Comparison of tree mortality patterns between even- and uneven-aged stands

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UQO-ISFORT

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Presentation objectives

- Terrestrial Mobile LiDAR approach
- Mortality project using LiDAR

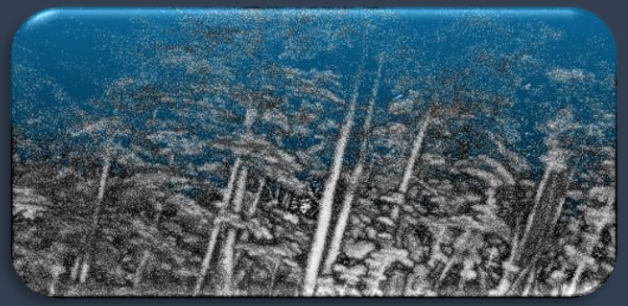
Forest inventory (LiDAR)
Sites are delimited

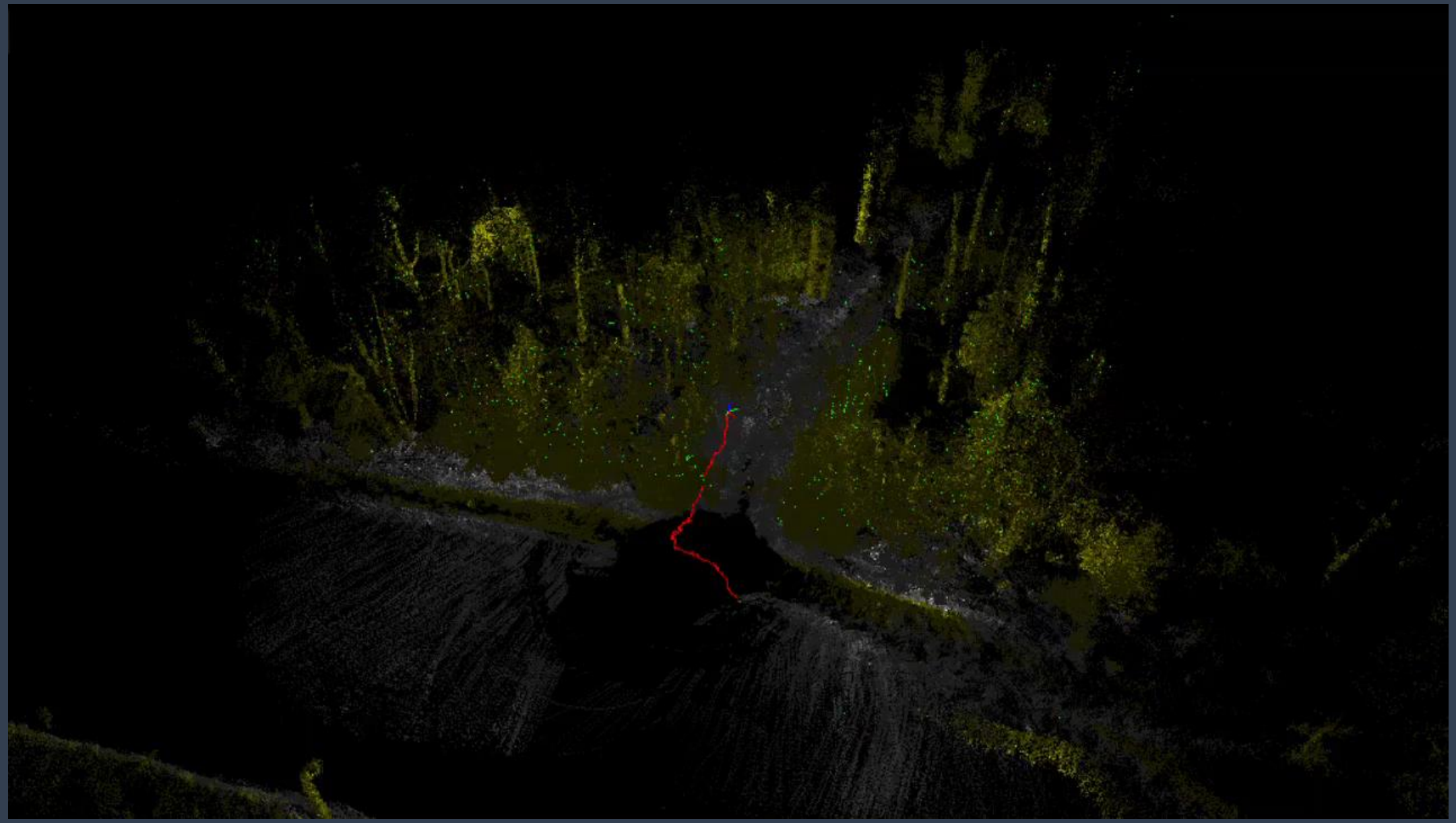
Point cloud collection

Velodyne LiDAR

Simultaneous localisation & mapping

Augmented™ LiDAR





Velodyne LiDAR® + Augmented™ LiDAR

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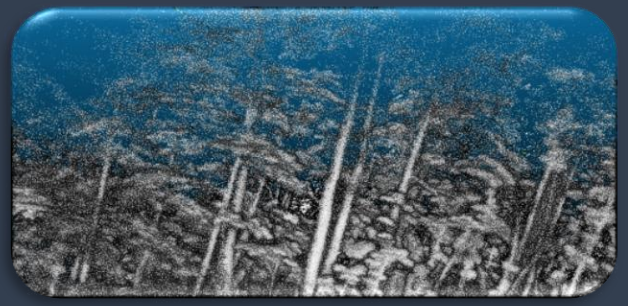


