subplots. Plot locations were selected in order to capture a range of environmental conditions of interest (e.g., distance from forest, soil types, or microtopography). All data were entered via the *Fulcrum* application, using the *Plots*, *Subplots*, and *Vegetation Surveys: Herbs and Shrubs* apps. For each plot, we first verified plot orientation (two edges of the square north-south, two east-west), measured geographic coordinates of the plot center and corners, and estimated slope angle and aspect. All plant species within the plot were identified. For each subplot, we made visual estimates of percent cover of all plant species present, as well as leaf litter and bare ground. If a drone was available, percent cover estimates were not made in the field; rather, overhead photographs taken with the drone were first annotated and later analyzed quantitatively using virtual point frames to obtain data on the abundance and distribution of plant species within the plots. The ground-based plant surveys were conducted in order to be paired with remotely-sensed aerial hyperspectral imagery.

EXTERNAL LINK

<http://www.caboscience.org/>

ATTACHMENTS

[BC_vasc.pptx](#)

[mb_classification_areas.pdf](#)

[MB_trees-fert_plots.pdf](#)

[Goud_EM_MSc thesis_Table 3.docx](#)

[CABO_species_list_per_site_2019.xlsx](#)

GUIDELINES

OVERVIEW OF OBJECTIVES AND GENERAL METHODOLOGY

Vegetation plots for CABO serve two main goals:

(1) Permitting field-based tests – and validation of airborne-based tests – of how plant diversity and composition vary according to predictor variables of interest (e.g., distance from forest, soil type)

This requires plot-based surveys in which each species present is quantified with respect to aspects of abundance (percent cover, location), and plot coordinates estimated with high precision.

(2) Permitting calibration/validation for identifying plant species from airborne imagery

This requires providing mapped locations of multiple individuals (or occurrences where individuals are difficult to distinguish) of as many plant species as possible. Individuals should occur in a variety of conditions relevant to the signal received on the airborne sensors (e.g., aspect, slope) and should represent different abundances. Individuals outside of vegetation plots, from which leaves were collected for spectra and trait measurements, have also been mapped (see Etienne Laliberté's "Measuring spectral reflectance and transmittance [...] 2 protocols, for small and big leaves) and so also contribute to this goal.

MATERIALS TEXT



CAT S41 fieldwork cellphone - [🔗](#)



Plot prioritization list -



Loop stake - [🔗](#)

About 40 cm long



Plant press and newspaper -



Laser Geo

Haglöf Sweden - [🔗](#)



24 rigid PVC pipes (top of frame), $\frac{3}{4}$ ", 1 m long -

To be used as the frame horizontal structure,
labelled with the subplot number they belong to.



16 rigid PVC pipes (legs), $\frac{3}{4}$ ", appropriate height

To be used as the legs, according to the vegetation height.

Heights:

- 0,37 m: this height allows for the scaffold to be placed over the grid (see the Vegetation Survey part of this protocol).

- 1 m

- 1,5 m



16 PVC connectors for the intersections, $\frac{3}{4}$ " - [🔗](#)

4 corner pieces: L-shaped with a leg junction

8 side pieces: T-shaped with a leg junction

4 middle pieces: X-shaped with a leg junction



L T X



Tape Measure -



3 Stake wire flags - [🔗](#)

About 50 cm long, 3.5" x 2.5" pink or orange vinyl flags on wire stakes



2 Step Steel Step Ladders (2) - [🔗](#)

CGOP site only.



3 m long Telescopic Aluminum Scaffold Plank - [🔗](#)

CGOP site only.



Mavic Air
Drone
DJI - [🔗](#)



Go 4
App
DJI -
The application used to connect your cellphone to the drone controller. Your cellphone then becomes the screen interface to control the drone.



DJI GO 4
Drone, FPV Camera, Mavic and DJI
Photo & Video
3D Flight
Flight



Identification guides -
See Open Vegetation Survey Protocol → Guidelines → Site Specific Information.



3 Square canopy cover negative templates -
1% = 10 x 10 cm
5% = 22,4 x 22,4 cm
10% = 31,6 x 31,6 cm



Trimble Catalyst GPS, NTRIP precision subscription



Wood panel for take-off and landing

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SAFETY WARNINGS

Open vegetation can be very sensitive to disturbance via trampling by researchers. Existing trails should be followed to the maximum extent possible, with trampling minimized, especially in the vicinity of survey plots, by using long strides and minimal steps. Researchers should never step inside a plot, in order to keep the vegetation intact for the inventories and airborne surveys.

Ticks have been spotted near these study sites, and mosquitoes and flies are abundant at the Mer Bleue Bog. Wearing long sleeves and pants and bringing bug spray are recommended.

BEFORE STARTING

In advance of the vegetation crew arriving, the local project leader may have identified the locations where vegetation surveys would be conducted, marking each plot in the field and defining each plot in *Fulcrum*. Also in advance of arriving on site, the vegetation crew familiarized themselves with the common species locally, using lists provided by local employees, websites and guidebooks.

For the first field day, the vegetation crew, with location guidance from the local crew, conducted site reconnaissance, learning how to identify all species in the field.

For the remainder of the time at a given field site (typically about two weeks), the vegetation crew implemented the protocol described in this document in as many plots as possible, except when aerial imagery was being collected. The vegetation crew coordinated with the local crew as necessary, for example to occasionally confirm plant identifications, but otherwise worked largely independently.

In the *Fulcrum* apps mentioned this protocol ("Vegetation Surveys: Herbs and Shrubs", "Plots", and "Subplots"), data entry requires the selection of a Project and a Site.

Plot prioritization

Plot locations were selected following a priority list aiming to cover as wide a range of environmental conditions as possible, with higher priority given to plots meeting the following criteria:

- Within (vs outside*) the airborne imagery polygons;
- Within the flight polygons that had already been imaged (vs not imaged yet);
- Relatively more accessible (vs less accessible) in order maximize the total number of plots surveyed and to gain experience prior to surveying more remote plots.

*This situation is not desired and only happened at the CGOP site because of last minute changes in the flight polygons.

Site Specific Information

Cowichan Garry Oak Preserve (CGOP):

- Project (in *Fulcrum*): "2018-Hacker-PhD-UBC".
- Site (in *Fulcrum*): "CGOP-1".
- Address: 1241 Maple Bay Road, Duncan, BC, V9L 5R9. Please park on Maple Bay Road and walk down to the end of Aitken Road.
- Project Leader: Paul Hacker, PhD Candidate, University of British Columbia.
- Local crew: Paul Hacker, PhD Candidate, UBC, and Irvin Banman, Site Manager, CGOP.
- Park contact: Irvin Banman, Site Manager, CGOP.
- Number of plots: 30.
- Site gradient: spatial relationship to roads, agricultural land use change and an encroaching Coastal Douglas-fir forest.

- Conservation value: very high. Nature Conservancy of Canada volunteers and employees work hard every season on planting indigenous species and controlling invasive ones. Trampling has a big impact. Efforts are to be made seriously to avoid disrupting the site.
 - Magnetic declination: approximately +16°1' (East).
- /!\ Magnetic declination changes with time, and has to be verified shortly before fieldwork at <http://www.magnetic-declination.com/>
- Plant ID ressources:
 - [E-Flora BC website](#).
 - Plants of Coastal British Columbia (Revised Edition, 2016). Jim Pojar, Andy MacKinnon. 2005. Lone Pine Publishing.
 - Wildflowers of the Pacific Northwest. Mark Turner & Phyllis Gustafson, 2006. Timber Press, Inc.
 - Flora of the Pacific Northwest, An Illustrated Manual (Second Edition). C. Leo Hitchcock, Arthur Cronquist, 2018. University of Washington Press in association with Burke Museum of Natural History and Culture.

Mer Bleue Bog:

- Project: "2019-MerBleue".
 - Site: "MBP-veg-crew".
 - Address: Dewberry Trail, Dolman Ridge Road, Orléans, ON. Park at the end of the road. There is a locked chain in the middle of Dolman Ridge Road. Contact Étienne Laliberté or Margaret Kalacska to know the locker number.
 - Project Leader: Margaret Kalacska, Prof., UMcGill.
 - Local crew: Tim Moore, Prof., UMcGill, et al.
 - Number of plots: 34.
 - 2019 plot distribution (in reference to the "MB classification areas" PDF)
 - Baseline: 5
 - Lagg: 5
 - Blue dome ("blue" in *Fulcrum*): 7
 - Tree dominated ("treed" in *Fulcrum*): 7
 - Dry: 2
 - Wet: 2
 - Hollow: 2
 - Fertilization ("fert" in *Fulcrum*): 4 (for 4 treatments: all N variations, in reference to the "MB trees-fert plots" PDF)
 - Site gradient: microtopography (hummocks to hollows, including lawns and mixes of hummocks and hollows).
 - Conservation value: high. Walking in snowshoes or on the boardwalks is mandatory to protect the vegetation.
 - Magnetic declination: about -13° 16' (West)
- /!\ Magnetic declination changes with time, and has to be verified shortly before fieldwork on <http://www.magnetic-declination.com/>
- Plant ID ressources:
 - [Wetland Plants of Ontario](#). Steven Newmaster, Alan Harris, Linda Kershaw. 1997. Lone Pine Publishing.
 - [Plantes des milieux humides et de bord de mer du Québec et des Maritimes](#). Martine Lapointe. 2014. Éditions Michel Quintin. Note: can also be useful for grasses and sedges.
 - [Les sphagnes de l'Est du Canada - Clé d'identification visuelle et cartes de répartition](#). Gilles Ayotte, Line Rochefort. 2019. Éditions JFD.

Parc national des Îles-de-Boucherville:

- Project: "2019-Boucherville".
- Site: "GrosboisFieldEL".
- Project Leader: Étienne Laliberté, Prof., UdeM.
- Park contact: Nathalie Rivard, Head of Conservation and Research.
- Local crew: Sabrina Demers-Thibault, lab technician at UdeM, et al.
- Notice: Prior to the inventories, the dates and times when the crew will enter and leave the park need to be communicated to Nathalie Rivard. A research permit delivered by the park authorities has to be carried all at times. A special authorization to drive the research vehicles inside the park (which is normally closed to cars) is needed and has to be shown on the car dashboard or windows.
- Number of plots: 30.
- Site gradient: botanical diversity, i.e. from monospecific plots of different species (all raspberries, all phragmites, all typha) to diverse plots.
- Conservation value: low. The site is invaded with Phragmites. Hence, if the vegetation surveys are done after the airborne imagery, trampling is not as much of an issue. Still, follow the existing pathways as much as possible, especially before the imagery.

- Magnetic declination: about -14° 24' (West).
!\\ Magnetic declination changes with time, and has to be verified shortly before fieldwork on <http://www.magnetic-declination.com/>
- Plant ID resources:
 - [Fleurs des champs du Québec et des Maritimes](#). Sylvain Parent. 2011. Éditions Michel Quintin.
 - [Arbres et plantes forestières du Québec et des Maritimes](#). 2016. Éditions Michel Quintin. Note: for trees and shrubs.
 - [Guide d'identification des mauvaises herbes du Québec](#). MAPAQ - CPVQ. Note: for grasses.
 - [Flore Laurentienne](#). Frère Marie Victorin. 1995. Les presses de l'Université de Montréal. Note: to confirm identifications.
 - [Plantes des milieux humides et de bord de mer du Québec et des Maritimes](#). Martine Lapointe. 2014. Éditions Michel Quintin. Note: can also be useful for grasses and sedges.
 - [Plantes sauvages des villes et des champs](#), volumes 1 et 2. Fleurbec.

