UW Academic Program

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SCHOOL OF ENVIRONMENTAL AND FOREST SCIENCES

UNIVERSITY *of* WASHINGTON

College of the Environment

PFC

PRECISION

Forestry Cooperative

UW ‘Geospatial’/Earth Observation

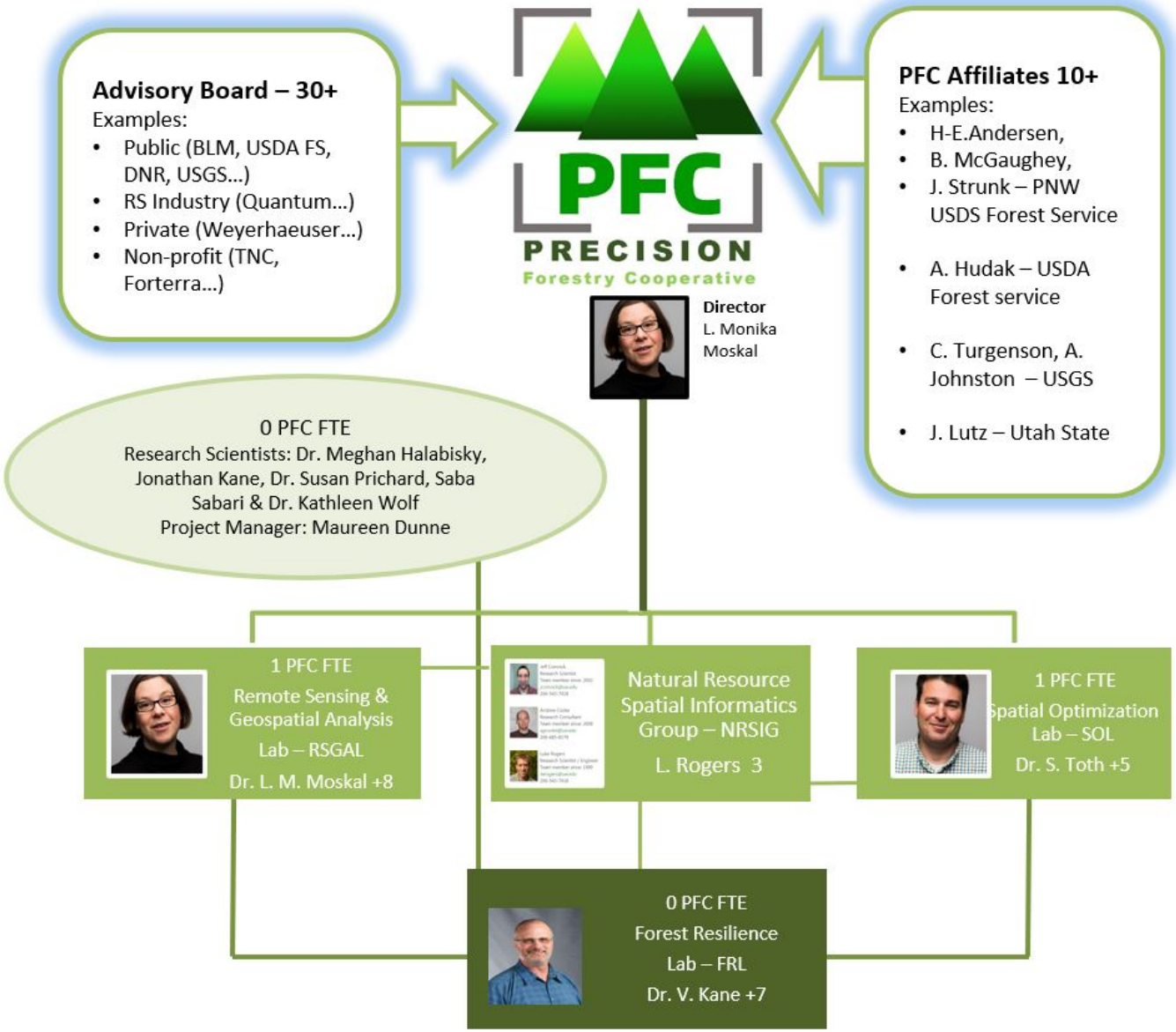
some caveats

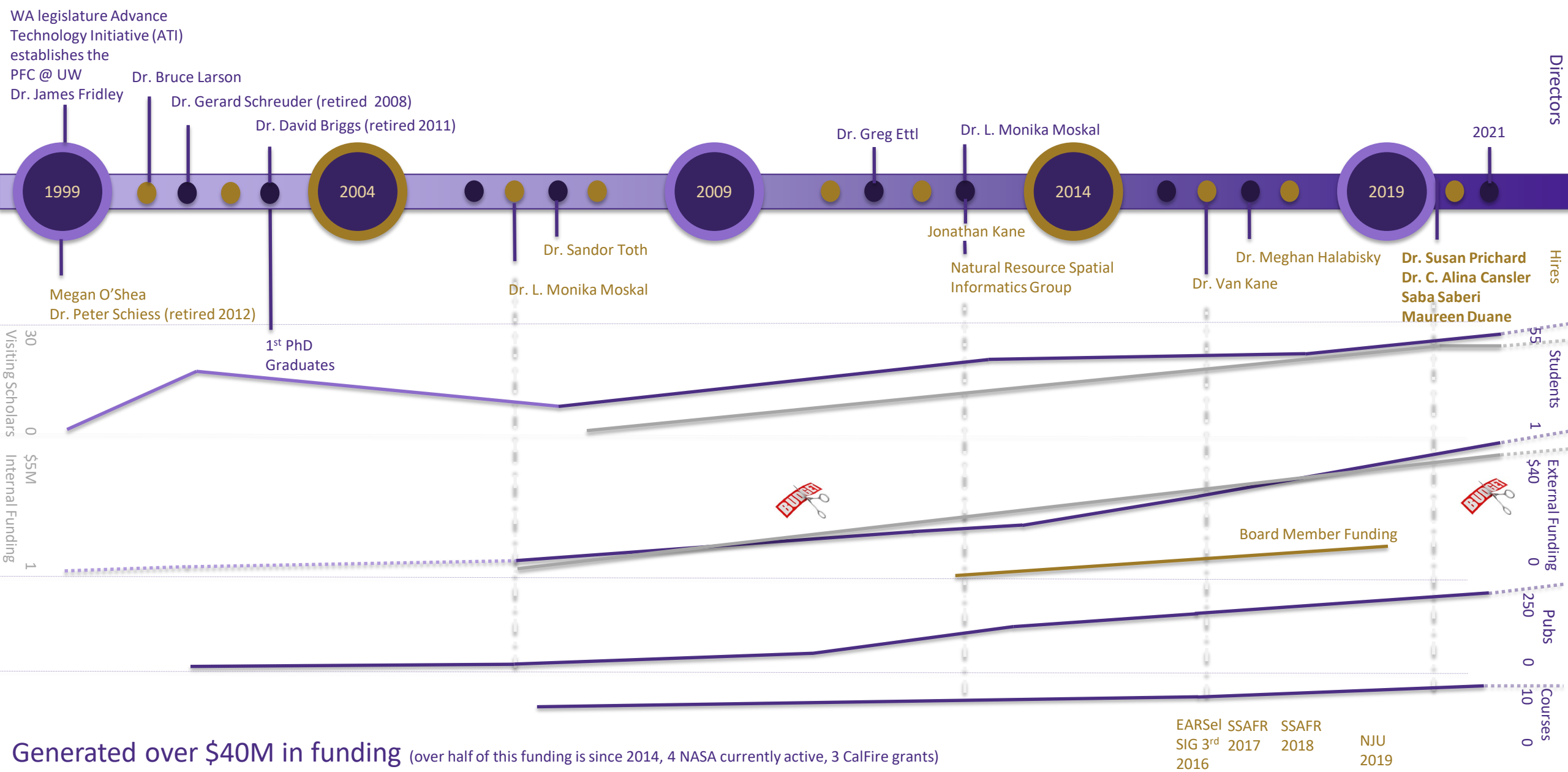
- Organic academic ecosystem, bottom-up
- GIS and data sciences minors and certificate programs in various units and on multiple campuses, flagships in Geography, Earth System Sciences, Oceanography and Archeology
- Ever evolving
- Will focus on through a focused perspective on UW Precision Forestry Cooperative (PFC) as an example

UW/SEFS/Precision Forestry Cooperative

Mission: *development of advanced technology solutions to improve the quality & reliability of information needed for planning, implementation, monitoring and conservation of ecological resources, to ensure sustainable landscape outcomes on forests, wetlands, meadows and wildlife habitats.*