Automatic identification

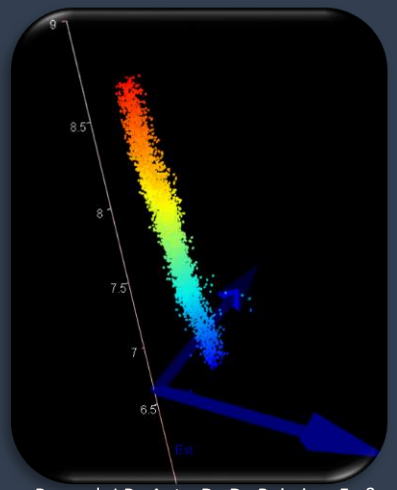
From a group of algorithms, the characteristics of the trees are extracted

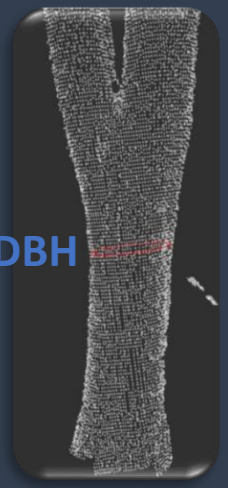
Computree

Digital elevation model

Extraction of the stems (only)

DBH calculation

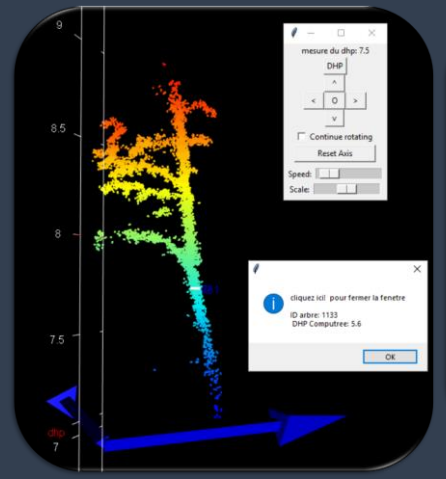


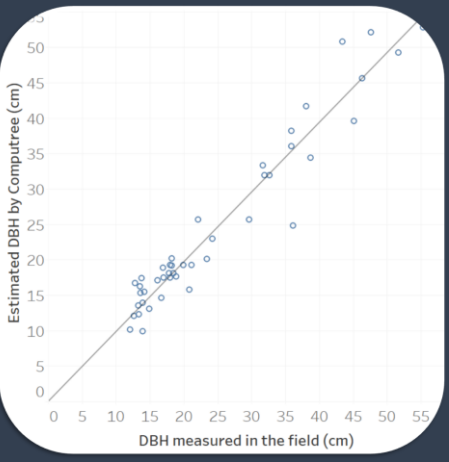


Roussel, J.R., Auty, D., De Boissieu, F., & Sánchez Meador, A. (2019).

Assisted validation (visual)

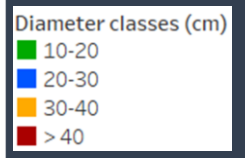
R & QGIS scripts-integrated were created to facilitate the DBH validation by QGIS



