

LVISA Data Import Form

v1 2014-11-16

LiDAR Research Group

LVISA is a novel system for analyzing point clouds of vegetation. This system constitutes a web-based Laser Scanning (LS) database for the management and analysis of reference signatures. It combines the techniques and methods of LiDAR and 3D GIScience.

www.lvisa.geog.uni-heidelberg.de

Contact

LiDAR Research Group (LRG),
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Heidelberg University

www.uni-heidelberg.de/lrg



Dear Madam or Sir,

Thank you for providing data for the LVISA geoportal!

For a successful integration of your data into the system, information regarding the data acquisition and information about all included objects are required in addition to the point cloud. To acquire the necessary information, the following form must be filled.

The *Data Import Form* collects information regarding

- the data provider
- the scanning campaign
- scanner properties
- information about the corresponding research project
- information about the captured objects
- object taxonomy

If you need more information or if you have any questions, feel free to contact us by email.

Sincere regards,

Kristina Koenig

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Terms of Use

The project “LVISA” aims to offer an easy-to-use online visualization, exploration and analysis tool of laser scanning data. The provided raw data will not be shared with any third parties.

Data are not downloadable via the LVISA website, only visualizations of the data as well as plots of derived analysis results will be accessible via the website.

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LVISA

Chair of GIScience

[LiDAR Research Group](#)

Institute of Geography, Heidelberg University

Principal Investigator: [Jun.-Prof. Dr. B. Höfle](#)

Project Investigator: [Dipl.-Geogr. K. Koenig](#)

Funding: [Ministry of Science, Research and Arts, Baden-Wuerttemberg](#)

Important Remarks

For a successful integration of your data, the following requirements have to be met regarding information about data and data acquisition.

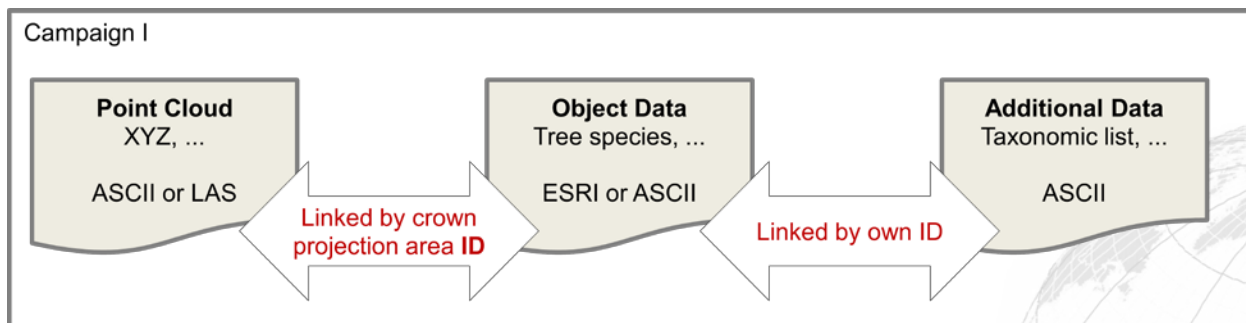
- Only datasets of one campaign and one setting (e.g., ground resolution, flight altitude) can be integrated. If your data consist of multiple campaigns and settings, please prepare the datasets accordingly. Each campaign and setting requires one separate form.
- The provided data should comprise at least
 - Section I and Section II of this form,
 - the point cloud itself,
 - the corresponding object information (e.g., species, tree height),
 - the corresponding digital terrain model (DTM) of the area covered by the data.

The **form** records information regarding the contact person and the data acquisition. The contact person should be able to answer questions regarding the data. The data can only be integrated if general information regarding the used scanning device and the campaign is given.

The **point cloud** can be stored in ASCII or LAS format with clear indication of existing features / items. Since LVISA based on single tree objects, the point data should already be segmented tree-wise and stored in one ASCII / LAS file, if possible. However, if the data is not segmented tree-wise, raw point cloud data can also be provided and the segmentation will be performed by us.

The **object information** can be stored as separate file or as additional feature in the point data. In case of a separate file, an ESRI Shapefile is sufficient, representing the tree location and its object information. The tree location can be represented by point or polygon. The species should be defined by the Latin name (e.g., *Fagus sylvatica*, *Acer platanoides*, *Pinus nigra*).

Data Volume:



0. Data

Please indicate the data volume you provide.