Vision*: engagement with technology, environmental, public & non-profit sectors in fulfillment of our mission.*





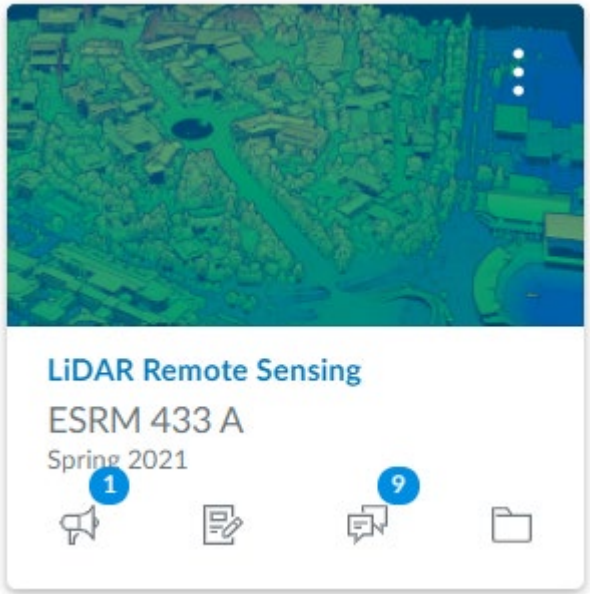
Generated over $40M in funding (over half of this funding is since 2014, 4 NASA currently active, 3 CalFire grants)

Published 230 papers (+many reports)

Teaching extending beyond classroom

Over 55 students with ~90% job placement (100% placement for 2021); every student funded

Course Example: ESRM433/SEFS533 LiDAR Remote Sensing



Established in 2016
5 credits
Started with 8 student, currently 45 students, will need to cap at 60 --- enrollment doubles yearly

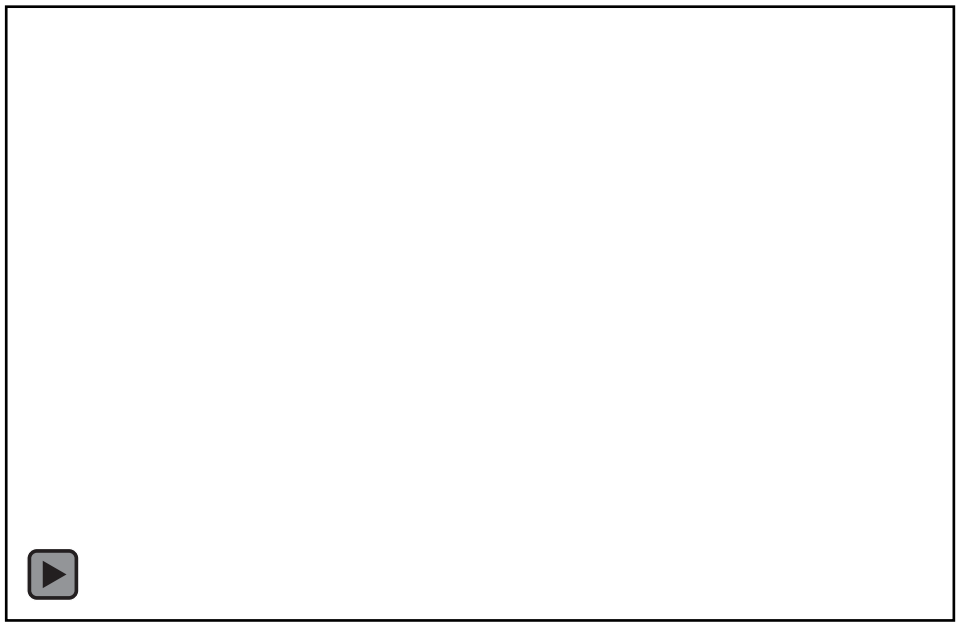
2016-2017 taught by V. Kane with mentorship from L. M. Moskal
2018-2021 taught by L. M. Moskal
2022 and subsequent years will be taught by an advance PFC PhD Candidate specializing in LiDAR research with mentorship from L. M. Moskal, V. Kane and S. Toth

Objectives: To develop an understanding of LiDAR remote sensing fundamentals and the ability to interpret and manipulate 3D point cloud remotely sensed data. Students will be presented with the operational and 'state of the art' processing techniques using current software and R code (also python code will be provided), and a firm theoretical and practical background in LiDAR remote sensing applications. By the end of the course students will be expected to evaluate available LiDAR data sources and design simple projects related to environmental applications.