Fieldwork Preparation

- 1 Confirm with the local project leader (see Guidelines → Site Specific Information) that the plots have been marked in the field and created in *Fulcrum*. If the plots have already been created in *Fulcrum*, skip to step 3. If not, go to step 2.
- 2 In *Fulcrum*, enter contextual data for the plots.



When selecting locations for the plots, the goal is to maximize herbaceous diversity. Trees are to be avoided. Shrubs can be included, especially if they are typical within the studied ecosystem. The plots have to be spread evenly through the site gradient (for ex.: distance from a forest, soil type, or microtopography).



CAT S41 fieldwork cellphone - [🔗](#)

- 2.1 From the *Fulcrum* main menu, select the Plots app and then within Plots select the list of records



CABO



Type to filter your apps - 13 total

Exports Imports

Active

Sort by Last Activity



Vegetation Surveys: Herbs and Shrubs

Surveys of low-lying herbaceous and/or woody vegetation.

Last activity 3 days ago

68 records



Subplots

Smaller areas of well-defined shape/size that are nested within plots.

Last activity 3 days ago

315 records



Plots

Small areas of well-defined shape/size, within which environmental conditions are relatively homogenous. Example: forest inventory plots.

Last activity 3 days ago

102 records



Sites

Sites are spatial clusters of field research activities. Sites are generally larger than plots, and their shape/size is not constrained.

62 records



3 days ago

Sabine St-Jean submitted 4 records in Vegetation Surveys: Herbs and Shrubs.
2 created 2 updated 0 deleted

3 days ago

Sabine St-Jean submitted 12 records in Subplots.
12 created 0 updated 0 deleted

3 days ago

Sabine St-Jean submitted 2 records in Plots.
2 created 0 updated 0 deleted

3 days ago

Sabine St-Jean submitted 2 records in Sites.
1 created 1 updated 0 deleted

3 days ago

Etienne Laliberté submitted 1 record in Vegetation Surveys: Herbs and Shrubs.
0 created 1 updated 0 deleted

3 days ago

Sabine St-Jean submitted 1 record in Vegetation Surveys: Herbs and Shrubs.
0 created 1 updated 0 deleted



CABO



Plots

Small areas of well-defined shape/size, within which environmental conditions are relatively homogenous. Example: forest inventory plots.

Last activity 3 days ago

Activity



102 records



28 contributors

Records

View/Edit Data

Importer

Import Data

Exporter

Export Data

	Sabine St-Jean submitted 2 records 2 days ago	2 created 0 updated 0 deleted
	Sabine St-Jean submitted 1 record 3 days ago	0 created 1 updated 0 deleted
	Sabine St-Jean submitted 1 record 3 days ago	1 created 0 updated 0 deleted
	Sabine St-Jean submitted 1 record 5 days ago	0 created 1 updated 0 deleted
	Sabine St-Jean submitted 1 record 24 days ago	1 created 0 updated 0 deleted

- 2.2 Create a new record by selecting the + symbol in a circle.



The following screen will show up:

Plots (editing)

55228770, sabine_test

Metadata

Duration 1 minute, 2 seconds (First Creation)

Location No Location Change

Record Status Pending Verification

Project - No Project -

Study Site

Site * **Select** **New**

Plot

Plot ID 55228770

Plot Field ID

First Established By *

- 2.3 Under Plots → Metadata → Project, select the appropriate project name (see Guidelines → Site Specific Information).

Plots (editing)

44079769, Baseline1, MBP_veg_crew

Metadata

Created (device)	15/07/2019 à 16:23:47 4 months ago by Sabine St-Jean
Updated (device)	19/11/2019 à 13:46:57 2 days ago by Sabine St-Jean
Created (web)	15/07/2019 à 16:34:56 4 months ago by Sabine St-Jean
Updated (web)	19/11/2019 à 13:46:57 2 days ago by Sabine St-Jean
Duration	8 minutes, 31 seconds (Total Time) 3 minutes, 2 seconds (Most Recent Update) 4 minutes, 5 seconds (First Creation)
Source	Fulcrum Web / Chrome 78.0.3904.97 / Windows 10
Location	45.408799, -75.518648 Change
Created Location	45.408816, -75.518793 (0m accuracy, 11.5m from the record)
Updated Location	45.408814, -75.518802 (5m accuracy, 12.1m from the record)
Record Status	Pending Verification
Project	2019-MerBleue

- 2.4 Under Plots → Study site → Site, select the appropriate site (see Guidelines → Site Specific Information).

Plots (editing)

44079769, Baseline1, MBP_veg_crew

Project

2019-MerBleue

Study Site

Site

- MBP_veg_crew

- 2.5 Under Plots → Plot, assign the plot a Plot Field ID, and indicate the names of the team members (one or more) creating the plot as well as the date of plot creation.

The default entries are the name of the person logged into *Fulcrum* and the current date.

Plots (editing)

44079769, Baseline1, MBP_veg_crew

Plot

Plot ID: 44079769

Plot Field ID: Baseline1

First Established By:

- Alizée Girard
- Anna Crofts
- Antoine Mathieu
- Alexandra Massey
- Charlotte Taillefer
- Clement Robert-Bigras
- Deep Inamdar
- Etienne Laliberté
- Florence Blanchard
- Guillaume Tougas
- Isabelle Gareau
- Kathryn Elmer
- Madeleine Trickey-Massé
- Margaret Kalacksa
- Maria Juliana Pardo Losada
- Mark Vellend
- Myriam Cloutier
- Oliver Lucanus
- Pablo Arroyo
- Paul Hacker
- Rime Nérón
- Rosalie Beauchamp-Rioux
- Sabine St-Jean
- Sabrina Demers-Timbeault
- Xavier Guilbeault-Mayers
- Other

Date First Established: 2019-07-15

- 2.6 Under Plots → Location, georeference the plot location approximately by clicking on Update Location with GPS using a fieldwork cellphone - coordinates will automatically be imported to the Latitude and Longitude fields.

Plots (editing)

44079769, Baseline1, MBP_veg_crew

Location

Latitude (degrees)	45.40880389999995
Longitude (degrees)	-75.51865140000001
Horizontal Accuracy (m)	0.02
Altitude (m)	37.8725
Vertical Accuracy (m)	

Current GPS Information.
Your GPS is not accessible. No Location Available

Update Location with GPS Update Location with GPS

GPS informations updated from Corners

- 2.7 Under Plots → Plot shape and Size, enter the Plot shape (Square), the Width (3 m) and the Azimuth of width axis (0° = true north).

Plots (editing)

44079769, Baseline1, MBP_veg_crew

GPS informations updated from Corners

Plot Shape and Size

Plot Shape	* square
Plot Width (m)	* 3
Azimuth of Width Axis (degrees)	* 0

- 2.8 Add any other relevant information under Optional Plot Info.

Plots (editing)

44079769, Baseline1, MBP_veg_crew

Optional Plot Info

Plot Remarks	Hummock. linaigrette
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- 2.9 Save the data entry.

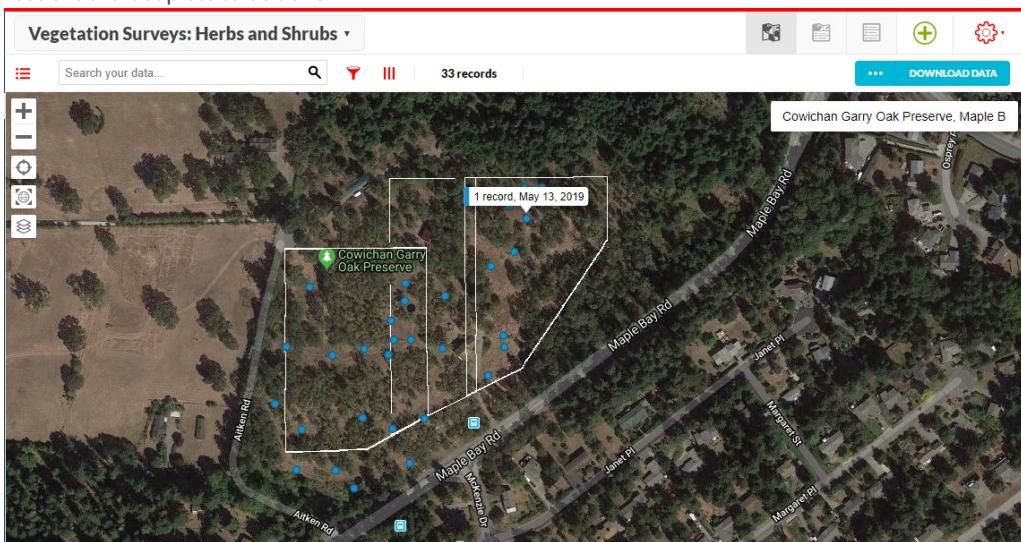


- 3 Create a plot prioritization list.

- 3.1 Given some degree of uncertainty at the outset with respect to how many plots can be surveyed in the allotted time, the plots must be done in accordance to the local prioritization criteria (see step 2).

Most sites will require more than one CASI/SASI flight. Each flight is defined by a polygon on the map. Communication between the veg crew and the drone crew is necessary in order to be outside a given polygon while it is being imaged. An effective solution is to survey all the plots in one polygon at a time to avoid being in the way during the imagery.

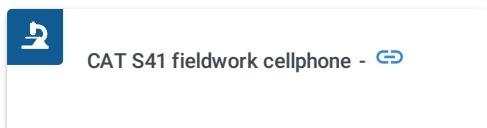
If some plots have been placed outside the flight polygons (not ideal, would happen only if a miscommunication occurred), these are the last plots to be done.



The 3 flight polygons (outlined in white) that were used to cover the Cowichan Garry Oak Preserve site (B. C.) in May 2019.

- 3.2 Validate that priority list with the local crew.

- 4 Enter contextual data for all the subplots.



- 4.1 In the *Fulcrum* main menu, select the Subplots app.



CABO CABO ▾



Type to filter your apps - 13 total

Exports Imports

Active ▾

Sort by Last Activity ▾



Vegetation Surveys: Herbs and Shrubs

Surveys of low-lying herbaceous and/or woody vegetation.

Last activity 3 days ago



68 records



Subplots

Smaller areas of well-defined shape/size that are nested within plots.

Last activity 3 days ago



315 records



Plots

Small areas of well-defined shape/size, within which environmental conditions are relatively homogenous. Example: forest inventory plots.

Last activity 3 days ago



102 records



Sites

Sites are spatial clusters of field research activities. Sites are generally larger than plots, and their shape/size is not constrained.



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3 days ago

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3 days ago

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3 days ago

Etienne Laliberté submitted 1 record in Vegetation Surveys: Herbs and Shrubs.
0 created 1 updated 0 deleted

3 days ago

Sabine St-Jean submitted 1 record in Vegetation Surveys: Herbs and Shrubs.
0 created 1 updated 0 deleted



CABO CABO ▾



Subplots



Smaller areas of well-defined shape/size that are nested within plots.

