

**LiDAR**  
**Light Detection And Ranging**

collaboration with UMO and CFRU

Pilot Project to see how Single Photon LiDAR works for describing  
forest cover

SFMA, Holt, Howland, and PEF

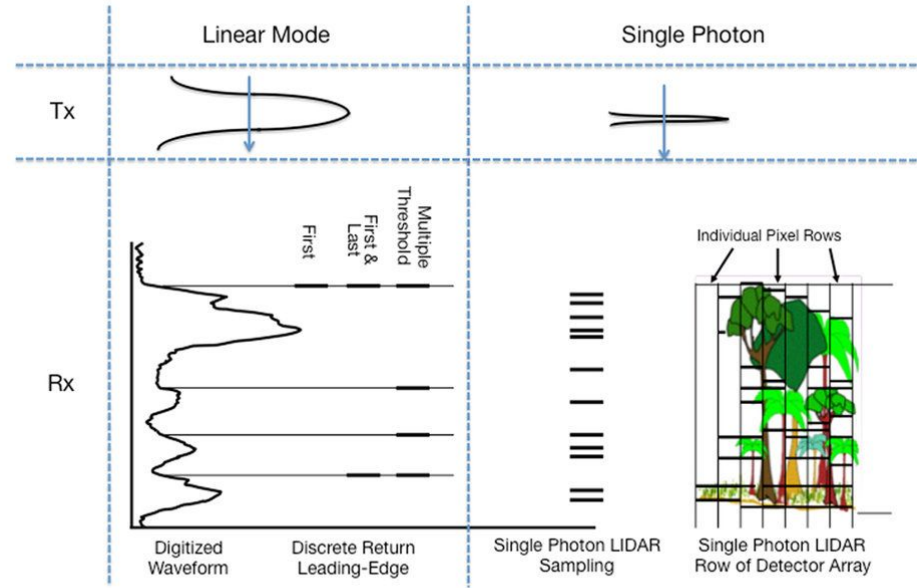
Figure 1: Schematic diagram showing SPL and other lidar systems.

From: Rapid, High-Resolution Forest Structure and Terrain Mapping over Large Areas using Single Photon Lidar

## single photon vs discrete return

### lidar pulse split into 10x10 array and all returned data captured

- one photon needed for single measurement, as opposed to hundreds or thousands
- fly higher and faster and achieve same or better point density
- ability to use for bathymetric data

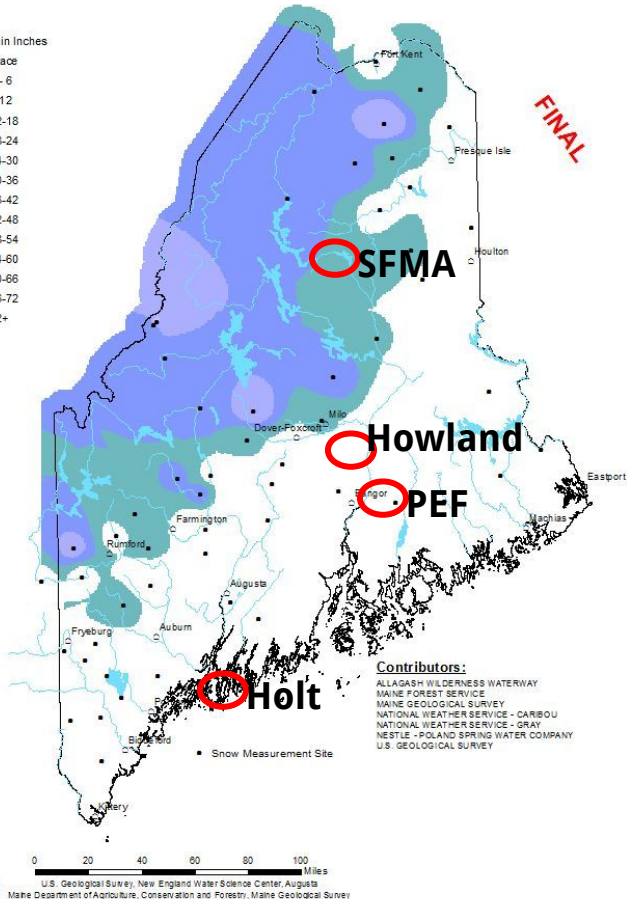


Tx is the transmitted laser pulse and Rx is the returned energy. The SPL laser pulse has a shorter pulse width than other systems. The detector consists of a  $10 \times 10$  array that records several returns per pulse.