[Check all that apply]

	<i>Comments ...</i>
<i>Point Data</i>	ASCII LAS segmented
<i>Object Data</i>	included in point data separate file as point data as crown projection area
<i>Additional Data</i>	DTM DSM Images

I. Contact Information

Name (Contact Person)

Institution

Address

Email

Phone

Comments

II. General Information (required for each scanning campaign with constant settings)

For a successful integration of new data, information regarding the scanner properties, the campaign, and data provider are needed. All fields must be filled. Please note that this information must be valid for the provided point cloud.

1. Technical Information Laser Scanner

- 1.1 The name of the **manufacturer** of the used scanner (e.g. Riegl, Optech).
- 1.2 The **type** of the used laser scanner (e.g. RIEGL LMS-Q560).
- 1.3 The given **firmware version**.
- 1.4 The given **shots per second (pulse repetition frequency)**.
- 1.5 The scanner's **wavelength** given in [nm].
- 1.6 The given **scanning angle range** in [°].
- 1.7 The given **beam divergence** in [mrad].
- 1.8 The **type** of data capturing (e.g. full-waveform airborne).

2. Campaign

- 2.1 **Date** of data capturing (yyyy-mm-dd).
- 2.2 Name of the **study area**.
- 2.3 Average **flying altitude** given in [m].
- 2.4 Spatial Reference **EPSG** of the data set.
- 2.5 **Season** condition during data acquisition (e.g. leaf-off, leaf-on)
- 2.6 The name of the **data provider**.
- 2.7 The name of the **data owner**.
- 2.8 **Weblink to data provider**.^{*1}

3. Research

- 3.1 **Field** of research (e.g. DTM generation, agriculture, forestry, urban).
- 3.2 Weblink to **references** (e.g. published papers).^{*1}

^{*1} Additional information which is not required for data import.

^{*2} to be set if data is full-waveform data.

III. Object Data

Object data comprises all point cloud information related to a single object (=tree) on **point level** (point attributes like amplitude and echo width) and on **object level** (attributes regarding the crown projection area like species and height of the object). The point data can be stored in ASCII or LAS format with indication of existing features / items.

1. Point Cloud

The point cloud file comprises the XYZ coordinates as well as the following features (check all features that apply and define the unit):

Feature	Description	Unit
XYZ	Coordinates of given point.	
Range	Range R as distance between point and scanner, given in meter [m]	
Height	Normalized height , defined as height above DTM, given in meter [m]. If height information is not available, it will be calculated during import by given DTM.	
Return Number	The return number of that point.	
Number of Returns	The number of returns as the recorded returns per laser pulse.	
Raw Amplitude	The raw (original) amplitude .	
Calibrated Amplitude	The calibrated amplitude (peak power), given in range [0;1]	
Echo Width*2	The echo width EW as temporal length (FWHM) of the detected echo given in nano seconds [ns].	
Incidence Angle*1	The incidence angle α , given in degree [°].	
Sigma*2	The backscatter cross-section σ , given in square meter [m ² .]	
Gamma*2	The backscatter coefficient γ , given in square meter per square meter [m ² m ⁻²].	
Timestamp*1	The GPS time of the point during data acquisition.	
IDarea	ID of the corresponding reference area (tree object). Only required if object information is given as ASCII file and linked to point data by ID.	

2. Crown Projection Area and Object Information

The Crown projection area is the linkage between point data and information regarding the tree object. The information can be given as ESRI Shapefile or as a comma separated ASCII file with column headers. If object information is provided for point coordinates (not for crown projection area polygons), the crown projection area will be calculated automatically based on the point cloud belonging to a single object.

Check all features that apply:

Feature	Description
IDarea	ID of a crown projection area in case of separate ASCII file for object information. The point cloud of one object are linked by this ID.
Extraction Method	Extraction method of crown projection area (e.g. region growing, buffer regions, concave regions).
Species	The name or ID of the corresponding tree species. If the taxonomic information is given as a separate file, the ID should be set, otherwise the Latin species name is required.

*1 Additional information which is not required for data import.

*2 to be set if data is full-waveform data.

<i>DBH</i> ^{*1}	The Diameter at Breast Height (DBH), given in meter [m]. The diameter is measured at 1.3 meters above ground.
<i>Crown Diameter</i> ^{*1}	The crown diameter, given in meter [m].
<i>Height</i> ^{*1}	The height of the tree given in meter [m]. If not given, it will be calculated as the maximum point.
<i>Year of Planting</i> ^{*1}	The year of planting the tree.
<i>Health Condition</i> ^{*1}	The health condition of the tree.
<i>Managed</i> ^{*1}	Information regarding the managing condition (e.g., if the tree is natural grown or cut back regularly).
<i>Area</i> ^{*1}	Information regarding the area of location (e.g., street, park or forest).
	(Additional object information).
	(Additional object information).