Last activity 3 days ago

Activity

315 records

26 contributors

Records

View/Edit Data



Importer

Import Data



Exporter

Export Data



Sabine St-Jean submitted 12 records 2 days ago

12 created
0 updated
0 deleted

Sabine St-Jean submitted 1 record 3 days ago

0 created
1 updated
0 deleted

Sabine St-Jean submitted 1 record 3 days ago

0 created
1 updated
0 deleted

Sabine St-Jean submitted 1 record 3 days ago

0 created
1 updated
0 deleted

Sabine St-Jean submitted 1 record 3 days ago

0 created
1 updated
0 deleted

Sabine St-Jean submitted 1 record 3 days ago

1 created
0 updated
0 deleted

- 4.2 Create a new record under Subplots.

- 4.3 Under Subplots → Metadata → Project, select the appropriate project name (see Guidelines → Site Specific Infos).

Created (device)	15/07/2019 à 22:15:47 4 months ago by Sabine St-Jean
Updated (device)	19/11/2019 à 14:00:59 2 days ago by Sabine St-Jean
Created (web)	15/07/2019 à 22:24:41 4 months ago by Sabine St-Jean
Updated (web)	19/11/2019 à 14:00:59 2 days ago by Sabine St-Jean
Duration	31 seconds (Total Time) 2 seconds (Most Recent Update) 16 seconds (First Creation)
Source	Fulcrum Web / Chrome 78.0.3904.97 / Windows 10
Location	45.409176, -75.516638
Created Location	45.397755, -75.698239 (3m accuracy, 14239.0m from the record)
Updated Location	45.397791, -75.698221 (3m accuracy, 14237.2m from the record)
Record Status	Pending Verification
Project	2019-MerBleue

- 4.4 Under Subplots → Plot → Plot, select the appropriate plot.

4.5 Under Subplots → Subplot → Subplot Field ID, enter a value between 1 and 9, according to the following image.

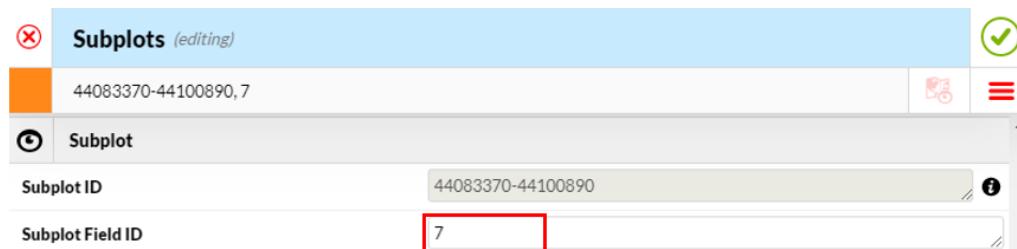


7 (-1, 1)	8 (0, 1)	9 (1, 1)
6 (-1, 0)	5 (0, 0)	4 (1, 0)
1 (-1, -1)	2 (0, -1)	3 (1, -1)

Representation of the positioning of the subplots within the plot, with the subplot field IDs (numbers from 1 to 9) and the (x, y) coordinates of every subplot (-1 to 1, -1 to 1) (to be used during step 4.8).

The numbers in parenthesis are used in accordance with the X-Y position from plot center subplot positioning method. The plot is virtually positioned on a plane, with the west-east axis being the x axis, and the north-south axis being the y axis. The numbers in parenthesis are the (x, y) coordinates of the subplot. The center of the plot (subplot 5) is defined as (0, 0).

The numbers from 1 to 9 are the subplot field IDs. The layout of the subplot field IDs has been used consistently since 2018. It was first established by Etienne Laliberté (PI) in order to allow more ease of motion when taking the small drone pictures.



- 4.6 Under Subplots → Subplot, indicate the names of the team members (one or more) doing the subplot setup as well as the date of the subplot setup.



The default entries are the name of the person logged into *Fulcrum* and the current date.

Subplots (editing)

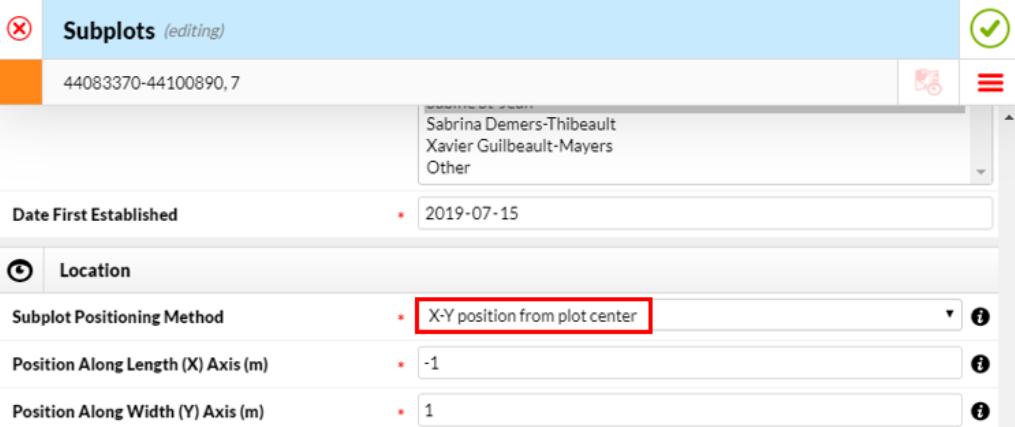
44083370-44100890, 7

Subplot

Subplot ID	44083370-44100890
Subplot Field ID	7
First Established By	<ul style="list-style-type: none">* Alizée GirardAnna CroftsAntoine MathieuAlexandra MasseyCharlotte TailleferClement Robert-BigrasDeep InamdarEtienne LalibertéFlorence BlanchardGuillaume TougasIsabelle GareauKathryn ElmerMadeleine Trickey-MasséMargaret KalacksaMaria Juliana Pardo LosadaMark VellendMyriam CloutierOliver LucanusPablo ArroyoPaul HackerRime NérónRosalie Beauchamp-RiouxSabine St-JeanSabrina Demers-ThibeaultXavier Guilbeault-MayersOther
Date First Established	* 2019-07-15

- 4.7 Under Subplots → Location, select the Subplot Positioning Method : X-Y position from plot center.

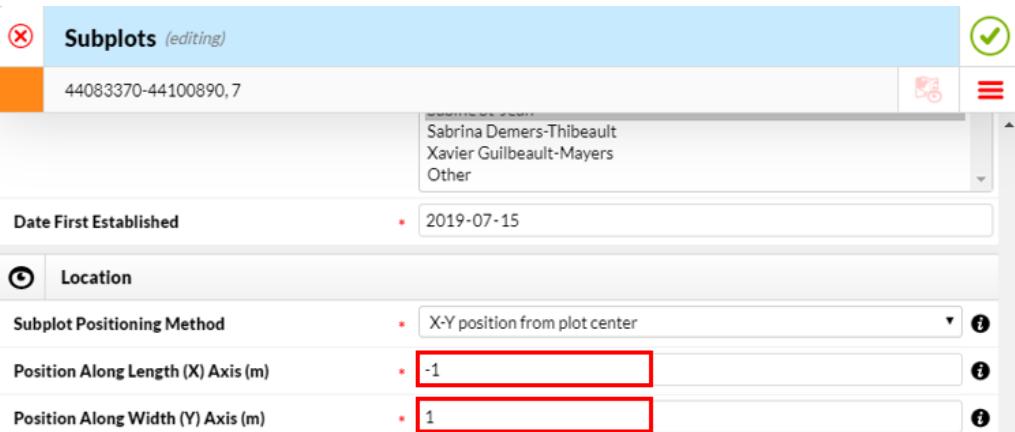
 As positioning method "X-Y from plot center" is selected, there is no need to accurately georeference the subplots.


Screenshot of the Subplots editing screen. The 'Location' section is selected. The 'Subplot Positioning Method' dropdown is set to 'X-Y position from plot center'. The 'Position Along Length (X) Axis (m)' field contains '-1' and the 'Position Along Width (Y) Axis (m)' field contains '1'.

The positioning method X-Y position from plot center is described at step 4.5.

- 4.8 Under Subplots → Location, indicate the values for the Position Along Length (X) Axis (m) and the Position Along Width (Y) Axis (m): -1, 0 or 1 (according to the image from step 4.5).

 Étienne Laliberté (PI) prefers not to use default values here to allow for more flexibility when positioning the subplots. As of November 20, 2019, there are no default values available.


Screenshot of the Subplots editing screen. The 'Location' section is selected. The 'Subplot Positioning Method' dropdown is set to 'X-Y position from plot center'. The 'Position Along Length (X) Axis (m)' field contains '-1' and the 'Position Along Width (Y) Axis (m)' field contains '1', both of which are highlighted with red boxes.

- 4.9 Under Subplots → Subplot Shape and Size, indicate the Subplot Shape (square), the Subplot Width (1 m) and the Azimuth of

The screenshot shows the 'Subplots (editing)' screen. At the top, there is an orange status bar with the ID '44083370-44100890,7'. Below it is a section titled 'Optional Subplot Info' containing fields for 'Subplot Remarks' (a red-bordered text input), 'Subplot Photos' (a 'Select File' button), and 'Subplot Audio Remarks' (another 'Select File' button). A note below states: 'This optional field has not been used in the 2019 vegetation surveys.'

- 4.10 If desired, add any other relevant information under Optional Subplot Info.

The screenshot shows the 'Subplots (editing)' screen. At the top, there is an orange status bar with the ID '44083370-44100890,7'. Below it is a section titled 'Optional Subplot Info' containing fields for 'Subplot Remarks' (a red-bordered text input), 'Subplot Photos' (a 'Select File' button), and 'Subplot Audio Remarks' (another 'Select File' button). A note below states: 'This optional field has not been used in the 2019 vegetation surveys.'

- 4.11 Save the data entry.

The screenshot shows the 'Subplots (editing)' screen. At the top, there is an orange status bar with the ID '44083370-44100890,7'. The save button in the top right corner is highlighted with a green checkmark icon.

- 4.12 The subplots will automatically be placed on the map, in reference to the plot center. Verify that all the subplots (9 for each plot) appear on the map.

The screenshot shows the 'Subplots' list view. At the top, there is a search bar and a 'Clear All Filters' button. The table has columns for 'Record Status', 'Title', 'Updated', 'Project', 'Updated By', 'Filter: Site', and 'Plot'. A green box highlights the 'Record Status' column header. The table lists 355 records, all of which are 'Submitted'. A green box also highlights the first record in the table.