# Maine Cooperative Snow Survey Program

Snowpack Depth: April 16-19, 2017

Scale in Inches

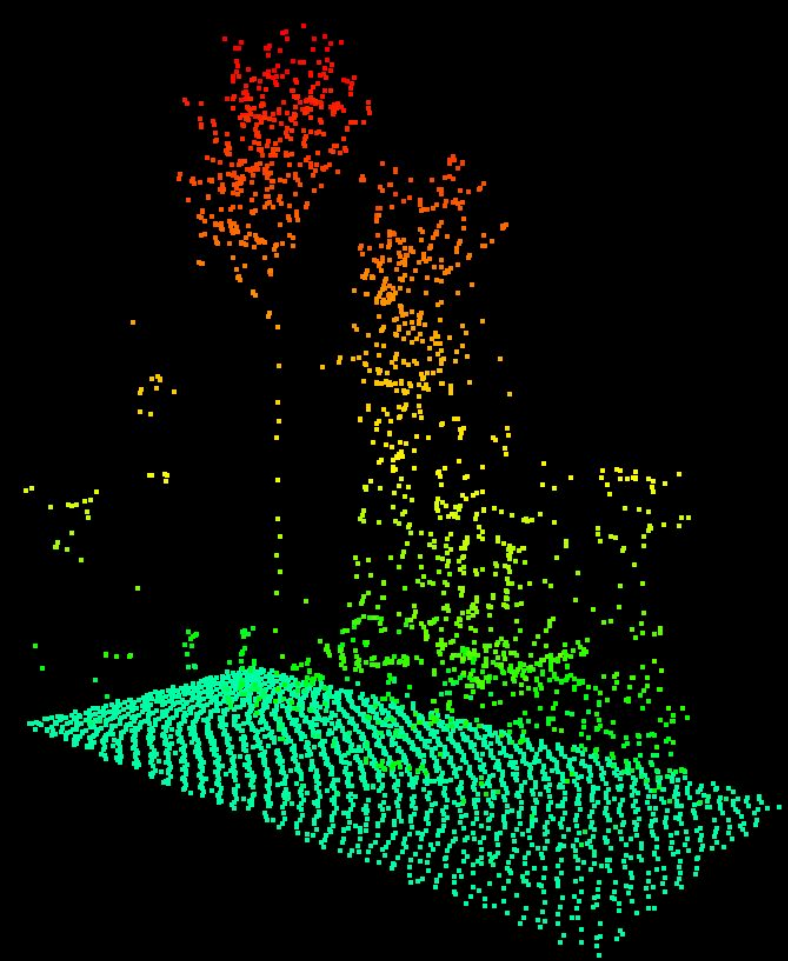


April 2016

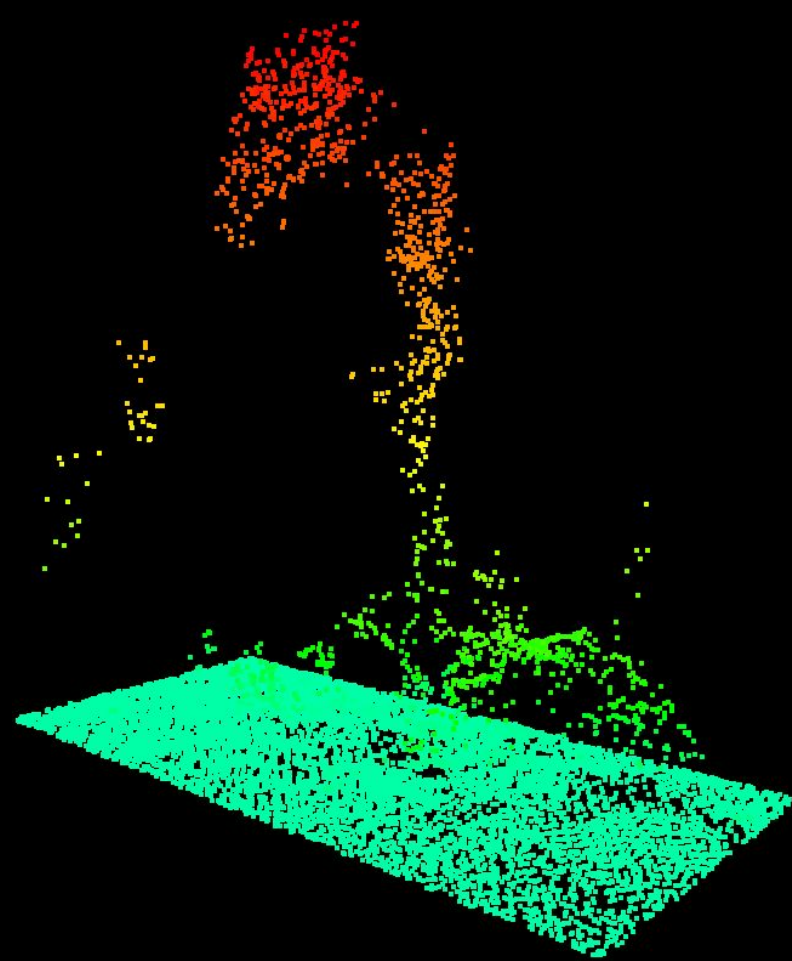
snow cover remained in SFMA whilst Holt buds broke

