Report on TRAIL 2018, organized in Postojna, Slovenia

TRAIL Meetings (Training and Research on the Archaeological Interpretation of Lidar) incorporate presentations of case studies and methods, interactive workshops, poster presentations, and a round table session. They bring together an international group of interdisciplinary scientists, professionals, and postgraduate (Masters and PhD) students and provide opportunities for practical training through small group work. We aim for a 4:1 student teacher ratio in workshops to provide learning opportunities that go beyond basic technical skills. Workshops focus on specific themes and every participant has time to attend most of the different workshops. TRAIL meetings are residential, with the entire group staying and taking meals on-site at the conference venue. We have an active social programme as part of the meeting, including an international potluck.

The fourth TRAIL took place in Postojna, Slovenia from 29th to 31st October 2018. The international meeting, previously organized three times in France (Glux-en-Glenne 2011, Frasne 2014, and Domaine national de Chambord 2016), was devoted to the study of aerial laser scanning (lidar) applications in archaeology, with a special focus on the use of lidar data for the study of pathways and movement. Recently, the detection and identification of ancient pathways has profited enormously from the increased use of lidar-based elevation models. These discoveries, however, are fragmentary and often difficult to date, which makes it challenging to interpret the function and development of ancient communication and transport networks. In order to understand the long-term dynamics of movement and its relation to landscape and settlement development, the information on pathways retrieved through excavation, survey and remote sensing needs to be better integrated with computer models and other spatial data.

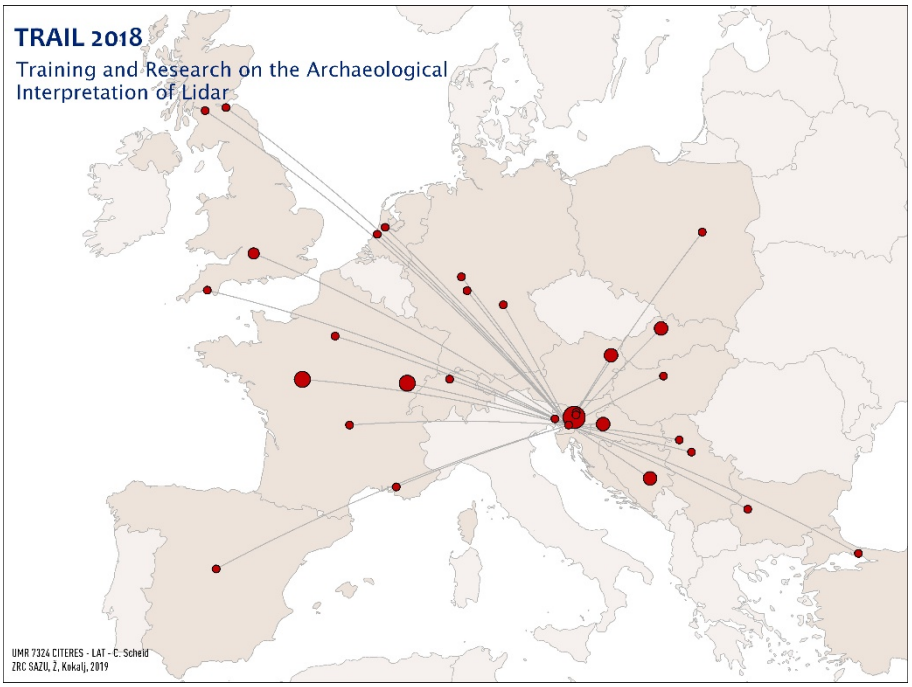
We therefore focused on the detection of pathways and movement through lidar surveys, and discussed connections with theories, methods and data used to study pathways and movement through diverse case studies. We discussed a series of questions: How do we detect paths, itineraries or networks? What kind of paths or networks can be detected using lidar? Can we interpret their chronology or function? What is missing from the lidar data and what is preserved? How can we connect different types of evidence or missing evidence?