Subplots

Search your data... 355 records Clear All Filters Save View DOWNLOAD DATA

Filter Data

Record Updated

- All
- Today 11/2/2019
- Yesterday 11/09/2019
- Last 7 days 11/14/2019 - 11/21/2019
- Last 30 days 10/22/2019 - 11/21/2019
- This Month 11/01/2019 - 11/30/2019
- Last Month 10/01/2019 - 10/31/2019
- Specific Range

Edit

Record Status Title Updated Project Updated By Filter: Site Plot

7	21/11/2019 à 16:54:11	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew	
1	19/11/2019 à 14:02:02	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew	
9	19/11/2019 à 14:05:05	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew	
8	19/11/2019 à 14:02:36	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew	
3	19/11/2019 à 14:02:17	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew	
Submitted	44083370/44100890;5	19/11/2019 à 14:02:28	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Submitted	44083370-44100820;6	19/11/2019 à 14:03:16	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Submitted	44083370-44100729;4	19/11/2019 à 14:02:43	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Submitted	44083370-44100635;2	19/11/2019 à 14:02:59	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew

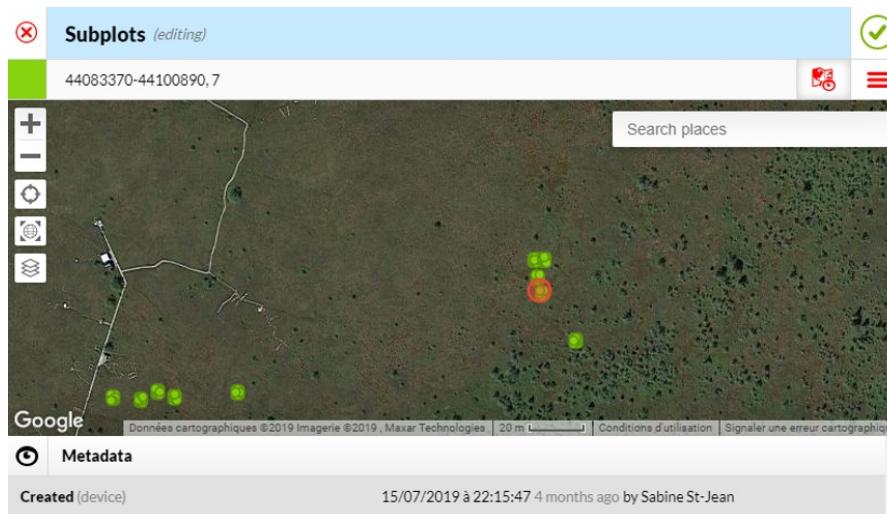
Subplots (editing)

44083370-44100890;7

Metadata

Created (device) 15/07/2019 à 22:15:47 4 months ago by Sabine St-Jean

When clicking on the map icon, the following view will appear.



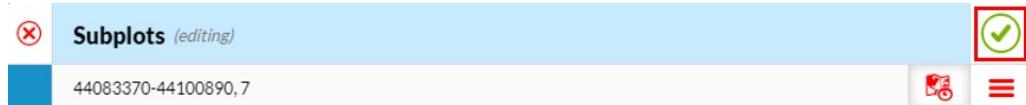
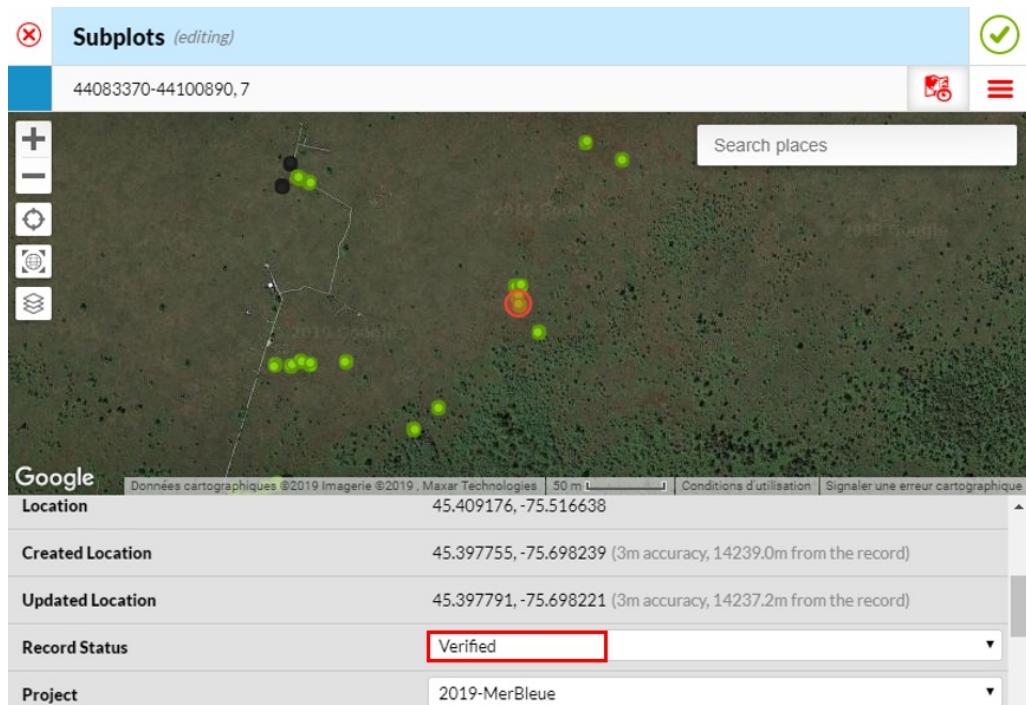
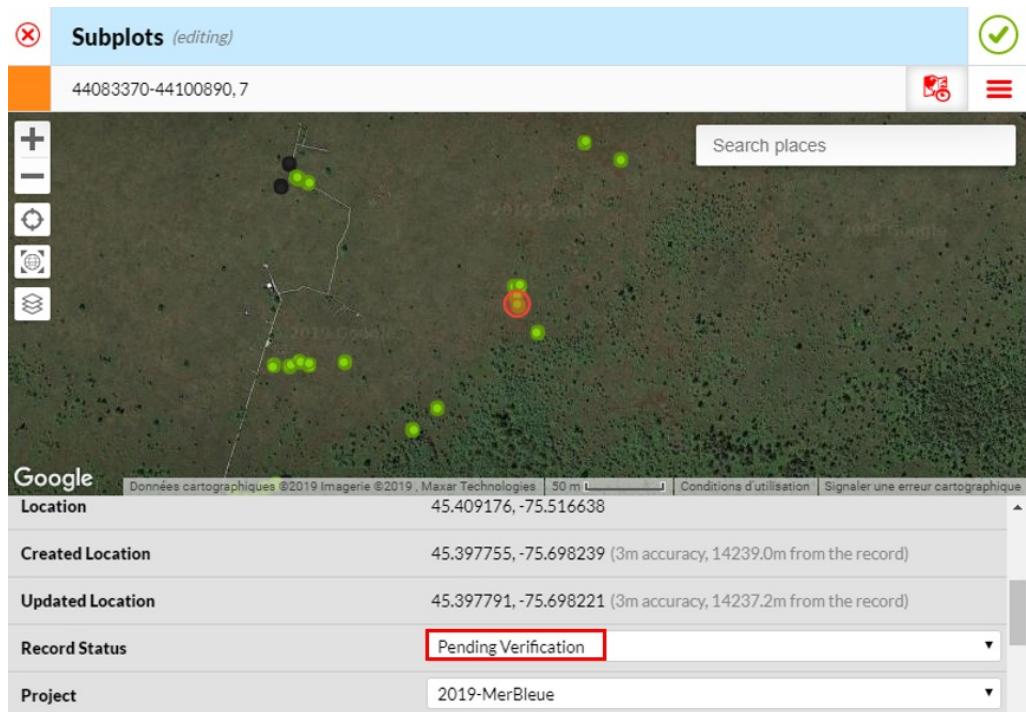
By zooming in, the 9 subplots will become visible.



If a subplot is missing, refer yourself to the configuration shown at step 4.5 to go back to the missing subplot record and check its (x, y) coordinates that need to be corrected.

- 4.13 Update the Record Status of every correct subplot record by following the Menu icon → Edit → Record Status. In the drop-down list next to Record Status, change it from Pending verification to Verified and save that change. This has to be done one subplot at a time.

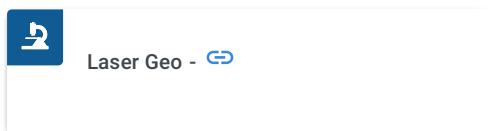
Subplots						
		Search your data...			355 records	
		Y	III	Clear All Filters	Save View	DOWNLOAD DATA
Filter Data						
Record Status	Edit	Title	Updated	Project	Updated By	Filter: Site Plot
All		7	21/11/2019 à 16:54:11	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Today 11/21/2019		1	19/11/2019 à 14:02:02	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Yesterday 11/20/2019		9	19/11/2019 à 14:05:05	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Last 7 days 11/14/2019 - 11/21/2019		8	19/11/2019 à 14:02:36	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Last 30 days 10/22/2019 - 11/21/2019		3	19/11/2019 à 14:02:17	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
This Month 10/01/2019 - 11/30/2019		Submitted 44083370/44100746,5	19/11/2019 à 14:02:28	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Last Month 10/01/2019 - 10/31/2019		Submitted 44083370-44100820,6	19/11/2019 à 14:03:16	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
Specific Range		Submitted 44083370-44100729,4	19/11/2019 à 14:02:43	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew
		Submitted 44083370-44100635,2	19/11/2019 à 14:02:59	2019-MerBleue	Sabine St-Jean	44083370,Blue4,MBP_veg_crew



- 5 To measure true north (vs magnetic north), the Laser Geo needs to be setup with the local magnetic declination. Find the updated magnetic declination of your field site by locating it on <http://www.magnetic-declination.com/>. This has to be done shortly before fieldwork, as magnetic declination changes with time. Enter this value in the Laser Geo under Settings → Magnetic declination.

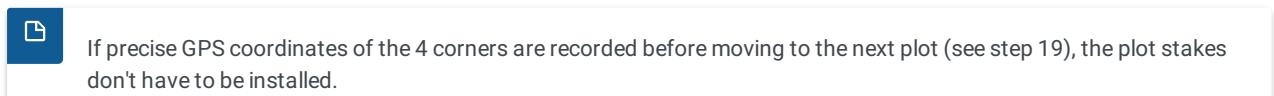
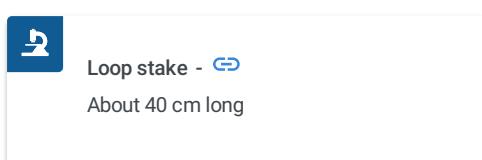
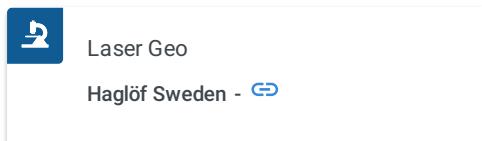
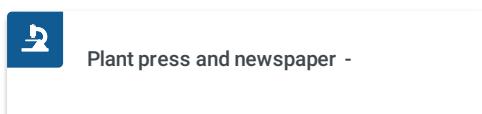
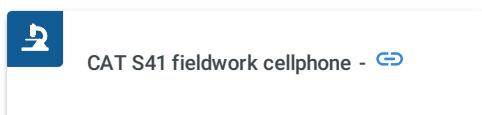
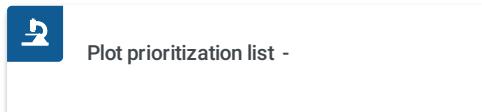
The screenshot shows a web browser window with two tabs open. The active tab is titled "Magnetic Declination" and displays the URL www.magnetic-declination.com. The page content includes a compass rose, a title "Find the magnetic declination at your location", and a search bar with the placeholder "Find your location or click on the map to display your magnetic declination". On the left, there's a sidebar with "Sites of Interest" (Cosmos Plus!, Live Meteors, Satellite tracking, Radio Astronomy) and a "Find your location" section where "boucherville" is entered in the search field, with "Canada" selected from a dropdown. Below this is a "SEARCH MAP:" button and a link to "Browse countries". A message says "No match. Try again or click on the map for your location". To the right of the search bar is a "360° Earth Map Live - Satellite Map Street View" section with the subtitle "Discover The Beauty Of The World. streetview-360.com". It features a satellite map of a coastal area with a callout box over a point labeled "POINTE-AUX-TREMBLES". The callout box contains the following information:

- You clicked here:
- Latitude: 45° 37' 31.7" N
- Longitude: 73° 28' 4.4" W
- POINTE-AUX-TREMBLES**
- Magnetic Declination: -14° 22'** (highlighted in red)
- Declination is **NEGATIVE (WEST)**
- Inclination: 69° 55'
- Magnetic field strength: 53620.8 nT



Plot Installation

- 6 Begin setting up the highest-priority plot for the vegetation survey. Ensure that the central part of the plot is representative of the larger 3x3m area (i.e.: there are no drastic changes in vegetation within the plot).