agreed to fly SPL if we could get a separate DEM (snow does unknown bad things to LiDAR)

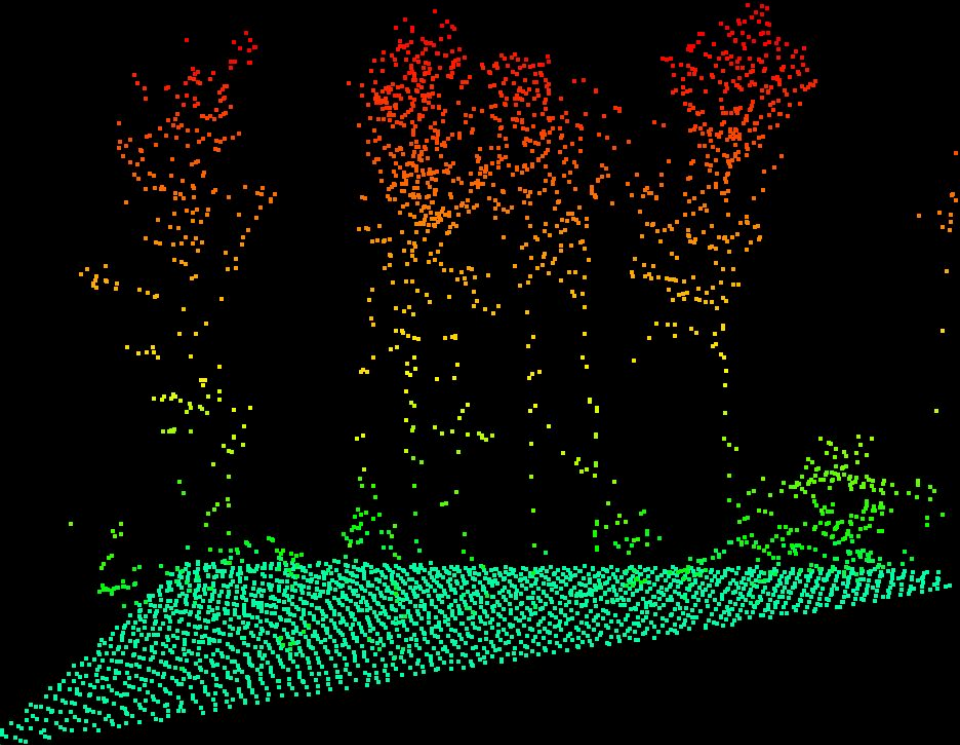
Quantum flew discrete return LiDAR @ 4ppsm this also provided an interesting comparison