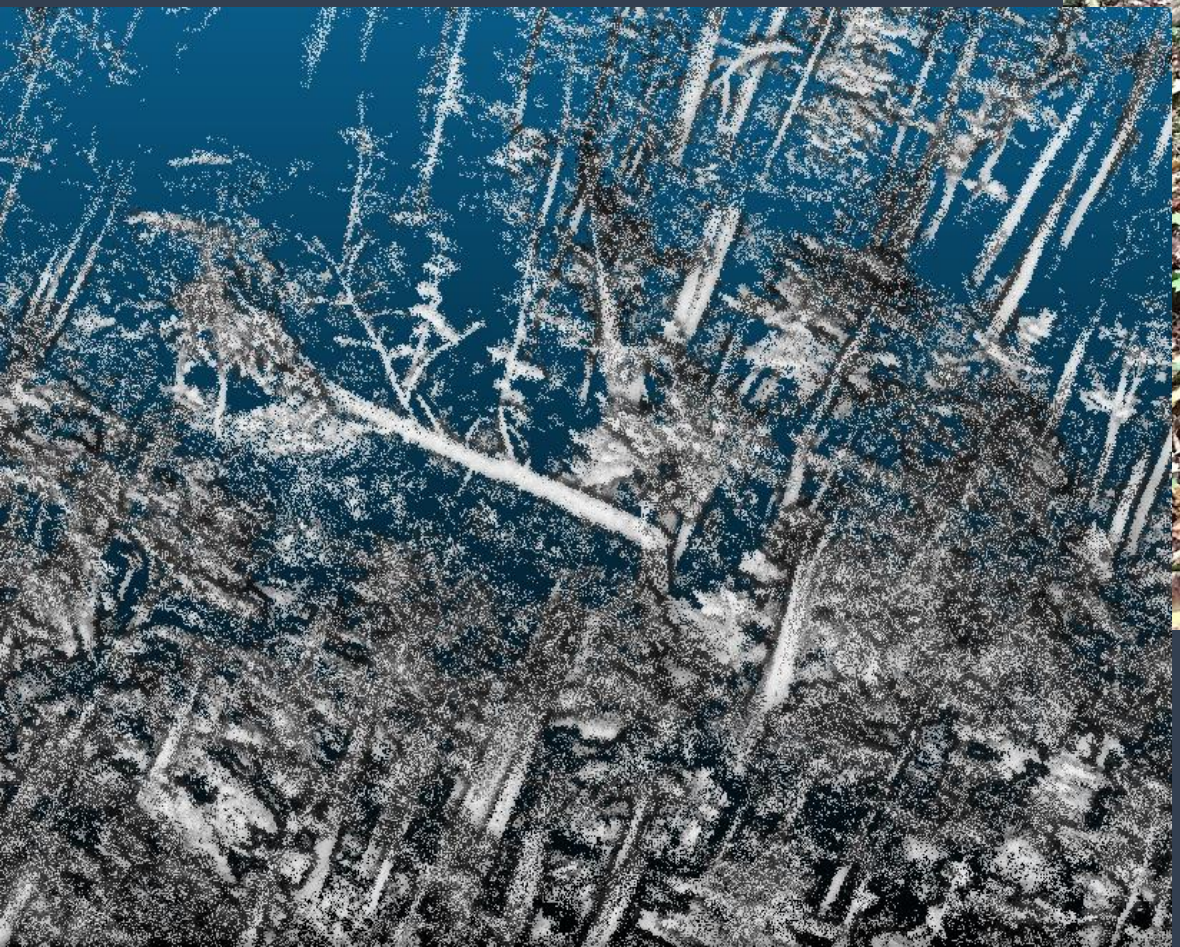


QGIS® trademark

Final tree site map



Woody debris



Vernal pool

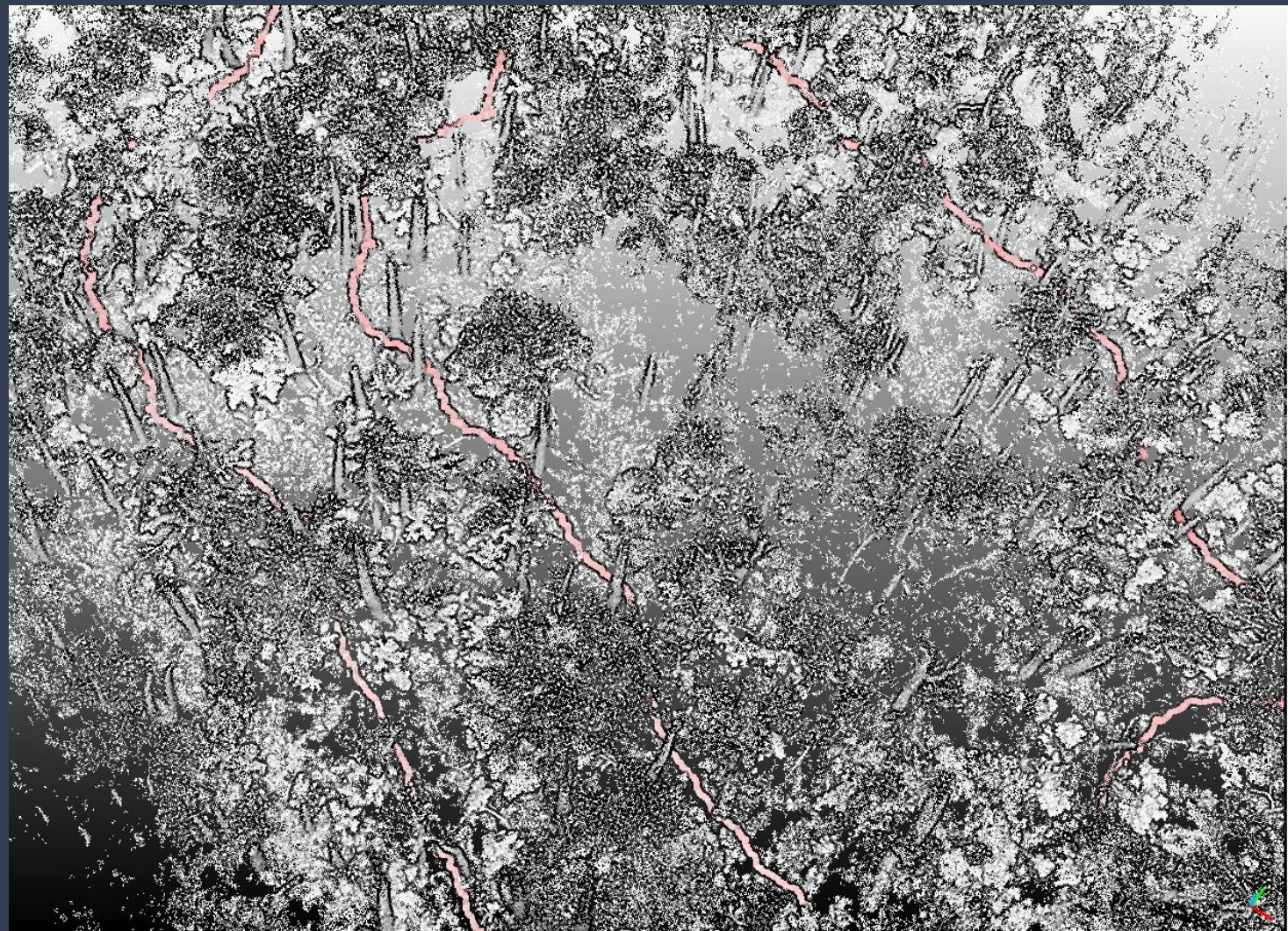


PHOTO S.OUKPEDJO.

Comparison of tree mortality patterns between even- and uneven-aged stands

Even-aged

- Stand structure is continuously changing
- Favors shade-intolerant tree species

Uneven-aged

- Stable stand structure
- Favors shade-tolerant species

Nolet, P., Kneeshaw, D., Messier, C., & Béland, M. (2018).

Spatial and temporal scales

Kuuluvainen, Tahvonen, & Aakala (2012)