- 6.1 Write the Plot field ID on a piece of flagging tape and tie it to a loop stake, without positioning it.

- 6.2 Use the COMPASS function of the Laser Geo to visualize a 0° – true north alignment. Position the loop stake as the southwest corner of the plot. Make sure the representative portion of the plot is about 1.5 meters northeast from where you position the loop stake.



When using the Laser Geo, temporarily move the loop stake aside as it causes magnetic interference with the compass function of the Laser Geo.



NOTES ON USING THE LASER GEO:

- The buttons are facing up;
- Place yourself in a sitting position, with your eye in the hole (objective) of the Laser Geo;
- Aim by maintaining a pressure on the orange button;
- Look at the value that appears on the side screen.

- 7 Assemble the PVC grid.



Avoid disturbance to the plot at all costs, and to the neighbouring area as much as possible.

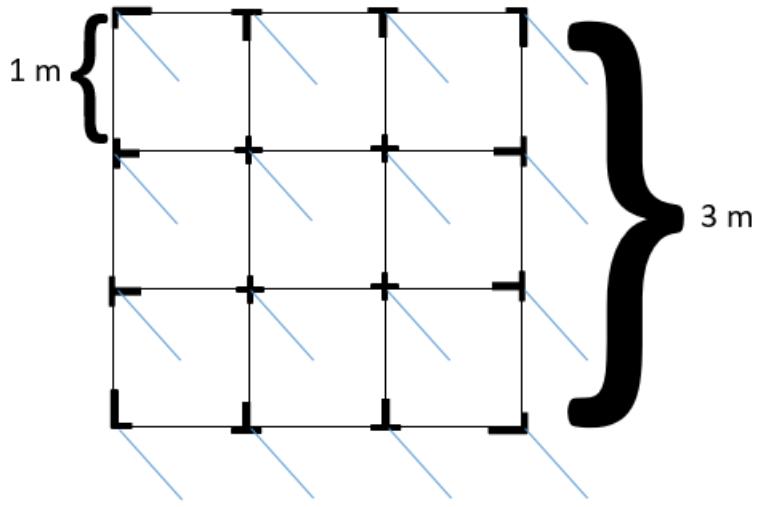
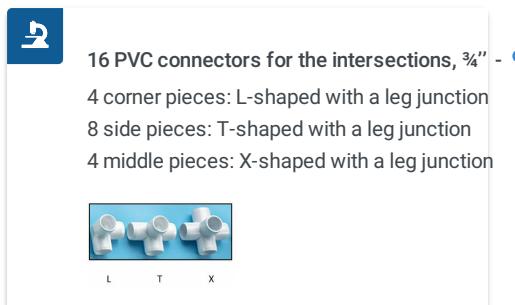
Once the grid is assembled, it can be carried from plot to plot by a minimum of 2 people. This avoids disassembling and reassembling it multiple times, thus saving a lot of time.



24 rigid PVC pipes (top of frame), $\frac{3}{4}$ ", 1 m long -
To be used as the frame horizontal structure,
labelled with the subplot number they belong to.



16 rigid PVC pipes (legs), $\frac{3}{4}$ ", appropriate height
To be used as the legs, according to the vegetation height.
Heights:
- 0,37 m: this height allows for the scaffold to be placed over the grid (see the Vegetation Survey part of this protocol).
- 1 m
- 1,5 m



Layout of the grid.

Figure legend:

16 PVC connectors for the intersections:

- 8 side pieces: T-shaped with a leg junction
- 4 corner pieces: L-shaped with a leg junction
- 4 middle pieces: X-shaped with a leg junction

- 16 rigid PVC pipes (legs) of the appropriate height
- 24 rigid PVC pipes (top of the grid), 1 m long

7.1 First, set up the top of the grid, using the 24 rigid PVC pipes (top of frame) of 1 m long and the 16 PVC connectors for the intersections.

7.2 Then, add the legs of the appropriate height (16 PVC pipes).

- 8 Align the PVC grid.



Laser Geo

Haglöf Sweden -

- 8.1 Have the Laser Geo rest directly on the southwest corner of the PVC grid (the one marked with the loop stake). Use the COMPASS function of the Laser Geo to align the PVC grid. The grid should already be close to perfectly aligned so that only minor adjustments are needed.



Temporarily move the loop stake aside as it causes magnetic interference with the compass function of the Laser Geo.



If precise GPS coordinates of the 4 corners are recorded before moving to the next plot (see step 19), the plot stakes don't have to be installed.

- 8.2 First, from the southwest corner, face north and turn the frame so that it has a $0^\circ (\pm 2^\circ)$ – true north alignment.

- 8.3 From the same corner, face east and ensure a $90^\circ (\pm 2^\circ)$.

- 9 Verify that adjacent plot corners are 3.00 ± 0.01 meters apart, using the tape measure to measure* to length of one side of the grid at a time.

*: From one inner corner to another, to avoid couting the width of the frame in the measurement.



Tape Measure -

10 Install stake wire flags on the 3 unmarked corners.



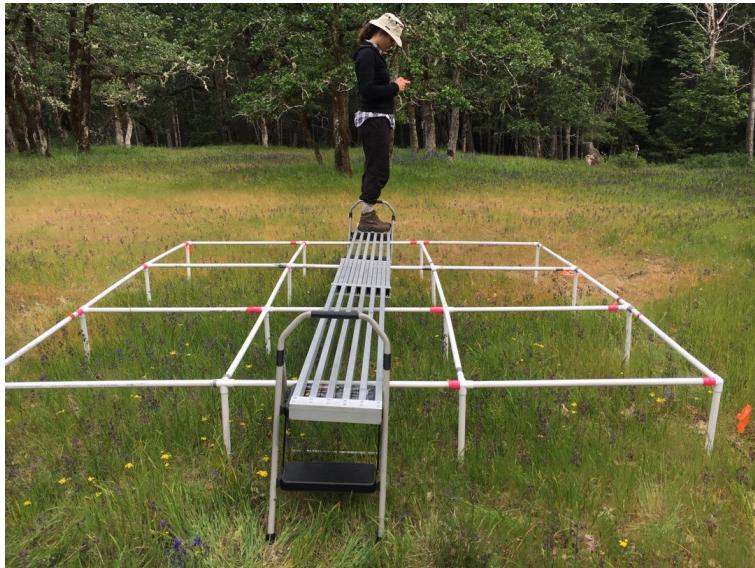
3 Stake wire flags -

About 50 cm long, 3.5" x 2.5" pink or orange vinyl flags on wire stakes

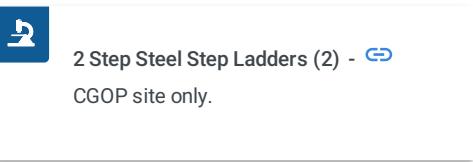


If precise GPS coordinates of the 4 corners are recorded before moving to the next plot (see step 19), the plot stakes don't have to be installed.

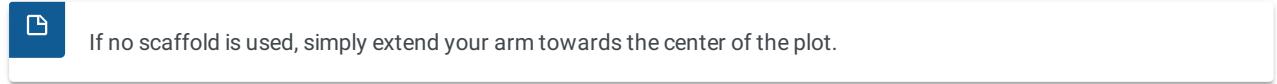
- 11 Install the scaffold on top of the grid, across its middle row, having it rest on a 2 step steel ladder on each side.



Such placement allows 6 subplots to be surveyed without having to move the scaffold. The scaffold will later be moved (step 16.9) in order to survey the 3 underlying subplots.



- 12 Update the approximate location of the plot center.



- 12.1 Under Plots → Location, click on Update Location with GPS on a fieldwork cellphone. This will automatically generate numbers in the Latitude and Longitude fields.

The screenshot shows the 'Plots (editing)' screen with the title '44079769, Baseline1, MBP_veg_crew'. The 'Location' tab is selected. The following data is visible:

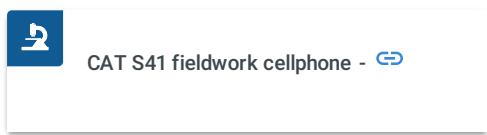
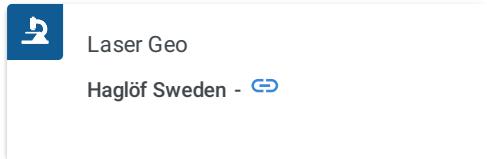
Latitude (degrees)	45.40880389999995
Longitude (degrees)	-75.51865140000001
Horizontal Accuracy (m)	0.02
Altitude (m)	37.8725
Vertical Accuracy (m)	

Current GPS Information.
Your GPS is not accessible. No Location Available

Update Location with GPS Update Location with GPS

GPS informations updated from Corners

- 13 Record the slope of the plot.



- 13.1 Laying the Laser Geo on the frame of the grid, facing the direction of the steepest slope, measure to the nearest degree the inclination (ANGLE → DEG) and orientation (COMPASS) of the slope* under the plot and enter those values under Plots → Optional Plot Info → Slope 1 (inclination) and Bearing 1 (orientation).
 *Ignore Slope 2 and Bearing 2. Open vegetation plots are normally not that inclined (vs forest plots), so one slope is sufficient to characterize them.

Plots (editing)

37444686, P_1, CGOP_1

Corners 0 Items

Optional Plot Info

Plot Remarks

Select File

Plot Photos

Plot Audio Remarks

Slope 1 (°) -9

Bearing 1 (°) 258

Slope 2 (°)

Bearing 2 (°)

- 13.2 Save the data entry.

Plots (editing)

37444686, P_1, CGOP_1

Vegetation Survey: Creation

- 14 Enter the contextual information for the vegetation survey in *Fulcrum* → Vegetation Surveys: Herbs and Shrubs.



- 14.1 From the *Fulcrum* main menu, select the Vegetation Surveys: Herbs and Shrubs app. The basic sequence of things in *Fulcrum* is similar to creating a new plot (record creation, project selection, names of the team members, date of the inventory).

A screenshot of the Fulcrum app's main menu. At the top, there is a search bar with the placeholder 'Type to filter your apps - 13 total'. Below the search bar are two buttons: 'Active' and 'Sort by Last Activity'. A list of apps is displayed, each with a thumbnail image, name, description, and last activity status. The 'Vegetation Surveys: Herbs and Shrubs' app is highlighted with a red box around its name. To the right of the app list, there is a sidebar showing recent activity logs for other users.

- 14.2 Under Vegetation Surveys: Herbs and Shrubs → Sampling Plot → Plot, select the appropriate plot.