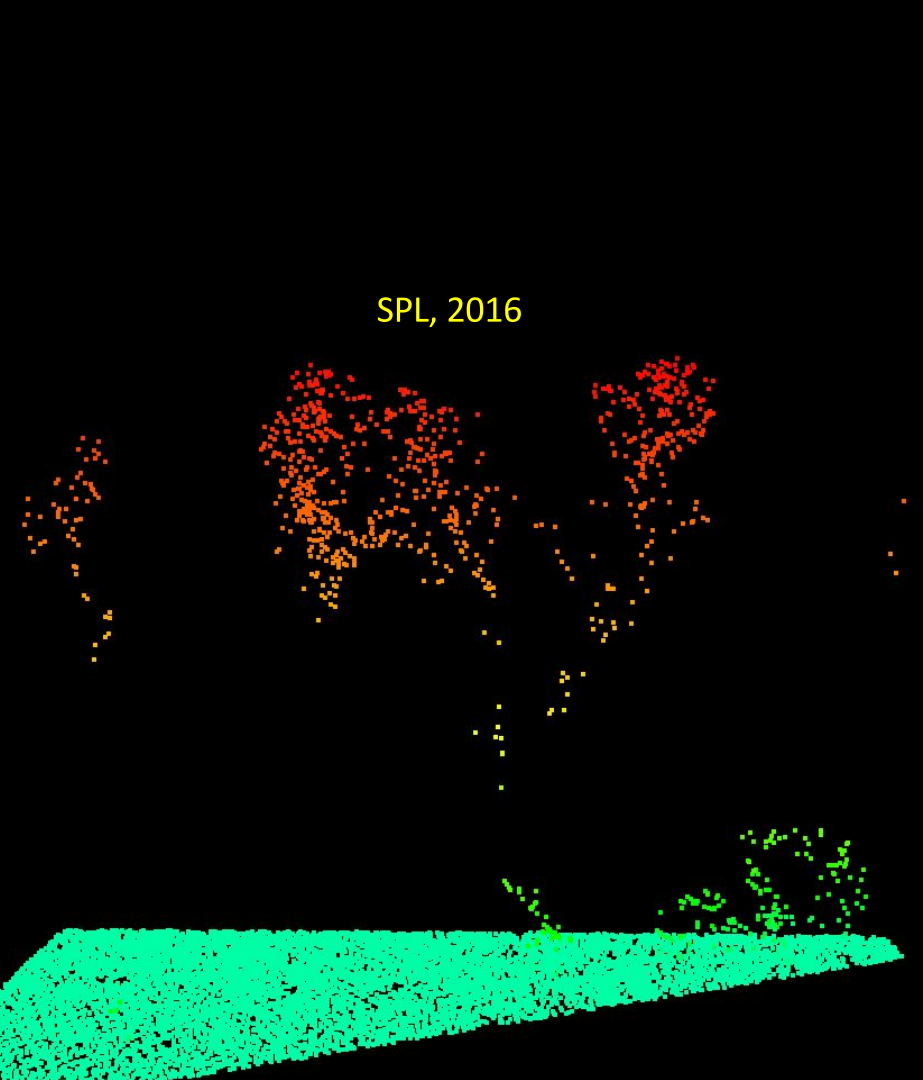
Full Waveform (6ppm) 2013



SPL, 2016



