



# Protocol for Ground Lidar Surveys in RAPELD Plots

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## Necessary Material:

- 1- Sensor (Riegl LD90-3100VHS-FLP)
- 2- Sensor power cable (for connection to the battery)
- 3- Serial RS 232 - USB cables (previously tested for connection to the computer)
- 4- 12V batteries (ampereage may vary - duration?)
- 5- Battery charger
- 6- Field computer with Riegl's LogVHS software (for recording and converting data)
- 7- Cable for charging the computer
- 8- Generator (Line filter + extension + power strip)
- 9- Aluminum support and screws (+ thin ropes and back support for wearing)
- 10- Screwdrivers and wrench for the support screws
- 11- 2 Backpacks to carry the equipment
- 12- 2 Waterproof bags (1 for the lidar and 1 for the computer)
- 13- Plastic bags in case of rain in the field
- 14- Copy of the LogVHS program
- 15- Pen drive for backing up collected data
- 16- Field notebook
- 17- 30m tape measure in case of needing to measure a section of the survey
- 18- Boxes to store the equipment
- 19- Toolbox
- 20- GPS

• The survey can be done by one person, but two people may be advisable because one person carries the aluminum support with the sensor, and the other takes care of naming the files and turning on and off the sensor at the right time during the survey.

## Sensor - Battery and Computer Connection:

1. Connect the power cable to the bottom of the sensor, paying attention to the pin numbering and fitting. Turn clockwise to fit and press and turn counterclockwise to detach.
2. Connect the serial RS 232 cable to the sensor and the USB part to the field computer (an adapter cable, RS232-USB, will be necessary as the cable that comes with the sensor is serial-serial)
3. Turn on the computer
4. Start the LogVHS program
5. Check the settings through the "Communication" button

Port: 3	Data Bits: 8
Baudrate: 115200	Stop Bits: 1
Parity: None	

6. Create a file to test if the connection works

(LogVHS => File => Open Log File - give it any name and save => Start Log).

If it is working, the number of Bytes Logged will start to increase

- If nothing happens, check the communication settings in the Control Panel => System => Hardware => Device Manager => Ports/System devices (you need to see the path in Windows XP to reach COM Port 3)
- Test again if the program is recording the bytes. If not, try restarting the program and if necessary, restart the computer. If you need to adjust the USB connection, remember that it is better to connect the USB before starting the Log VHS program.

7. If the connection works, everything is ready to start the measurements.

## How to Conduct the Survey:

1. The collection will be done along the central line of the plot in 10m sections, i.e., one file for each 10m segment of the central line of the plot. In plots with a length of 250m, there will be 25 files.
2. Before starting the survey, walk through the plot to check if everything is correct with the sequence of stakes in the central line, which is composed of PVC stakes with plates on the left side (On BR-319, the stakes on the right side mark the corridor boundary for walking, except for M02. In this module, the accessory line of the corridor is on the left side).
3. If there are isolated palm leaves or other large leaves very low in the sensor line (1 to 1.5m from the ground), they will prevent the sensor from capturing the forest profile. Remove these leaves from the central line (\*do not cut plants in permanent plots!). Note that this only applies to isolated leaves; we do not want to change the characteristics of the forest understory.
4. When returning from the end of the plot, take the GPS points. Name only the final stake (e.g., M06TN1500-250) and the initial one (e.g., M06TN2500-00) and leave the numeric sequence of the GPS points for the remaining stakes. Mapping is better if you do not delay between taking one point and another on the central line.
5. Start the LiDAR survey from the zero stake of the plot. The person carrying the sensor should position themselves slightly before the initial stake, and the person carrying the computer a little further back. The LogVHS program should be open with the file properly named (see file section below).
6. The person carrying the sensor should start walking at a constant speed and signal to start recording data when the sensor passes the initial stake of the segment. Given the signal, the person carrying the computer with the LogVHS program starts recording data and walks along with the sensor.
7. When the sensor passes the next stake at the end of the 10m segment, a signal should be given to stop recording data. Once the recording is complete, the file for the segment should be closed, and the pair should position themselves again before the stake to restart the procedure in the next segment by recording a new file. Similar file sizes are a good indicator that the walking speed is constant between survey segments (larger files correspond to longer data collection times).
8. At the end of each working day, back up the original files generated by LogVHS and recharge the computer and batteries.

9. After backing up, the original files (without extension) should be converted to \*.ASC format through the Menu => Convert in the LogVHS program. Let the program save the converted files in the same folder as the original data.

## **Important:**

- Record in the field notebook the date, time, and weather conditions in which each plot was surveyed and make notes indicating the presence of large clearings in a certain section of the plot.
- Note the sections of the central line of the plot that cross the trail.
- In case of rain, wait until the water stops dripping from the vegetation before conducting the survey. Wet leaves can affect the signal reflection, so it should be noted if the survey had to be done shortly after a rain event. In the case of open forest or other types of vegetation, avoid surveys when the sun is at its peak.
- The sensor should always be aligned to point upwards (to emit the perpendicular beam to the ground). Avoid swinging the sensor during walking. If using the aluminum tray, fix the sensor, and if it is tilted to one side, adjust the connection wires for balance.
- Always walk in a straight line (avoid shortcuts as much as possible that people use to avoid tree trunks, for example).
- Walk at a constant speed. You can check this by the number of bytes recorded in each segment. Keep this number as constant as possible between files. Walk slowly to capture denser understory structures better. You can also use a metronome installed on the field computer to maintain a constant pace. There are metronome software programs that you can download on the field computer to follow a constant step.
- Obstacles in the way. It is best to walk over them at the same walking speed if possible. If there are very large logs in the way and you cannot walk over them, two survey segments (two files) need to be made, from the last PVC stake to the log and from the other side of the log to the next PVC stake. In this case, measure the two segments with the tape measure and include the measurements in the file name. E.g., "M06TNP0500\_40a46" and "M06TNP0500\_46a50".
- During the survey, check if the files are recording information. This can be done by checking if the recorded files in each plot folder occupy memory.

## Care for Transporting and Storing Equipment:

During field transport, always carry the sensor and cables in a waterproof bag inside the backpack.

During surveys in the plots, have large plastic bags on hand to protect the sensor, computer, and batteries during a rain event.

During road transport, carry the sensor inside a box with high-density foam to prevent shocks. Place the sensor box inside the car to also avoid rainwater, moisture, or excessive heat. Take the same precautions for the field computer.

## Files to Record Data:

1. Create a folder for each module where the survey will be conducted.
2. Create a subfolder indicating the trail and the plot.
3. Create files, using LogVHS, within the plot folder with the module, trail, and plot identification, plus the segment name. Example: "M06TNP0500\_0a10".
4. In the case of this survey on BR-319, the files should be organized as follows:

- Inside the folder "Lidar\_BR319\_juschietti" on the Desktop, create a subfolder with the name of the research site indicating (1) the Module where the survey is being conducted and (2) the date (month+year) in the following format: "ju\_M06\_aug2011".

- Within the subfolder of the research site, create folders indicating the Module, Trail, and Plot (e.g., "M06\_TNP0500"). The file structure will be as follows:

Desktop: Folder => "Lidar\_BR319\_juschietti"

Module Subfolder => "M06\_month2011"

Plot Subfolder => "M06\_TNP0500"

Files => "M06TNP0500\_0a10"  
"M06TNP0500\_10a20"...