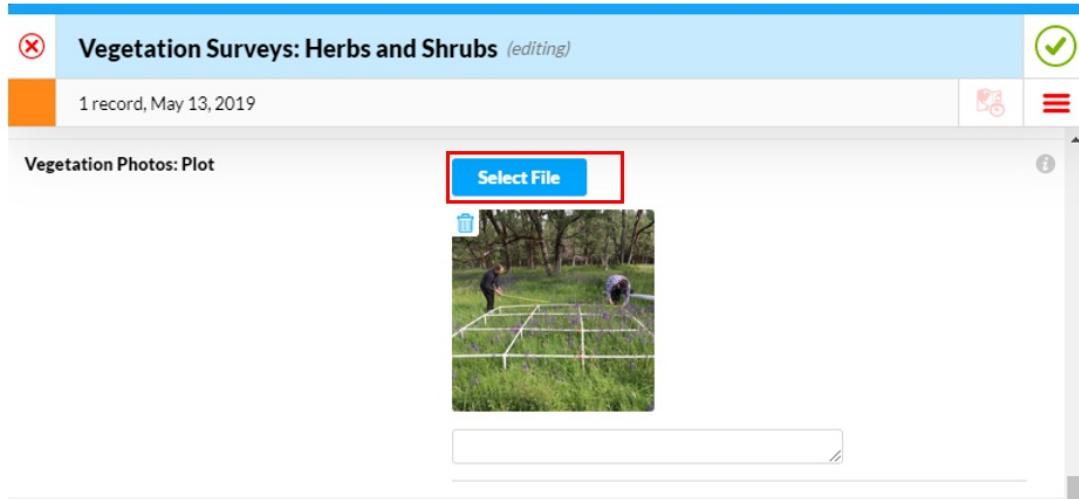
- 14.3 Under Vegetation Surveys: Herbs and Shrubs → Sampling Plot → Survey within a subplot?, answer Yes.

A screenshot of the 'Vegetation Surveys: Herbs and Shrubs (editing)' screen. The top bar shows a red 'X' icon and a green checkmark icon. The main area contains a table with two rows. The first row has a green background and contains the text '1 record, July 10, 2019'. The second row has a white background and contains the text 'Sampling Plot'. Below this is another table with two rows. The first row has a green background and contains the text 'Plot' followed by a field with the value '13228844, P30, GroboisFieldEL'. The second row has a white background and contains the text 'Survey Within a Subplot?' followed by two buttons: 'Yes' (highlighted with a red box) and 'No'. There are also small icons for photo, video, and more options.

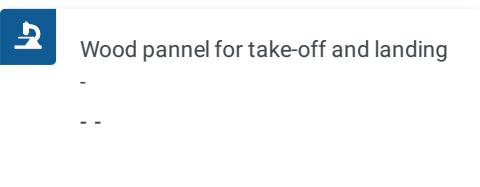
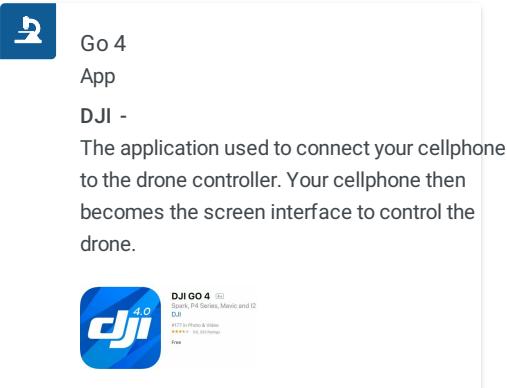
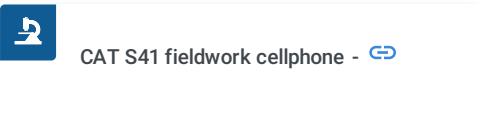
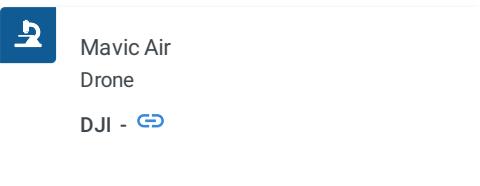
Photos

- 15 If NO small drone photos are taken:

With your field cellphone, take a photo of the whole plot (from the south side of the PVC grid, from eye-level when standing, so that the whole plot is visible) and import it in *Fulcrum* under Vegetation Surveys: Herbs and Shrubs → Survey Event → Vegetation Photos: Plot, then save your record.



16 Refer yourself to the Small Drone Photos - Open Vegetation Protocol to take pictures of the plots and subplots.



Vegetation Surveys: Plots

- 17 List all of the species occurring in the plot.



Identification guides -

See Open Vegetation Survey Protocol → Guidelines → Site Specific Information.



2 Step Steel Step Ladders (2) -

CGOP site only.



3 m long Telescopic Aluminum Scaffold Plank -

CGOP site only.



This step is done by the entire vegetation survey team, with everyone identifying and calling out species to one person who records them in *Fulcrum*. Uncertain identifications are discussed among team members.

- 17.1 Under Vegetation Surveys: Herbs and Shrubs → Species List → Plant Taxa, create the species list by selecting species present in the plot one by one from the provided VASCAN list.



The VASCAN list contains the Latin names only. Geography and growth form filters are optional.

The screenshot shows a software interface for managing plant surveys. At the top, there's a header for 'Vegetation Surveys: Herbs and Shrubs' with an 'editing' status indicator. Below the header, there's a summary bar showing '1 record, May 13, 2019'. The main area is divided into sections: 'Species List' and 'Plant Taxa'. The 'Plant Taxa' section is currently active, displaying a list of 22 items. A red box highlights the '22 Items' button at the bottom right of this section. There are also icons for deleting and filtering data.

Vegetation Surveys: Herbs and Shrubs (editing)	
	1 record, May 13, 2019 / Plant Taxa (22 Items)
	Alopecurus pratensis Linnaeus
	Anthoxanthum odoratum Linnaeus
	Camassia leichtlinii (Baker) S. Watson
	Camassia quamash (Pursh) Greene
	Danthonia californica Bolander
	Poa pratensis Linnaeus
	Vicia Linnaeus

Plant Taxa (editing)	
	Untitled
	Metadata
Duration	1 second (First Creation)
	Taxon
Taxon Checklist	* VASCAN
VASCAN Filter: Geography	<input type="text"/>
VASCAN Filter: Growth Form	<input type="text"/>
VASCAN Taxon	*
	Optional Info
Taxon Photos	
Taxon Remarks	<input type="text"/>



In some cases, the Latin names in VASCAN and in field guides might differ for a given species. VASCAN is to be considered more up to date. If you run into a species identified from a field guide that doesn't seem to be in the VASCAN drop-down list, use an internet connection to look up synonyms on the VASCAN website and obtain the accepted species name.



Betula alleghaniensis Britton

ACC *Betula alleghaniensis* Britton is an **accepted species name** sensu FNA Ed. Comm., 1997.

Hybrid parent of

↳ **ACC** *Betula ×purpurea* C. Schneider.

Vernacular names

ACC bouleau jaune	Darbyshire et al., 2000
SYN bouleau des Alléghanys	Marie-Victorin, 1995
SYN bouleau merisier	Louis-Marie, 1953
SYN merisier	Marie-Victorin, 1995
SYN merisier blanc	Louis-Marie, 1953
SYN merisier jaune	Louis-Marie, 1953
ACC yellow birch	Farrar, 1996
SYN swamp birch	Farrar, 1996

Synonyms

SYN <i>Betula alleghaniensis</i> var. <i>fallax</i> (Fassett) Brayshaw	FNA Ed. Comm., 1997
SYN <i>Betula alleghaniensis</i> var. <i>macrolepis</i> (Fernald) Brayshaw	FNA Ed. Comm., 1997
SYN <i>Betula lutea</i> F. Michaux nom. illeg.	FNA Ed. Comm., 1997
SYN <i>Betula lutea</i> F. Michaux var. <i>lutea</i>	TROPICOS

- 17.2 Optional info, such as photos, can be added for each species.

The screenshot shows the 'Plant Taxa (editing)' screen. At the top, there's a header with a red 'X' icon and the title. To the right is a green checkmark icon. Below the header, there are several sections: 'Untitled' (orange background), 'Metadata' (grey background), 'Duration' (grey background with '1 second (First Creation)'), 'Taxon' (grey background), and 'Optional Info' (grey background). Under 'Taxon', there are fields for 'Taxon Checklist' (set to 'VASCAN'), 'VASCAN Filter: Geography', 'VASCAN Filter: Growth Form', and 'VASCAN Taxon' (with a 'Select' button). Under 'Optional Info', there are fields for 'Taxon Photos' (with a 'Select File' button) and 'Taxon Remarks'. Both of these 'Optional Info' fields are highlighted with a red rectangular border.



Photos and remarks are especially useful for specimens for which you are unsure of the identification. For these, also collect a herbarium specimen (step 21). Temporarily name that species with a taxon that does not occur in your field site. When you have the required resources to proceed to the identification, update its name in *Fulcrum*.

- 17.3 Save each individual species record with the checkmark button.

The screenshot shows the 'Plant Taxa (editing)' screen again. The green checkmark icon at the top right is highlighted with a red rectangular border. The rest of the interface is identical to the previous screenshot, showing the 'Plant Taxa' header, 'Untitled' section, and various data entry fields.

- 17.4 As species are selected, the List of scientific names for species present the plot is automatically created and updated under Vegetation Surveys: Herbs and Shrubs → Species List → Plant Taxa.

The screenshot shows a software application window titled "Vegetation Surveys: Herbs and Shrubs (editing)". At the top left is a red "X" icon, and at the top right is a green checkmark icon. Below the title bar, there are three tabs: "Species List" (selected, indicated by a blue border), "Plant Taxa" (indicated by a grey border), and a third tab with a blue "22 Items" badge. Under the "Species List" tab, a red box highlights the heading "List of scientific names available:" followed by a bulleted list of plant names:

- *Alopecurus pratensis* Linnaeus
- *Anthoxanthum odoratum* Linnaeus
- *Camassia leichtlinii* (Baker) S. Watson
- *Camassia quamash* (Pursh) Greene
- *Danthonia californica* Bolander
- *Poa pratensis* Linnaeus
- *Vicia* Linnaeus

- 17.5 Save your edits.

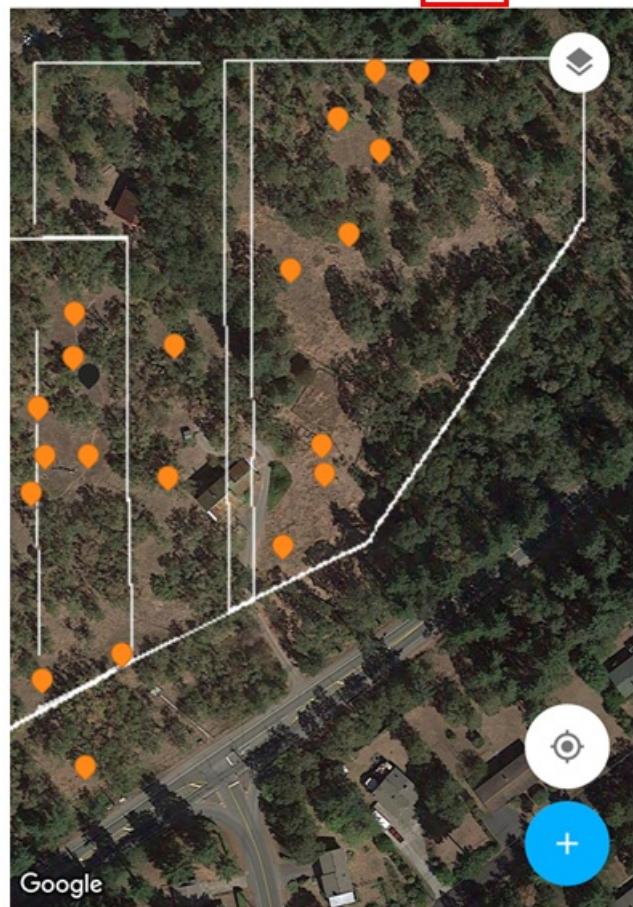
The screenshot shows the same software interface as the previous one, but now the green checkmark icon in the top right corner is highlighted with a red box, indicating that the edits have been successfully saved.