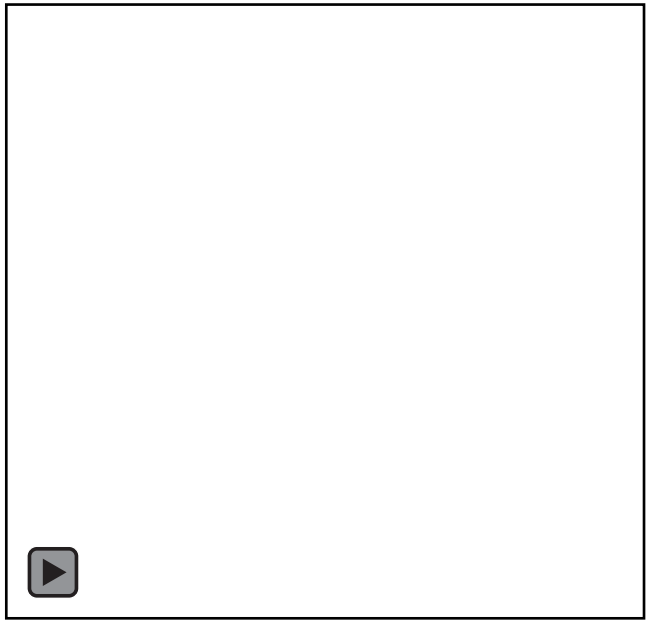
SEQUANCE OF REMOTE SENSING COURSES IN SEFS:

- Autumn ESRM430 Remote Sensing of Environment
- Winter SEFS521/CEE498 Advanced Remote Sensing
- Spring ESRM433/SEFS533 LiDAR Remote Sensing
- Summer ESRM190 Digital Earth

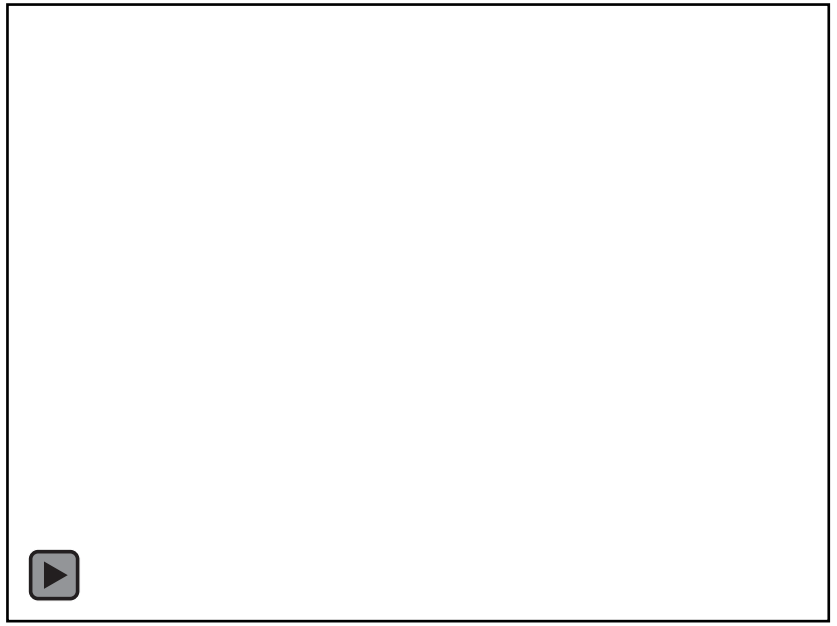
Remote Sensing and Geospatial Analysis Laboratory (RSGAL)