TRAIL 2018 brought together specialists in exploration and processing of lidar data, archaeologists, biologists, physicists, geographers, geodesist, computer scientists, and forest management experts to present the latest methodological advances and discuss different ways of understanding and integrating the results of lidar surveys. A total of 52 people from 16 European countries participated. Of them 19 were invited lecturers, 18 professionals and 15 postgraduate students. 18 were women.

This year main themes were:

- pathways and movement,
- deep learning from ALS data,
- complementary data sources and their integration, and
- ontologies and knowledge modelling for comparing and integrating case studies.

The fourth TRAIL Meeting was organized as part of the MoveScape project (coord. L. Nuninger, Ph. Verhagen, Ž. Kokalj) supported by the CNRS (France), ZRC SAZU (Slovenia), CLUE+, Vrije Universiteit Amsterdam (The Netherlands), and Slovenian Research Agency. It was organized in partnership with CITERES-LAT (Université François-Rabelais de Tours/CNRS) and the University of Glasgow.



Origin of participants

Agenda

Monday, October 29th 2018

12:00-13:15	Lunch
13:30-14:00	**Introduction and launch of the network**
14:00-15:30	**General session 1** **Keynote 1** by *Michael Doneus*: Evolution of airborne laser scanning in archaeology and future prospects **Keynote 2** by *Dave Cowley:* 'Because I say so' – 'Because the computer says so': towards accountable knowledge creation in archaeological prospection **Invited lecture 1** by *Maja Somrak*: Introduction to deep learning
15:30-16:30	Coffee break and poster session
16:30-18:15	**General session 2** **Invited lecture 2** by *Philip Verhagen* and *Laure Nuninger*: Introduction to the Movescape project: when studying past movement needs to integrate detection, spatial modeling and theory **Invited lecture 3** by *Dimitrij Mlekuž*: Towards the archaeology of landscape flows **Invited lecture 4** by *Edisa Lozi* : Detection of past movement. The Iron Age Knežak hillfort case study **Invited lecture 5** by *Catherine Fruchart and Valentin Chevassu*: Airborne laser scanning for the study of path networks and field systems
18:15-18:45	**Discussion Session**
19:00-20:00	Dinner

Tuesday, October 30th 2018

7:00-8:15	Breakfast
8:45-10:00	**Introductory discussion about workshops**
10:00-12:30a	**Excursion to Knežak hillfort**
10:00-12:30b	Optional visit of the Postojna cave or Karst Museum
12:30-14:00	Lunch
14:00-16:00	**Workshop session 1**
16:00-16:30	Coffee break
16:30-18:30	**Workshop session 2**
19:00-21:00	International dinner

Wednesday, October 31st 2018

7:00-8:15	Breakfast
8:45-10:45	**Workshop session 3**
10:45-11:15	Coffee break
11:15-12:30	**Round table discussion and closing session**
12:30-13:30	Lunch

Workshops

Airborne laser scanning and deep learning

Clément Laplaige, Dave Cowley, Maja Somrak, Žiga Kokalj

Increasing availability of easy-to-use libraries and software has put forward the use of Machine Learning also in the archaeological exploration of lidar. The aim of this workshop was to see what is required (e.g. algorithms, data quality and homogeneity) to successfully accomplish automatic classification.

Pathways: from practice to evidence of movement in lidar data

Laure Nuninger, Philip Verhagen, Xavier Rodier, Dimitrij Mlekuž

The aim of this workshop was to study the relationship between concepts used in detection and modelling approaches and to build a common conceptual framework. We also discussed the interest of such an approach to improve lidar interpretation and compare case studies from around the world.

Integrating lidar and complementary data sources

Rachel Opitz, Catherine Fruchart, Elise Fovet

This workshop focused on assessing the quality and character of various data types commonly integrated with lidar data in landscape studies. We considered issues such as scale, resolution, and reliability, and discussed ontological and spatial approaches to integration.