17.6



08 h 44

≡ Vegetation Surveys....

Synchronize your *Fulcrum* app at the end of this process.

Liste



Filtre Record



Paramètres

- 18 For each subplot, create a list of all the species present. If no small drone images are taken, also record a visual estimate of percent cover (to the closest 1%). If small drone images are taken, enter a description of the distribution of every plant species (see 17.6 for guidelines) under Cover Remarks. The latter option is preferred as it provides spatial distribution information.



3 Square canopy cover negative templates -

1% = 10 x 10 cm

5% = 22,4 x 22,4 cm

10% = 31,6 x 31,6 cm



Identification guides -

See Open Vegetation Survey Protocol → Guidelines → Site Specific Information.



2 Step Steel Step Ladders (2) - [🔗](#)

CGOP site only.



3 m long Telescopic Aluminum Scaffold Plank - [🔗](#)

CGOP site only.

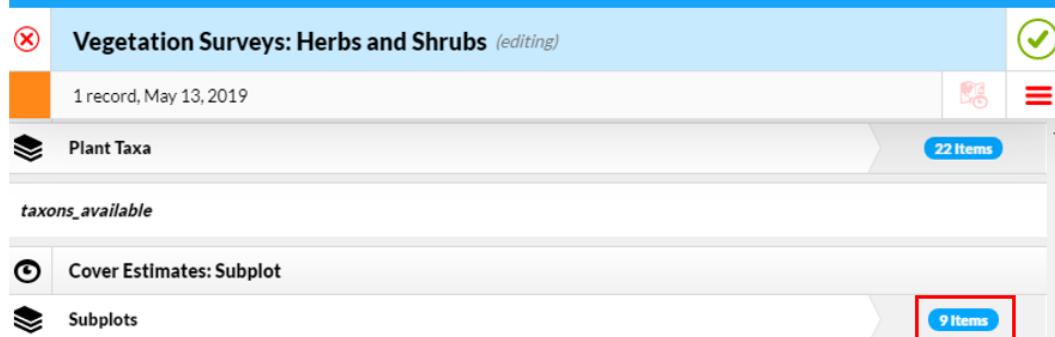


CAT S41 fieldwork cellphone - [🔗](#)



For the first plot(s), the technician and interns work together, one subplot at a time to confirm species identification and canopy cover estimates. As they gain confidence, they work separately on 3 subplots at a time, with verification as needed.

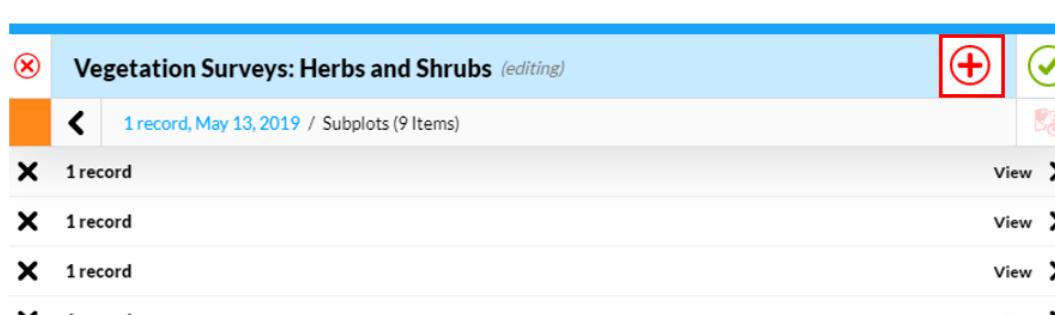
- 18.1 Under Vegetation Surveys: Herbs and Shrubs → Cover Estimates: Subplot, create a new subplot entry by clicking on the items and the plus buttons.



Cover Estimates: Subplot

Subplots

9 Items



Vegetation Surveys: Herbs and Shrubs (editing)

1 record, May 13, 2019 / Subplots (9 Items)

1 record

1 record

1 record

1 record

View >

View >

View >

View >

- 18.2 Under Vegetation Surveys: Herbs and Shrubs → Cover Estimates: Subplot → Subplots → Metadata, select the subplot number [# from 1 to 9] for which a record will be created.

The screenshot shows a software interface for managing subplot data. At the top, there's a header bar with tabs: 'Subplots (editing)' (highlighted with a red border), 'Untitled', and 'Metadata'. Below the header, there are fields for 'Duration' (set to '1 second (First Creation)') and 'Location' (set to 'No Location' with a 'Change' link). A 'Subplot' section has a 'Select' button highlighted with a red border. To the right, there's a 'Cover Estimates' section with a '0 Items' button. A modal window titled 'Select a Record' is open in the center. It contains a search bar and a list of records, with the first item, '37498926-37963536, 1,P_26,CGOP_1', selected and highlighted with a red border. Other items in the list include:
37498926-37963574, 2,P_26,CGOP_1
37498926-37963603, 3,P_26,CGOP_1
37498926-37963631, 5,P_26,CGOP_1
37498926-37963657, 7,P_26,CGOP_1
37498926-37963682, 4,P_26,CGOP_1
37498926-37963761, 6,P_26,CGOP_1
37498926-37963799, 8,P_26,CGOP_1

18.3 If NOT taking small drone pictures:

Under Vegetation Surveys: Herbs and Shrubs → Cover Estimates: Subplot → Subplots → Record [# from 1 to 9] → Cover Estimates, enter directly the Cover Estimates for the Bare Ground (i.e.: ground (soil or rocks) with no vegetation on it) and Leaf Litter (i.e.: dead leaves).

Subplots

1 record

Duration
11 minutes, 45 seconds (Total Time)
5 seconds (Most Recent Update)
11 minutes, 40 seconds (First Creation)

Location
48.808435, -123.629617

Created Location
48.808435, -123.629617 (3m accuracy, 0.0m from the record)

Updated Location
48.863394, -123.637858 (10m accuracy, 6142.7m from the record)

Subplot
37498926-37963603, 3.P_26.CGOP_1

Cover Estimates 9 items

Total Canopy Cover (%): Subplot	100
Bare Ground Cover (%): Subplot	0
Leaf Litter Cover (%): Subplot	0
Total Cover (%): Subplot	100

Vegetation Photos: Subplot

- 18.4 Under Vegetation Surveys: Herbs and Shrubs → Cover Estimates: Subplot → Subplots → Record [# from 1 to 9] → Cover Estimates, enter each plant species observed inside the subplot by clicking on the items and then the plus buttons.

The Total Canopy Cover (%): Subplot and Total Cover (%): Subplot fields will automatically be updated.

Subplots

1 record

Duration 11 minutes, 45 seconds (Total Time)
5 seconds (Most Recent Update)
11 minutes, 40 seconds (First Creation)

Location 48.808435, -123.629617

Created Location 48.808435, -123.629617 (3m accuracy, 0.0m from the record)

Updated Location 48.863394, -123.637858 (10m accuracy, 6142.7m from the record)

Subplot * 37498926-37963603, 3,P_26,CGOP_1

Cover Estimates

Total Canopy Cover (%): Subplot 100

Bare Ground Cover (%): Subplot 0

Leaf Litter Cover (%): Subplot 0

Total Cover (%): Subplot 100

Vegetation Photos: Subplot

9 Items

- 18.5 If finding species while looking closely that were not noticed at first, add the missed species to the plot species list (see Step 17), and it will now appear in the subplot species choice list. Synchronize your *Fulcrum* app after adding new species to the plot list to make them visible for the other users.

The list of species for each subplot can only be done from the total species list created for the plot.

- 18.6 Under Vegetation Surveys: Herbs and Shrubs → Cover Estimates: Subplot → Subplots → Record [# from 1 to 9] → Cover Estimates, list every occurring species within the subplot by selecting its scientific name. Also enter abundance (if not using a small drone) or distribution (if using a small drone) data as follows:

- Abundance (Canopy Cover):

<input checked="" type="checkbox"/>	Cover Estimates (editing)	<input checked="" type="checkbox"/>
	77, Anthoxanthum odoratum Linnaeus	
<input checked="" type="checkbox"/>	Metadata	
Duration		17 seconds (First Creation)
Location		No Location Change
<input checked="" type="checkbox"/>	Taxon Cover	
Scientific Name		* Anthoxanthum odoratum Linnaeus
Canopy Cover (%)		77
Cover Remarks		

NOTES ON CANOPY COVER:
In order to best approximate what will be viewed by the airborne surveys:

Record an estimate of cover within the subplot, even if the plant is rooted outside the subplot.
Similarly, do not measure cover that is outside the subplot, even if the plant is rooted within the subplot.
If the leaves of two species overlap, only consider the species on top.
The sum of all cover estimates must be 100%.

- Distribution (Cover Remarks):

<input checked="" type="checkbox"/>	Cover Estimates	<input checked="" type="checkbox"/>
	Andromeda polifolia Linnaeus	
<input checked="" type="checkbox"/>	Metadata	
Created (device)		24/07/2019 à 10:54:34 2 weeks ago
Updated (device)		24/07/2019 à 11:02:24 2 weeks ago
Duration		1 minute, 9 seconds (Total Time) 6 seconds (Most Recent Update) 1 minute, 3 seconds (First Creation)
Location		45.405600, -75.491185
Created Location		45.405600, -75.491183 (3m accuracy, 0.1m from the record)
Updated Location		45.405611, -75.491176 (3m accuracy, 1.4m from the record)
<input checked="" type="checkbox"/>	Taxon Cover	
Scientific Name		* Andromeda polifolia Linnaeus
Canopy Cover (%)		
Cover Remarks		SO 10 NO 13 SE 13 NE 6



NOTES ON COVER REMARKS:

Divide each subplot in areas identified with direction acronyms (S = south, N = north, O or W = west, E = east, C = center) and add the number of individuals for a given species.

- 18.7 Click on the checkmark button after the addition of each species to the subplot species list to save your update.

Cover Estimates (editing)

77, *Anthoxanthum odoratum* Linnaeus

- 18.8 Keep adding species until the *Fulcrum* record is complete for the subplot and, if entering Abundance values (Canopy Cover), the sum of the cover estimates equals 100%, then save your record.