SEFS from aerial LiDAR or ALS



SEFS from dDAP or
UAS photogrammetry

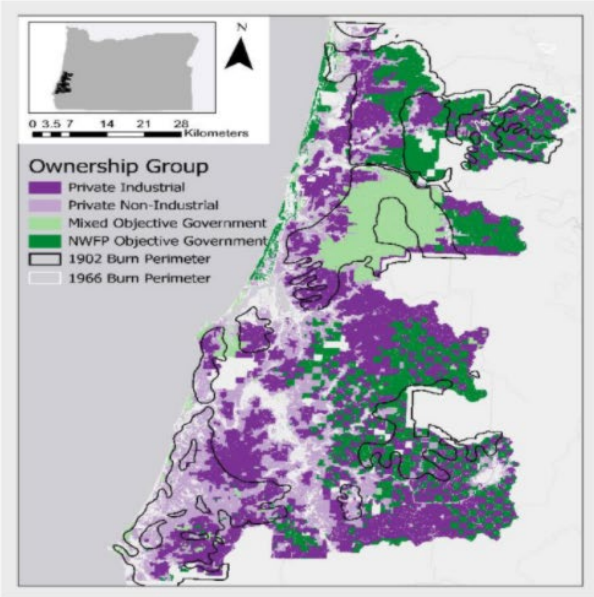


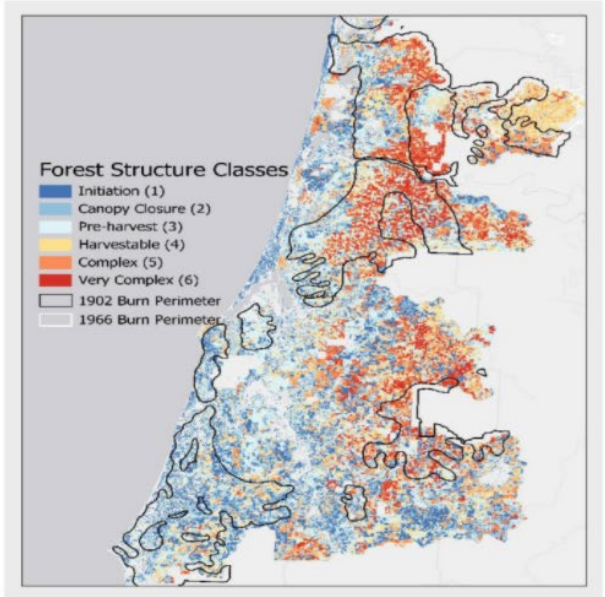
SEFS from mobile LiDAR or MLS

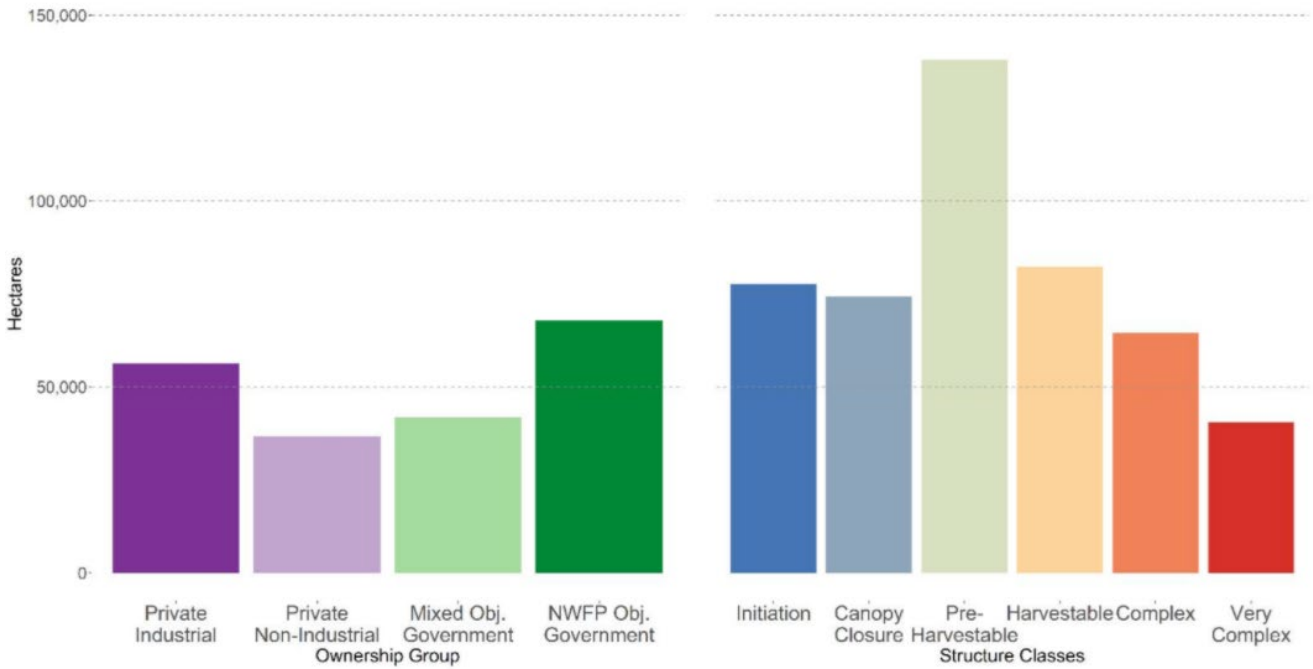
L. M. Moskal has been working with LiDAR since 2002 (IceSAT); teaches 3 RS Courses; many students in RSGAL involved in teaching GIS
Latest LiDAR related publication:

Barnhart, B., P. Pettus, J. Halama, R. McKane, P. Mayer, A. Brookes, K. Djang, L. M. **Moskal**, 2021. Modeling the hydrologic effects of watershed-scale green roof implementation in the Pacific Northwest, United States. Journal of Environmental Management. 277(111418). 10.1016/j.jenvman.2020.111418.

Forest Resilience Laboratory (FRL)







V. Kane has been working with LiDAR since 2008; advises and mentors large student lab
Latest LiDAR related publication:
Griffey, V.S., Kellogg, B.S., Haugo, R.D., **Kane**, V.R. 2021. Ownership patterns drive multi-scale forest structure patterns across a forested region in southern coastal Oregon, USA. Forests. 12, 47. 10.3390/f12010047

Natural Resource Spatial Informatics Group (NRSIG)

The performance of all Mashel models decreased when applied to the OESF plots, except for the existing diameter model when used on the full OESF plots, which performed equally as well. The existing density model when used on the full OESF plots had only a slight decrease in performance. Refitting and adapting the models improved performance for all models, but still did not achieve the accuracy of the Pilot Study, except for the existing diameter model and the existing density model when used on the full OESF plots.

Table 16: Accuracies of Mashel models in the Pilot Study

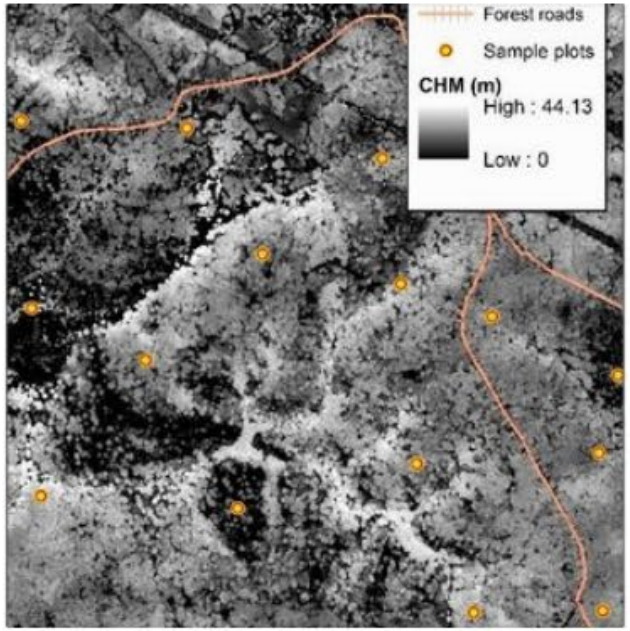
	Mashel Pilot Study Results	
	r^2	RMSE
Basal Area	0.72	63.12
Density	0.46	68.96
Diameter	0.70	2.77

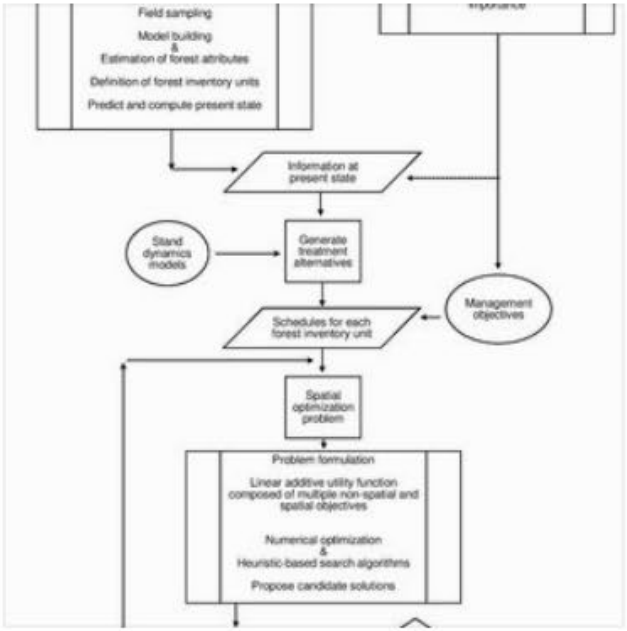
Table 17: Accuracies of the Mashel Models, and new OESF models, predicting full OESF plots