Full Waveform (6ppm) 2013



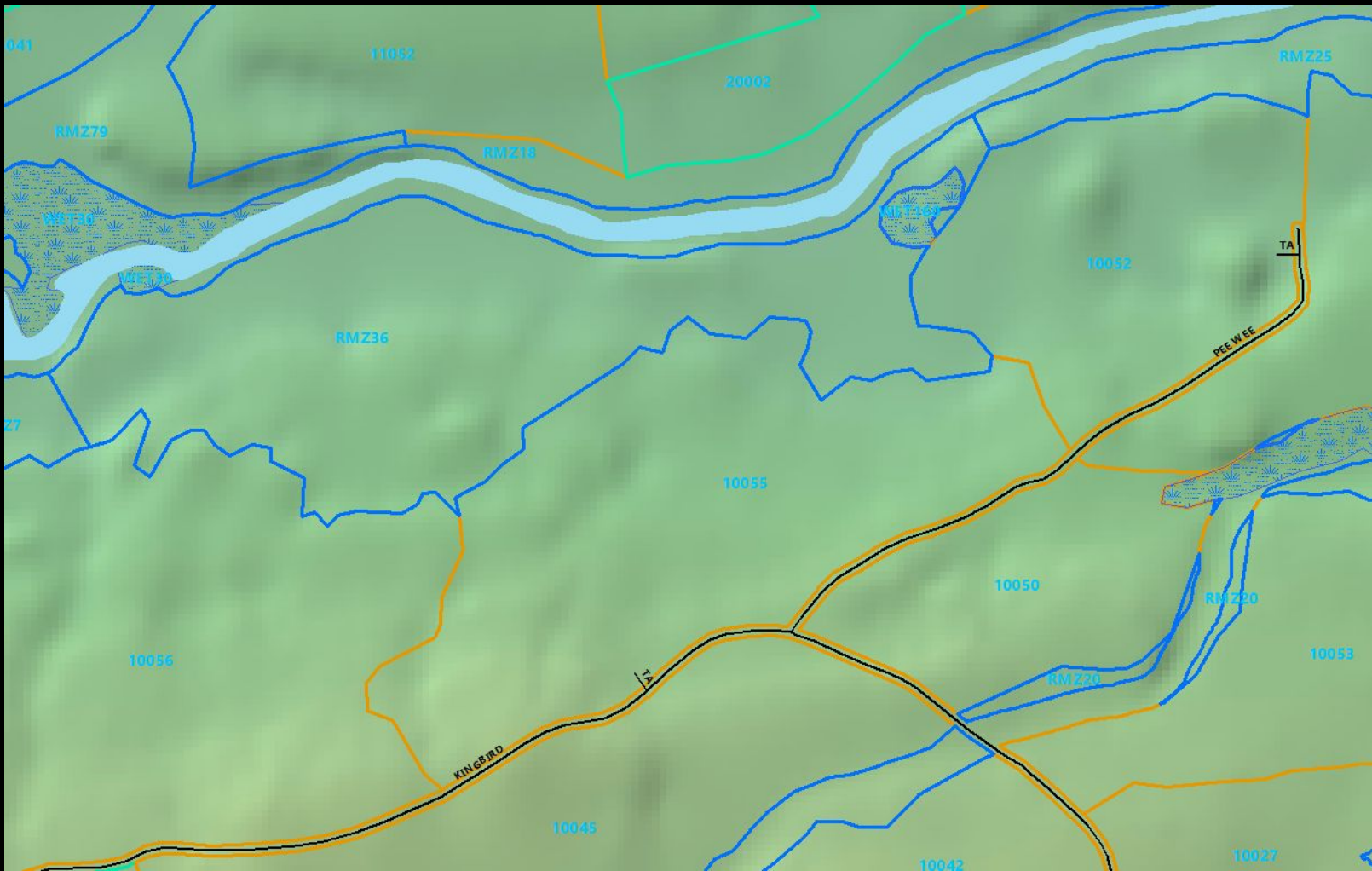
SPL, 2016

what happened?