List of participants

Name	Institution	Country
Agnes Schneider	Vorgeschichtliches seminar, Philipps-Universität Marburg	Germany
Aleksandar Stamenković		Serbia
Andrej Žitnan	VIA MAGNA s.r.o.	Slovakia
Aude Crozet	Université de Tours	France
Axel Posluschny	Keltenwelt am Glauberg	Germany
Benjamin Štular	ZRC SAZU	Slovenia
Benoit Longet	LAMPEA	France
Catherine Fruchart	MSHE C.N. Ledoux UFC	France
Charlotte Willis	Air Photo Services	United Kingdom
Christopher Sevara	University of Vienna	Austria
Clément Laplaige	UMR 7324 CITERES-LAT / Université François-Rabelais de Tours / CNRS	France
Damian Evans	École française d'Extrême-Orient	France
Damien Vurpillot	Université de Tours, Centre d´études supérieures de la Renaissance, Ard Intelligence Des	France
Dave Cowley	Historic Environment Scotland	United Kingdom
Derviš Hadžimuhamedović	University of Sarajevo	Bosnia and Herzegovina
Dimitrij Mlekuž	University of Ljubljana	Slovenia
Edisa Lozić	National museum of Slovenia	Slovenia
Elise Fovet	MSH Clermont Ferrand USR 3550 / CNRS	France
Estelle Gauthier	University of Franche-Comté	France
Jack Powell	Air Photo Services	United Kingdom
Jasmina Štajdohar	SPACE-SI	Slovenia
Jernej Rihter	ZRC SAZU	Slovenia
Jesenko Hadžihasanović	Faculty of Humanities Koper	Bosnia and Herzegovina
Jonas Nyffeler	Museum Burghalde Lenzburg	Switzerland
Jošt Hobič		Slovenia
Juan Antonio Merino Romero	UCM (Universidad Complutense de Madrid)	Spain
Jugoslav Pendić	BioSense Institute, Dr Zorana Djindjica, Novi Sad, Serbia	Serbia
Julia Chyla	Institute of Archaeology, University of Warsaw	Poland
Laure Nuninger	MSHE C.N. Ledoux / Cjrono-Environement CNRS	France
Lenka Horáková	VIA MAGNA s.r.o.	Slovakia
Maida Turkmanović	Faculty of Philosophy	Bosnia and Heryegovina
Maja Somrak	ZRC SAZU	Slovenia
Marijana Krmpotić	Croatian Conservation Institute	Croatia
Martin Fera	University of Vienna	Austria
Mate Stibranyi	Lelohely-diagnosztikai Osztály	Hungary
Matic Vehovec		Slovenija
Melda Küçükdemirci	Istanbul University Geophysical Engineering Department	Turkey
Michael Doneus	University Vienna	Austria
Mikołaj Kostyrko	Informationsverarbeitung in der Geoarchäologie, Otto-Friedrich-Universität Bamberg	Germany
Milan Horňák	VIA MAGNA s.r.o.	Slovakia
Miroslav Vuković	University of Zagreb, Faculty of Humanities and Social studies, Department of Archaeology	Croatia
Monja Šebela	University of Ljubljana	Slovenija
Nadezhda Kecheva	National Archaeological Institute with Museum at the Bulgarian Academy of Sciences	Bulgaria
Nika Shilobod	Plymouth University	United Kingdom
Philip Verhagen	Vrije Universiteit Amsterdam	The Netherlands
Rachel Opitz	University of Glasgow	United Kingdom
Tomaž Nabergoj	Narodni muzej Slovenije	Slovenia
Tomislav Zojceski		Croatia
Valentin Chevassu	Univ. Bourgogne Franche-Comté / USR 3124 MSHE C.N. Ledoux - UMR 6249 Chrono-	France
Wouter Verschoof-van der Vaart	Leiden University	The Netherlands
Xavier Rodier	UMR 7324 CITERES-LAT / Université François-Rabelais de Tours / CNRS	France
Žiga Kokalj	ZRC SAZU	Slovenia