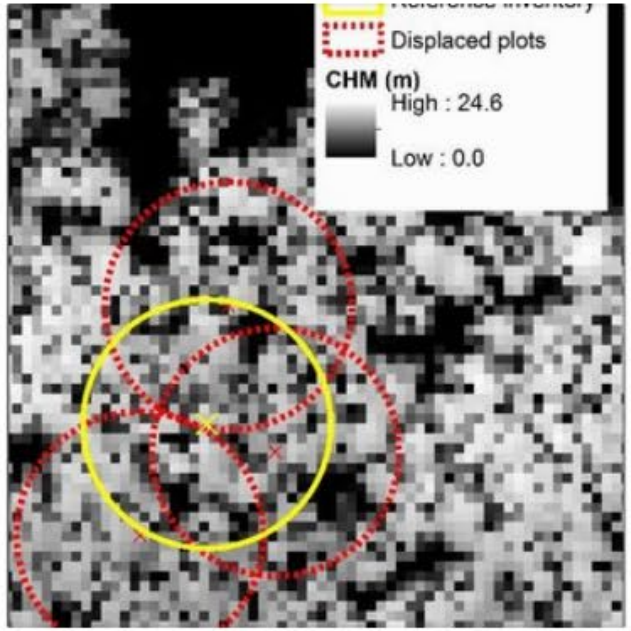
	Existing Mashel Models		Refit Mashel Models		Adapted Mashel Models		New OESF Models	
	r^2	RMSE	r^2	RMSE	r^2	RMSE	r^2	RMSE
Basal Area	0.32	59.50	0.36	57.90	0.44	54.16	0.61	44.87
Density	0.44	57.40	0.53	52.58	0.53	52.67	0.71	41.51
Diameter	0.70	2.28	0.77	2.02	0.76	2.05	0.86	1.55

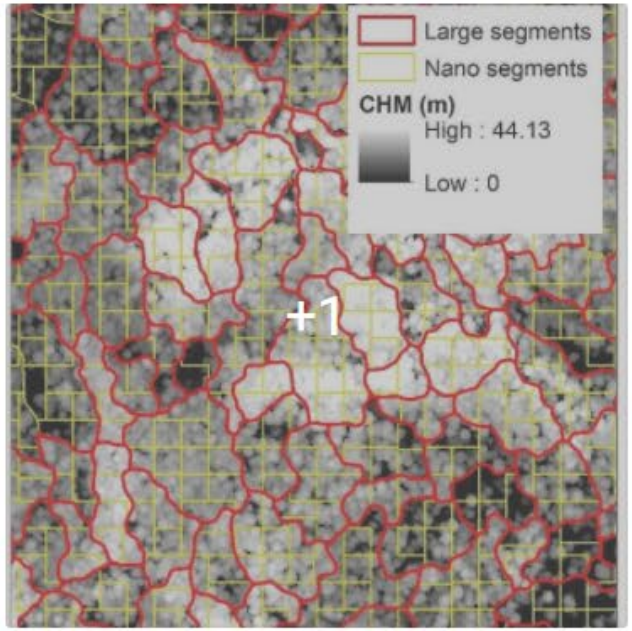
NRSIG has been working with LiDAR since 2000; student interships
Latest LiDAR related publication:
Cooke, Andrew G, and Warren Devine. 2020. Extensive Riparian Vegetation Monitoring, Model Transferability Testing. Seattle, WA: University of Washington.

Spatial Optimization Laboratory (SOL)









S. Toth has been working with LiDAR since 2015; teaches optimization and consulting courses
Latest LiDAR related publication:
Pascual, A. & S.F. **Tóth**. In press 2021. Using mixed integer programming and airborne laser scanning to generate forest management units. Journal of Forest Research.