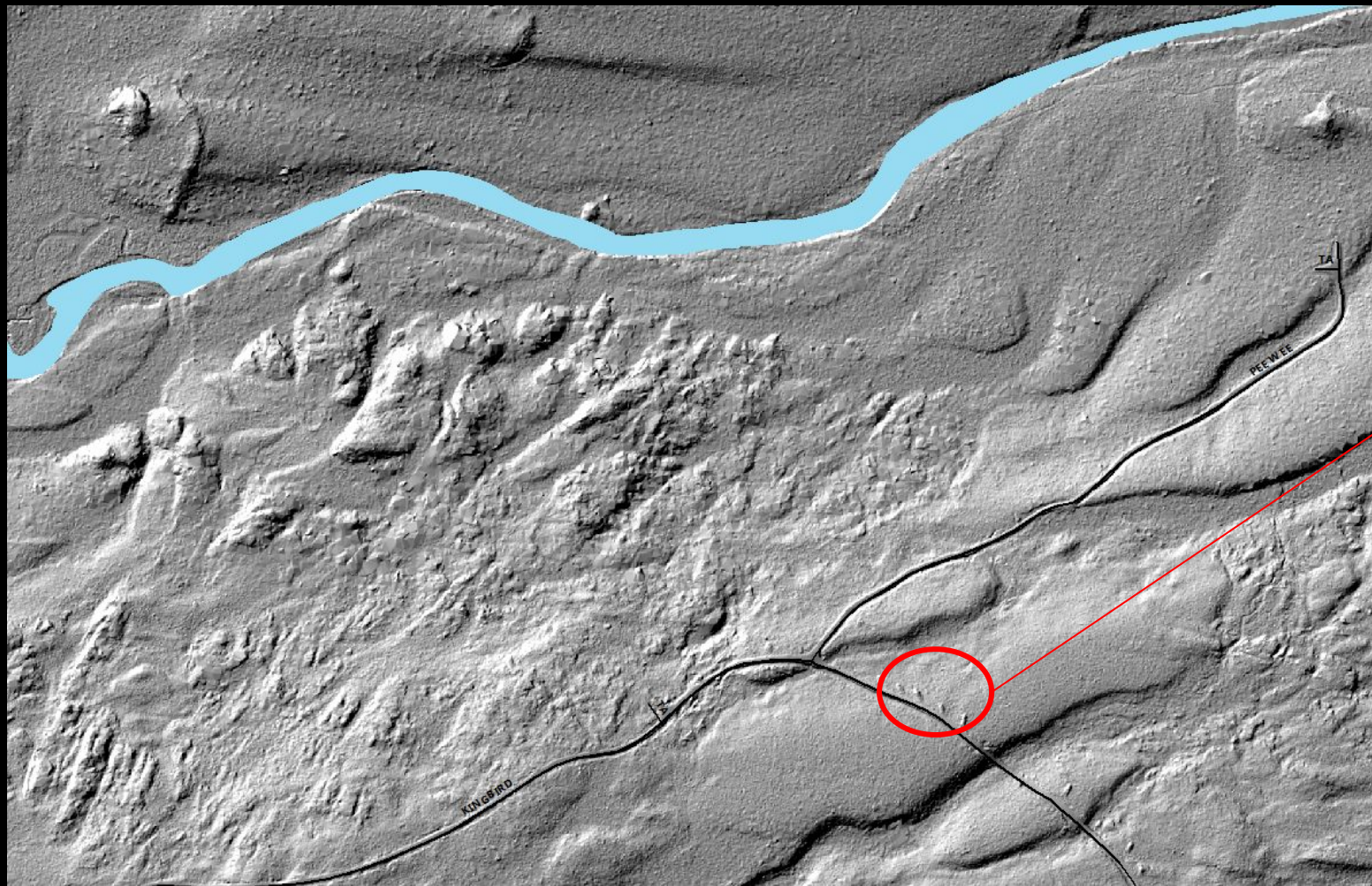
(radio silence)

what did we get?