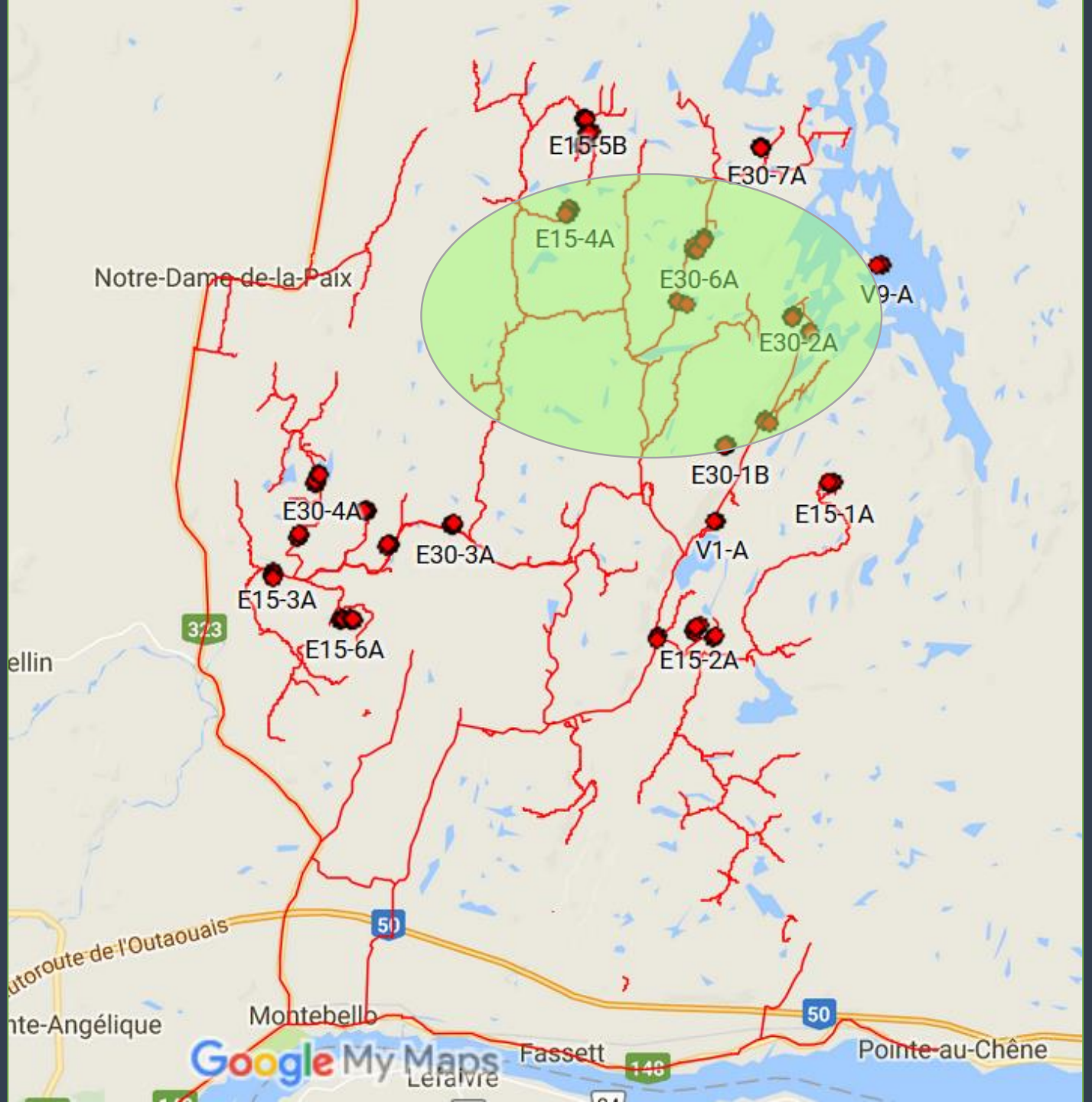
Hypothesis

Stand dynamics influences tree vulnerability to stressors

Long-term trial (2016-2017):

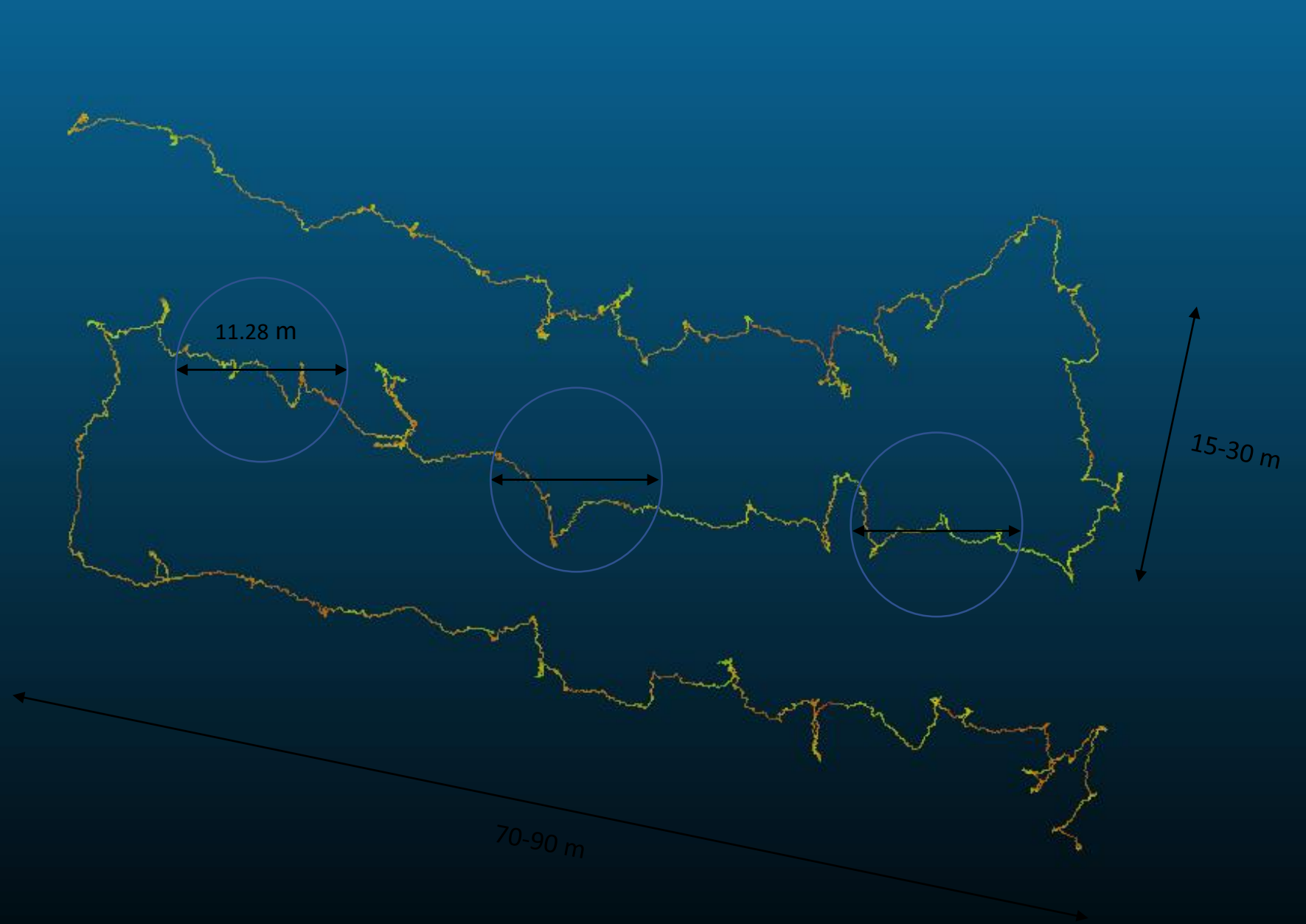
- Strips 15 years
- Strips 30 years
- Old forests