Subplots (editing)

< 1 record / Cover Estimates (9 Items)

X 1, <i>Stellaria media</i> (Linnaeus) Villars	
X 2, <i>Geranium dissectum</i> Linnaeus	
X 1, <i>Valerianella locusta</i> (Linnaeus) Laterrade	
X 1, <i>Galium aparine</i> Linnaeus	
X 1, <i>Lathyrus sphaericus</i> Retzius	
X 11, <i>Vicia</i> Linnaeus	
X 8, <i>Alopecurus pratensis</i> Linnaeus	
X 20, <i>Camassia leichtlinii</i> (Baker) S. Watson	
X 55, <i>Poa pratensis</i> Linnaeus	

Subplots (editing)

< 1 record / Cover Estimates (9 Items)

Subplots

1 record

Duration	11 minutes, 45 seconds (Total Time) 5 seconds (Most Recent Update) 11 minutes, 40 seconds (First Creation)
Location	48.808435, -123.629617
Created Location	48.808435, -123.629617 (3m accuracy, 0.0m from the record)
Updated Location	48.863394, -123.637858 (10m accuracy, 6142.7m from the record)
Subplot	* 37498926-37963603, 3,P_26,CGOP_1
Cover Estimates	
Total Canopy Cover (%): Subplot	100
Bare Ground Cover (%): Subplot	0
Leaf Litter Cover (%): Subplot	0
Total Cover (%): Subplot	100
Vegetation Photos: Subplot	

Subplots

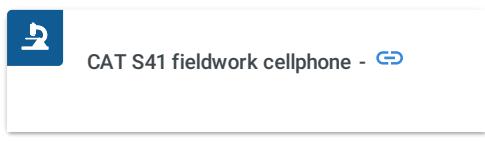
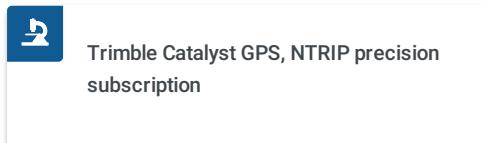
1 record

- 18.9 Repeat this process until all 9 subplots have been surveyed and saved into *Fulcrum*. When the vegetation survey of the 6 subplots visible from the scaffold is done, move the scaffold (along with the steel ladders) to an exterior row of subplots, in order to survey the 3 subplots previously hidden under the scaffold.
 If no scaffold is available, walk around the plot to survey the different subplots, while being careful not to trample. To survey the central subplot (no 5), the survey from outside the plot is completed by observing the small drone picture from subplot 5.
- 18.10 Save the data entry in *Fulcrum* to indicate that the field survey has been finished.

Vegetation Surveys: Herbs and Shrubs (editing)

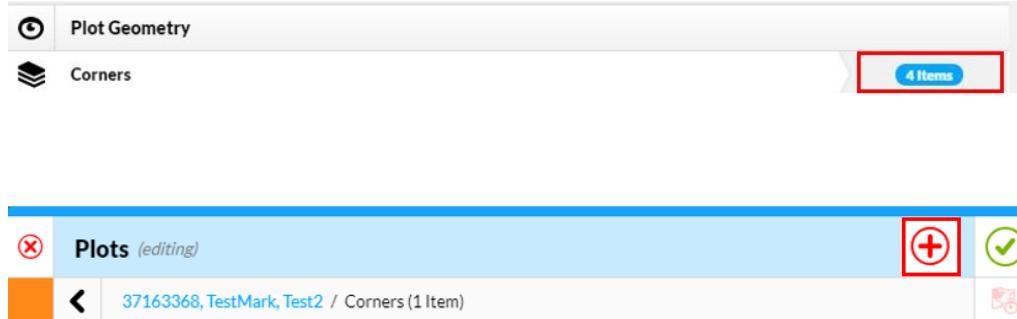
1 record, May 13, 2019

19 Refer yourself to the Trimble GPS Protocol to precisely georeference the 4 corners of each surveyed plot.



- 
- Each surveyed plot has to be precisely georeferenced OR marked with stakes before moving the grid to the following plot.
- If the Trimble GPS is available continuously, the precise georeferencing of the 4 corners can be done right away, and the plot stakes don't have to be installed.
 - If the Trimble GPS is only available at a specific time, the plot corners are marked with stakes as indicated in steps 5 to 9. The precise coordinates of all surveyed plots are taken at once when the Trimble GPS is available.

- 19.1 Connect the Trimble GPS to a field cellphone.
- 19.2 Place yourself on the southwest corner of the plot.
- 19.3 Under Plots → Plot Geometry, select the appropriate corner field ID and click on Update Location with GPS and wait for the horizontal accuracy to be ≤ 3 cm to save your record. This will automatically update the Location fields.



Corners (editing)

37499711-SW

Updated Location: 48.809004, -123.629151 (0m accuracy, 0.0m from the record)

Corner Number	1
Corner ID	37499711-SW
Corner Field ID	* SW

Location

Latitude (degrees)	48.8090039
Longitude (degrees)	-123.6291506
Horizontal Accuracy (m)	0.03
Altitude (m)	48.5
Vertical Accuracy (m)	

Current GPS Information.
Your GPS is not accessible. No Location Available

Update Location with GPS [Update Location with GPS](#)

Plots (editing)

37163368, TestMark, Test2 / Corners (1 Item)

37163368-SW View >

- 19.4 Repeat step 19.3 for each corner, turning clockwise.

Corners (editing)

37163368-NW

i.e. Georeference plot corners in the following order: SW, NW, NE, SE.

- 19.5 Save the data entry.

Plots (editing)

37083114, demo-banff

- 19.6 Once the precise georeferencing of the 4 corners is done, the plot stakes (if present) need to be removed before the airborne surveys of the polygon they are within.

Next Plot

20 In accordance with the plot prioritization list, survey the next plot by following Steps 6 to 19 over again.

Herbarium Specimens

21 Refer yourself to the Herbarium Specimens protocol to collect herbarium specimens for 1) the species identified in the vegetation surveys, and 2) unknown plants.

Maintenance of equipment and records: To do every evening during a fieldwork episode

22 Plug in to charge all electronic devices (Laser Geo, Trimble battery, Drone and controller batteries, and field cellphones).

23 From the plots prioritization list, maintain a list of the plots done, classified by day.

24 In *Fulcrum*, export in .csv format the data from the appropriate project for Plots, Subplots, Vegetation Surveys, Plants, and Pressed Specimens (including photos) to your computer in order to create a local backup.

Fulcrum

The screenshot shows the Fulcrum app interface. At the top, there is a search bar with the placeholder "Type to filter your apps - 13 total". Below the search bar are two buttons: "Active" and "Sort by Last Activity".

The first data item is "Bulk Leaf Samples", which includes an image of a person wearing gloves holding a white cloth over a green plant, a description "Bulk samples of fresh leaves for spectral and trait measurements.", and a timestamp "Last activity 13 minutes ago". It shows 1,848 records and has three circular icons below it: location, upload, and download, with the download icon being red.

The second data item is "Vegetation Surveys: Herbs and Shrubs", which includes an image of three people in a field, a description "Surveys of low-lying herbaceous and/or woody vegetation.", and a timestamp "Last activity about 1 hour ago". It shows 182 records and has three circular icons below it: location, upload, and download, with the download icon being red.



Exporter

With your current filters, the export will contain **196** record(s).

File Format	CSV (.csv)
Date Range	Mobile Device Created Time
	to
Date Time Zone	(GMT+00:00) UTC
Area Filter	Select Area
Include Photos	<input checked="" type="checkbox"/> 502.7 MB
Include GPS Data	<input type="checkbox"/>
Include Full History	<input type="checkbox"/>
Include Changesets	<input type="checkbox"/>

Apps

[Toggle all](#)

- Bryoquel
- Bulk Leaf Samples
- CABO Generic List
- FloraBase
- Identification References
- Plants
- Plots
- Pressed Specimens
- Sites
- Subplots
- VASCAN
- Vegetation Surveys: Herbs and Shrubs
- Vegetation Surveys: Large Trees

Projects [Toggle all](#)

- 2017-Dessain-MSc
- 2018-BeauchampRioux-MSc-UdeM
- 2018-Boucherville
- 2018-Elmer-MSc-McGill
- 2018-Girard-MSc-UdeM
- 2018-Hacker-PhD-UBC
- 2018-MyersSmith-Qikqitaruk
- 2019-Boucherville
- 2019-CABO-General
- 2019-Crofts-PhD-UdeS
- 2019-MerBleue
- 2019-Phragmites-temporal
- CABO-General
- CABO-test

[Cancel](#) [Next](#)

 **Fulcrum** CABO CABO ▾ [?](#) [⚙️](#)

Exporter

Please confirm the following settings for exporting your data. Your data export will take some time to process and will be available for download once it is completed.

Apps: Vegetation Surveys: Herbs and Shrubs, Sites, Plants, Subplots, Vegetation Surveys: Large Trees, Pressed Specimens, Plots

Projects: 2018-Hacker-PhD-UBC, 2019-Boucherville, 2019-Crofts-PhD-UdeS, 2019-MerBleue

Export format: CSV (.csv)

Timezone for exported dates: (GMT+00:00) UTC

Exporting photos: Yes

Number of records to be exported: 1,999

[Back](#) [Finish](#)



CABO CABO ▾



Data Exports

[New Export](#)

The export has been started and it will be ready soon.

Apps	Projects	Format	Photos	Date Range	Started	
Vegetation Surveys: Herbs and Shrubs, Sites, Plants, Subplots, Vegetation Surveys: Large Trees, Pressed Specimens, Plots	2018-Hacker-PhD-UBC, 2019-Boucherville, 2019-Crofts-PhD-UdeS, 2019-MerBleue	csv	Yes		less than a minute ago	



CABO CABO ▾



Data Exports

[New Export](#)

Apps	Projects	Format	Photos	Date Range	Started	
Vegetation Surveys: Herbs and Shrubs, Sites, Plants, Subplots, Vegetation Surveys: Large Trees, Pressed Specimens, Plots	2018-Hacker-PhD-UBC, 2019-Boucherville, 2019-Crofts-PhD-UdeS, 2019-MerBleue	csv	Yes		9 minutes ago	

Finalization

- 25 Identify any unknown plant and make the appropriate edits in the *Fulcrum* database.
- 26 When all the necessary information has been entered, change the Plots and Vegetation Surveys status from Pending Verification

to Verified.

Plots (editing)	
37499711, P_30, CGOP_1	
Metadata	
Created (device)	30/04/2019 à 12:36:09 7 months ago by Paul Hacker
Updated (device)	22/11/2019 à 15:00:48 4 hours ago by Sabine St-Jean
Created (web)	05/05/2019 à 20:15:35 7 months ago by Paul Hacker
Updated (web)	22/11/2019 à 15:00:48 4 hours ago by Sabine St-Jean
Duration	5 minutes, 50 seconds (Total Time) 6 seconds (Most Recent Update) 1 minute, 5 seconds (First Creation)
Source	Fulcrum Web / Chrome 78.0.3904.108 / Windows 10
Location	48.809081, -123.629154 Change
Created Location	48.809010, -123.629213 (4m accuracy, 9.0m from the record)
Updated Location	48.809033, -123.629151 (0m accuracy, 5.4m from the record)
Record Status	Pending Verification

Plots (editing)	
37499711, P_30, CGOP_1	
Metadata	
Created (device)	30/04/2019 à 12:36:09 7 months ago by Paul Hacker
Updated (device)	22/11/2019 à 15:00:48 4 hours ago by Sabine St-Jean
Created (web)	05/05/2019 à 20:15:35 7 months ago by Paul Hacker
Updated (web)	22/11/2019 à 15:00:48 4 hours ago by Sabine St-Jean
Duration	6 minutes, 12 seconds (Total Time) 28 seconds (Most Recent Update) 1 minute, 5 seconds (First Creation)
Source	Fulcrum Web / Chrome 78.0.3904.108 / Windows 10
Location	48.809081, -123.629154
Created Location	48.809010, -123.629213 (4m accuracy, 9.0m from the record)
Updated Location	48.809033, -123.629151 (0m accuracy, 5.4m from the record)
Record Status	Verified

- 27 Refer yourself to the Post Processing: Abundance and Distribution of Species in Open Vegetation Plots protocol to process the small drone pictures in order to obtain abundance and distribution data.

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