IV. Taxonomic Information

The taxonomic data comprises the species affiliations regarding **species** name, **family** name, **class** name and **division** name (English and Latin) of all species occurring in the data.

If the species name is already set by object information data, no additional information is needed and this section can be skipped.

If the taxonomic information is related by ID to object information, an additional definition file has to be provided.

The following taxonomic information is stored in the LVISA database (check all features that apply):

Taxonomic Rank

IDspecies

Species Name (Latin)

Species Name (English)

Family Name (Latin)

Family Name (English)

Class Name (Latin)

Class Name (English)

^{*1} Additional information which is not required for data import.

^{*2} to be set if data is full-waveform data.

V. Additional Information / Comments

Input File Format

In the following, examples for files comprising the point data and the object information are given.

At least, one point cloud data file and one corresponding object data file comprising tree information (location, name, other attributes) are required for the import in LVISA.

1 Point Cloud

The **point cloud data** can be stored in ASCII or LAS format with indication of existing features / items.

Point cloud data stored as ASCII should include a column header like in the example 'pointdata.txt' below. The features should be clearly recognizable by the header:

pointdata.txt

```
x,y,z,range,elevation,returnnumber,numberreturn,ampl,ewidth,incangle,sigma,gamma
3476628.336,5475819.163,112.157,5.781,1,3,0.78956,3.7,6.9,0.00930028,0.00052004
3476628.991,5475819.9173, .....
```

2 Crown Projection Area and Object Information

The **object information** can be stored as separate file or as additional item in the point cloud data. In case of a separate file, an ESRI Shapefile is sufficient, representing the tree location and its object information. The tree location can be represented by point or polygon. The species should be defined by the Latin name, e.g. *Fagus sylvatica*, *Acer platanoides*, *Pinus nigra*.

Following options in data formatting are possible:

a) Object information as separate ESRI Shapefile

The ESRI Shapefile consists of points or polygons which represent all trees and have the object information as attributes:

treeobjects.shp

```
geom,areaID,area,street,species,plantingyear,dbh,crowndiameter,height,managed
0106000020187A00000100,12,park,Any Park,Fagus sylvatica,1994,131.00,4.00,9.00,no
C1BEC000000000E3E8144,13,street,Any Street 5,Pinus nigra ,1989,71.00,3.00,8.00,yes
.....
```

b) Object information as separate ASCII file (in the case of already segmented tree data)

The object information is related to every single point of one tree by a clearly recognizable ID of the reference area (*IDarea*). This ID is given in the point data file as well as in the reference data file:

pointdata.txt

```
x,y,z,range,elevation,returnnumber,numberreturn,ampl,ewidth,incangle,sigma,gamma,idarea
34766.336,547.163,112.157,5.781,1,3,0.78956,3.7,6.9,0.00930028,0.00052004,12
34766.991,547.913, .....
```

referencearea.txt

```
idarea,area,street,species,plantingyear,dbh,crowndiameter,height,managed
12,park,Any Park,Fagus sylvatica,1994,131.00,4.00,9.00,no
13,street,Any street 5,Pinus nigra ,1989,71.00,3.00,8.00,,yes
...
```

c) The taxonomic information is given as separate ASCII file

It is also possible to relate the taxonomic information of every tree by a separated ASCII file. In this case, the taxonomic information is related to reference data file by ID.

pointdata.txt

```
x,y,z,range,elevation,returnnumber,numberreturn,ampl,ewidth,incangle,sigma,gamma,idarea
34766.336,547.163,112.157,5.781,1,3,0.78956,3.7,6.9,0.00930028,0.00052004,12
34766.991,547.913, .....
```

referencearea.txt

```
idarea,area,street,species,plantingyear,dbh,crowndiameter,height,managed,idspecies
12,park,Any Park,Fagus sylvatica,1994,131.00,4.00,9.00,no,1
13,street,Any street 5,Pinus nigra ,1989,71.00,3.00,8.00,,yes,2
...
```

taxonomy.txt

```
idspecies,species_lat,species_en,family_lat,family_en,class_lat,class_en
1,Fagus sylvatica,European beech,Fagaceae,beech family,Magnoliopsida,Magnoliopsida
2,Pinus nigra,European black pine,Pinaceae,Pines,Pinopsida,conifers
...
```