9 sites from each type of forest management

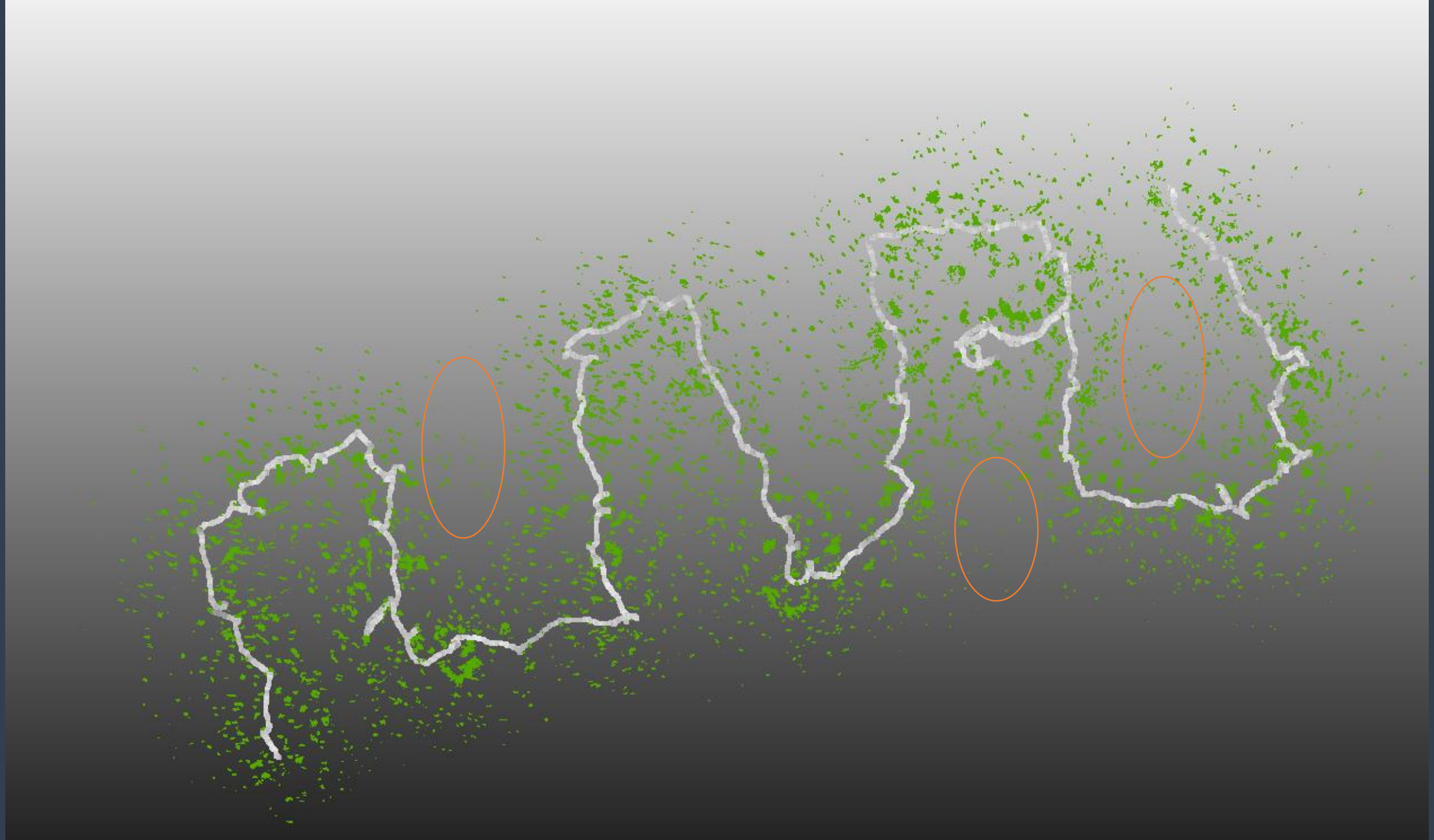


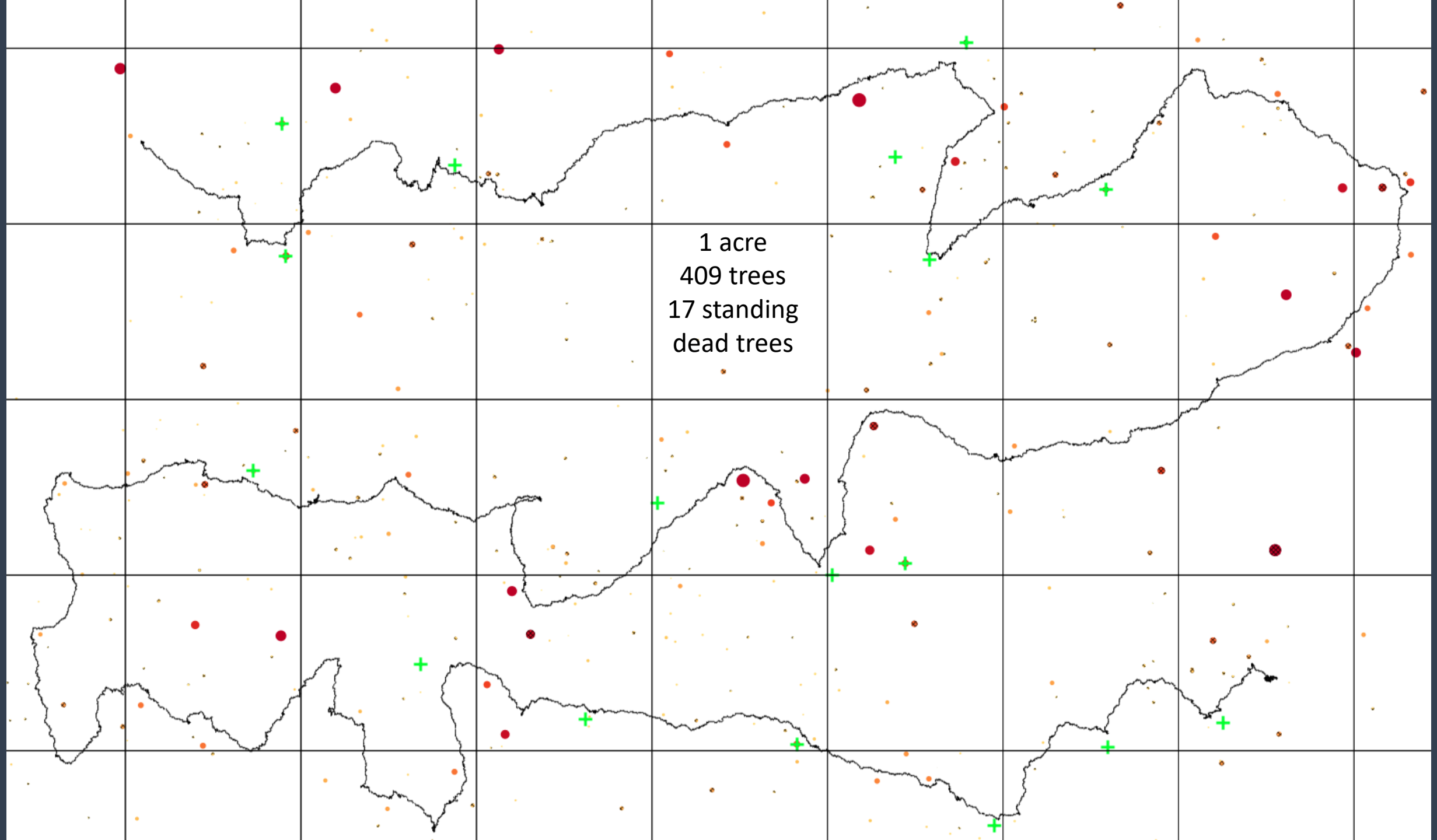
A sampling with a great variability!

61k acres



Data collection- LiDAR path




1 acre
409 trees
17 standing
dead trees

Results & Potential use

>>> point cloud Database

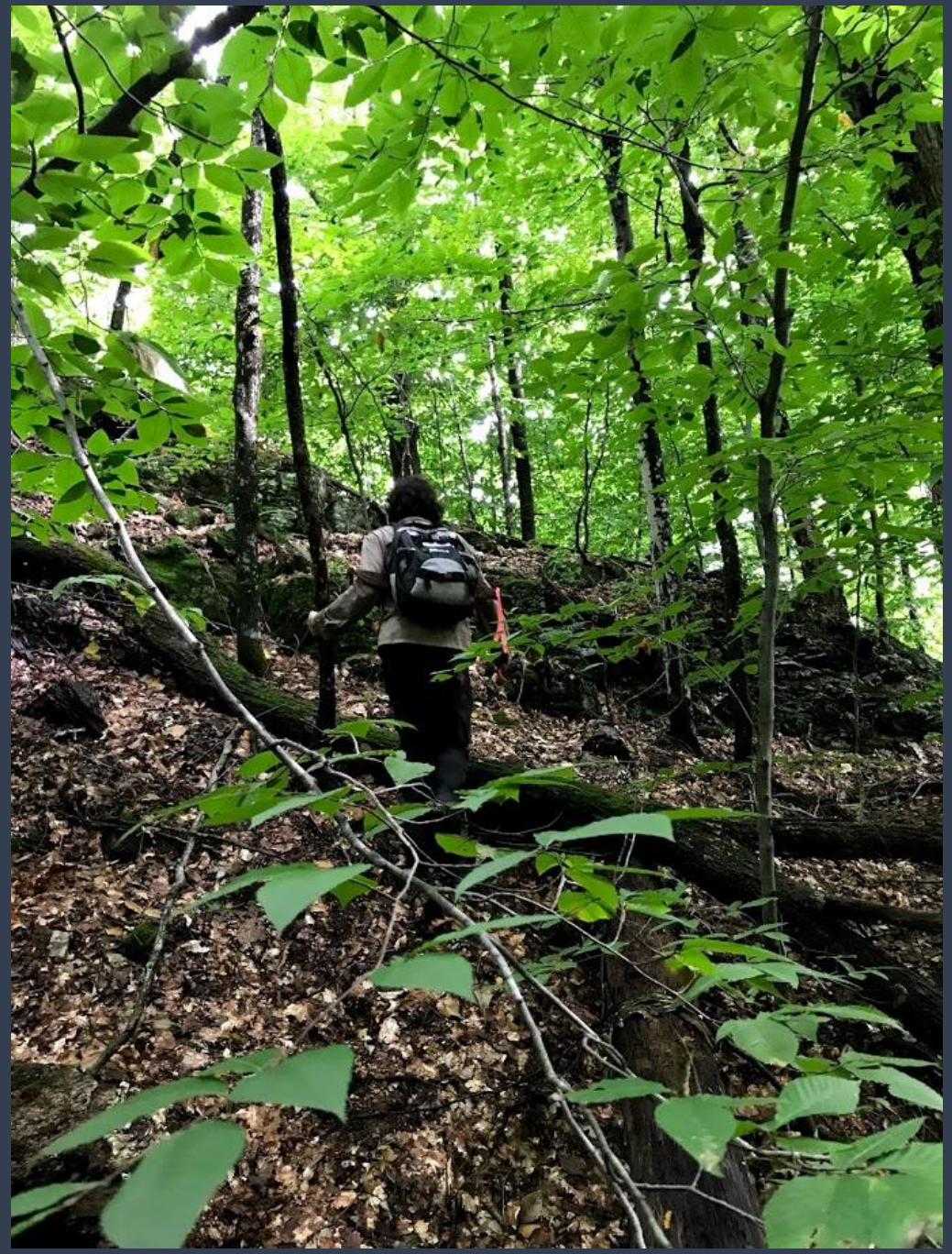
Overview

Inventory for 22 sites

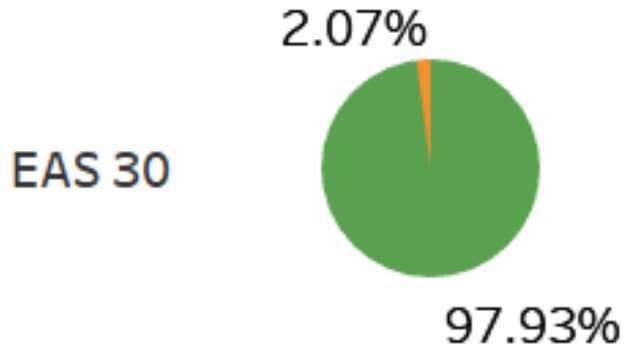
Management	alive	dead
EAS 30	3,984	70
UEAS 30	2,345	112
UEAS 15	2,792	164
Grand Total	**9,121**	**346**

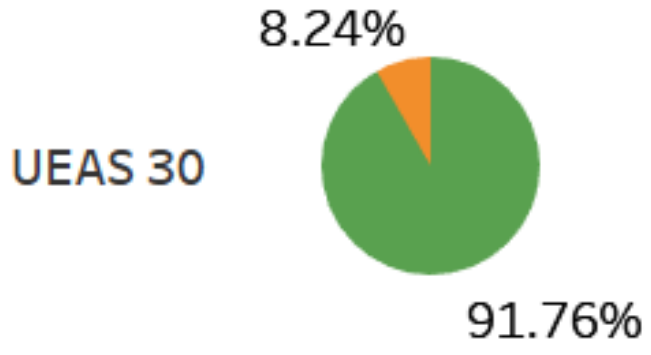
Local topograpy

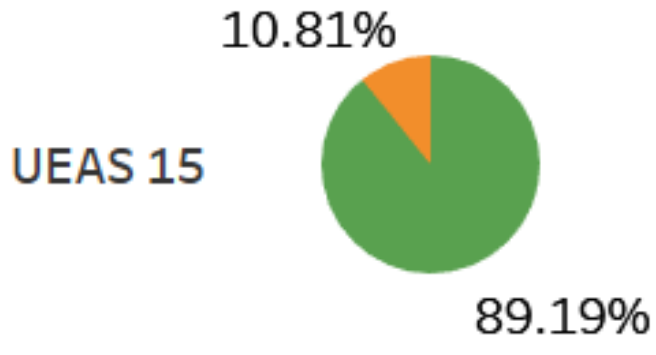
		alive	dead
EAS	Flat Area	98.78%	1.22%
	Lower Slope	97.13%	2.87%
	Middle Slope	98.35%	1.65%
	Ridge	98.10%	1.90%
	Upper Slope	98.55%	1.45%
	Valley	98.28%	1.72%
UEAS	Flat Area	95.95%	4.05%
	Lower Slope	95.26%	4.74%
	Middle Slope	94.43%	5.57%
	Ridge	95.10%	4.90%
	Upper Slope	93.48%	6.52%
	Valley	96.80%	3.20%

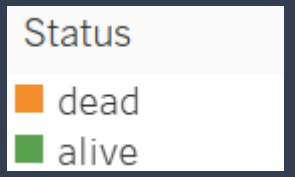


Basal area

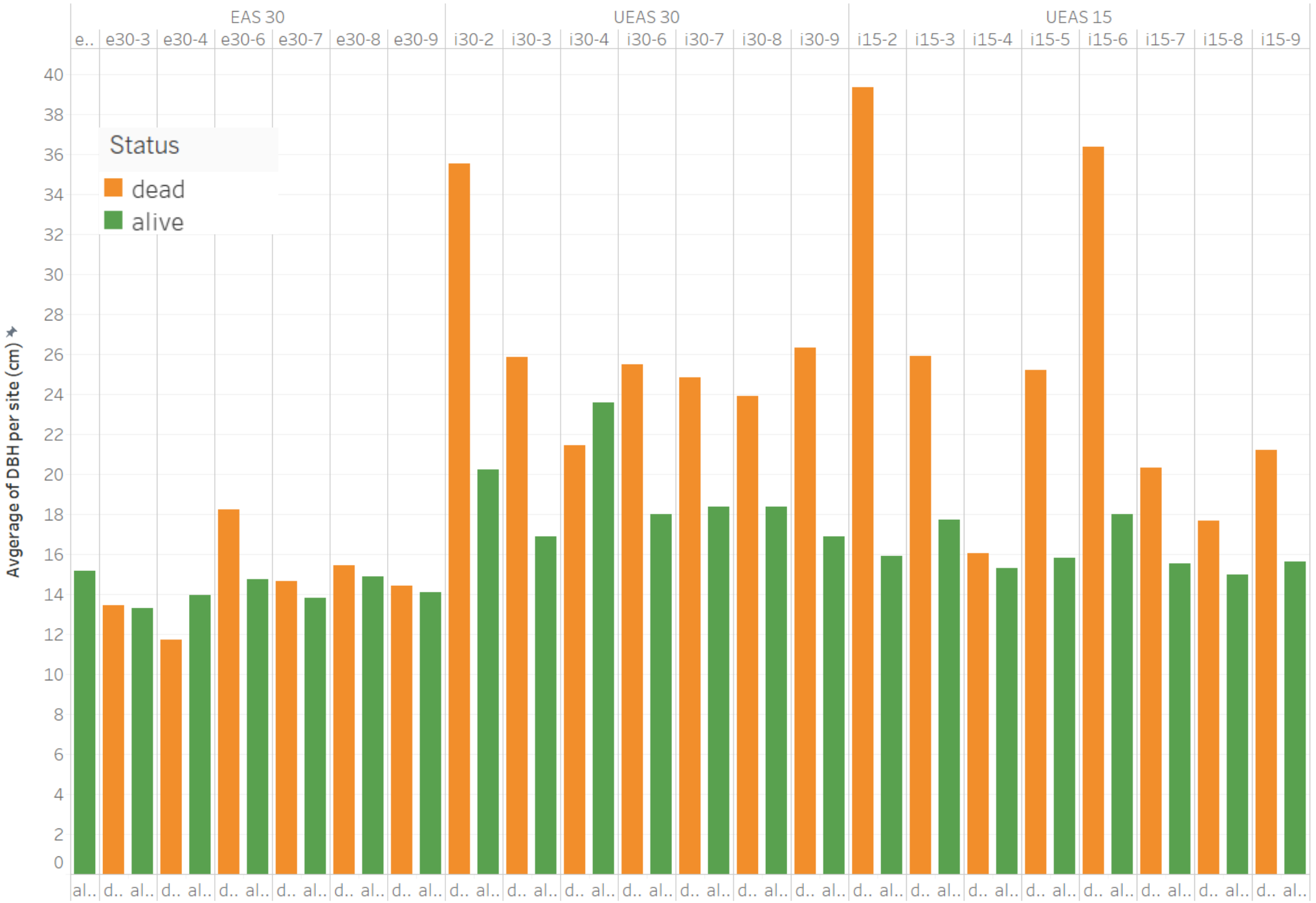

2.07%
EAS 30
97.93%


8.24%
UEAS 30
91.76%


10.81%
UEAS 15
89.19%

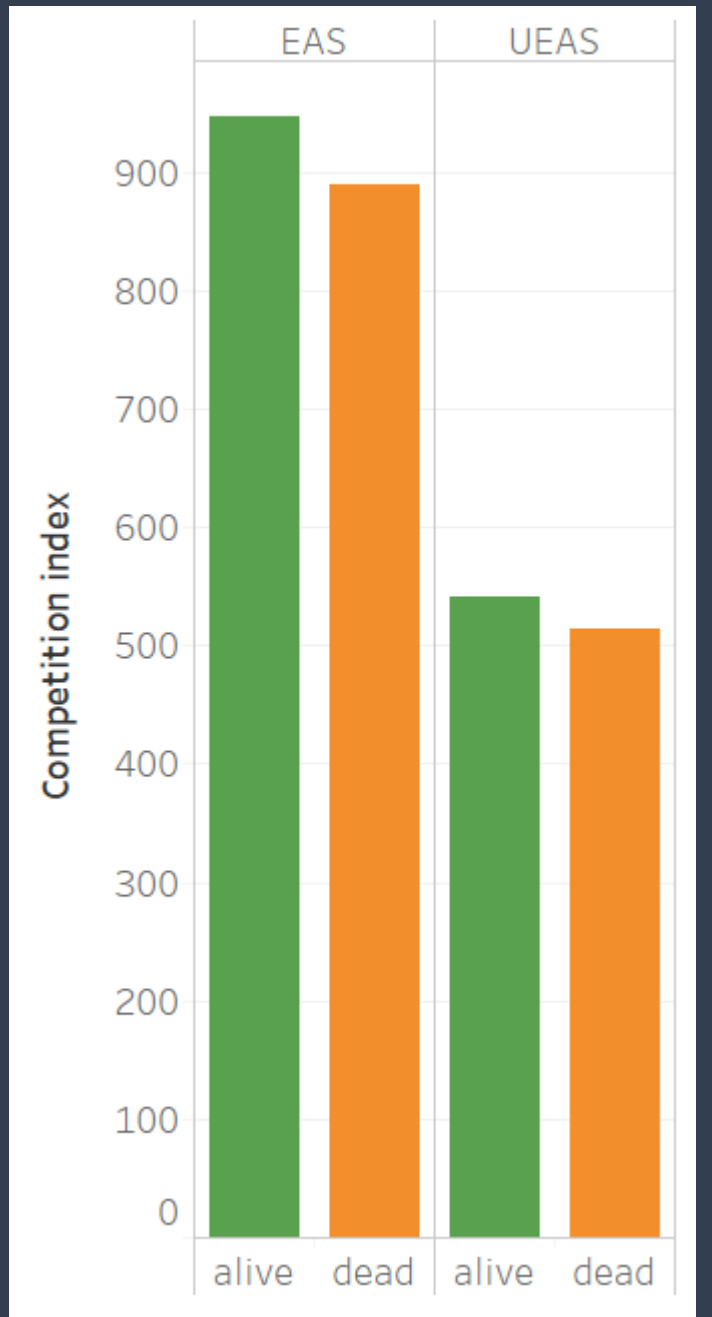

Status
dead
alive

Diameter class distribution for the Even-aged (EAS) and Uneven-aged (UEAS) stands



Mortality occurring by self-thinning versus other factors (e.g. stressed-related)

X, Y position of every tree



Take-home message

- For similar DBH classes tree mortality is higher in UEAS than in EAS stands.
- Current competition does not explain this higher mortality, hence…
- It seems that trees growing in UEAS stands have a higher vulnerability to stressors than the ones in EAS stands.
- Terrestrial mobile LiDAR: a promising technique ≠ ‘plug & play’ tool
- A database provided by a point cloud gives endless opportunities for studying the forest from the office.

Acknowledgements

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