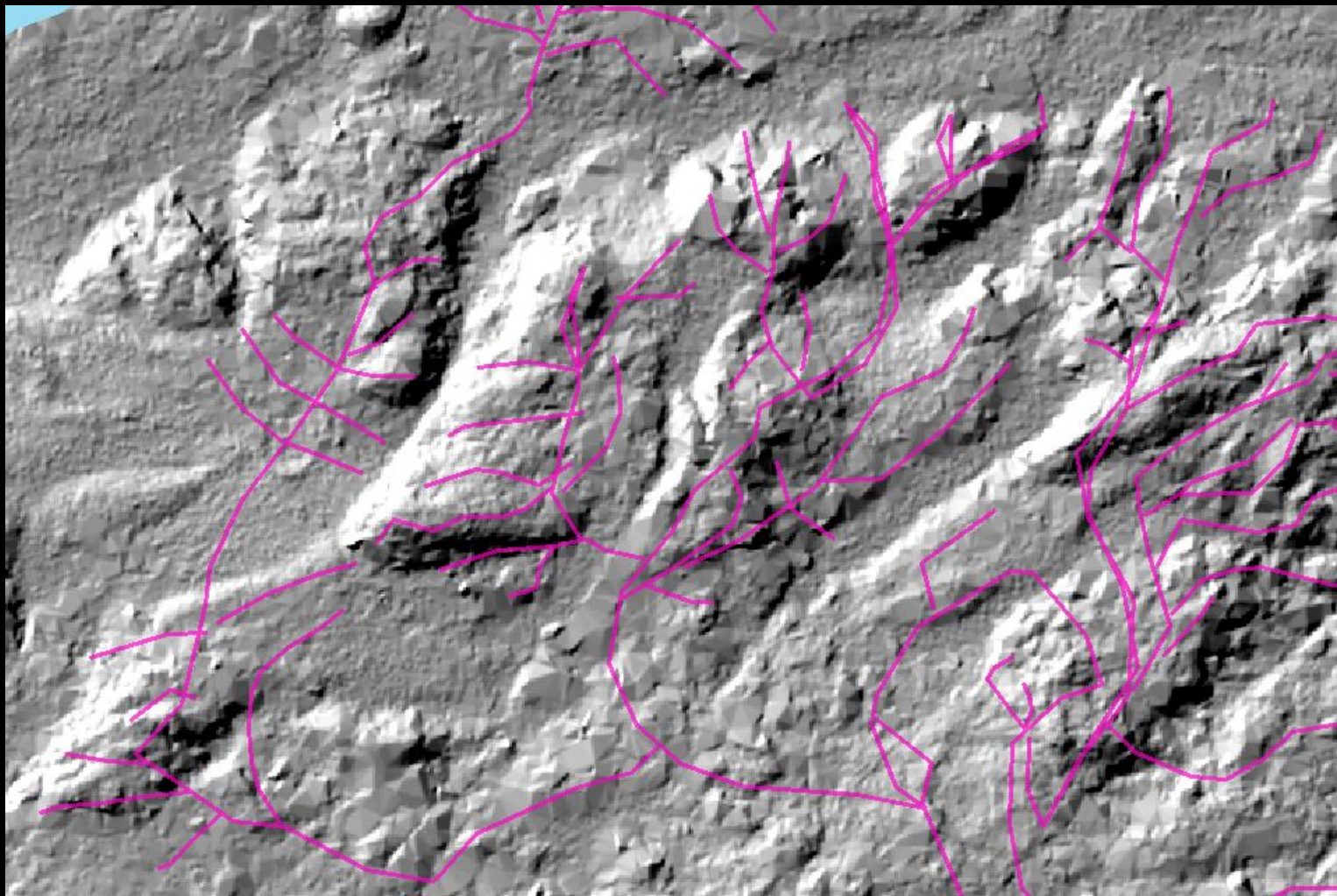


what we had

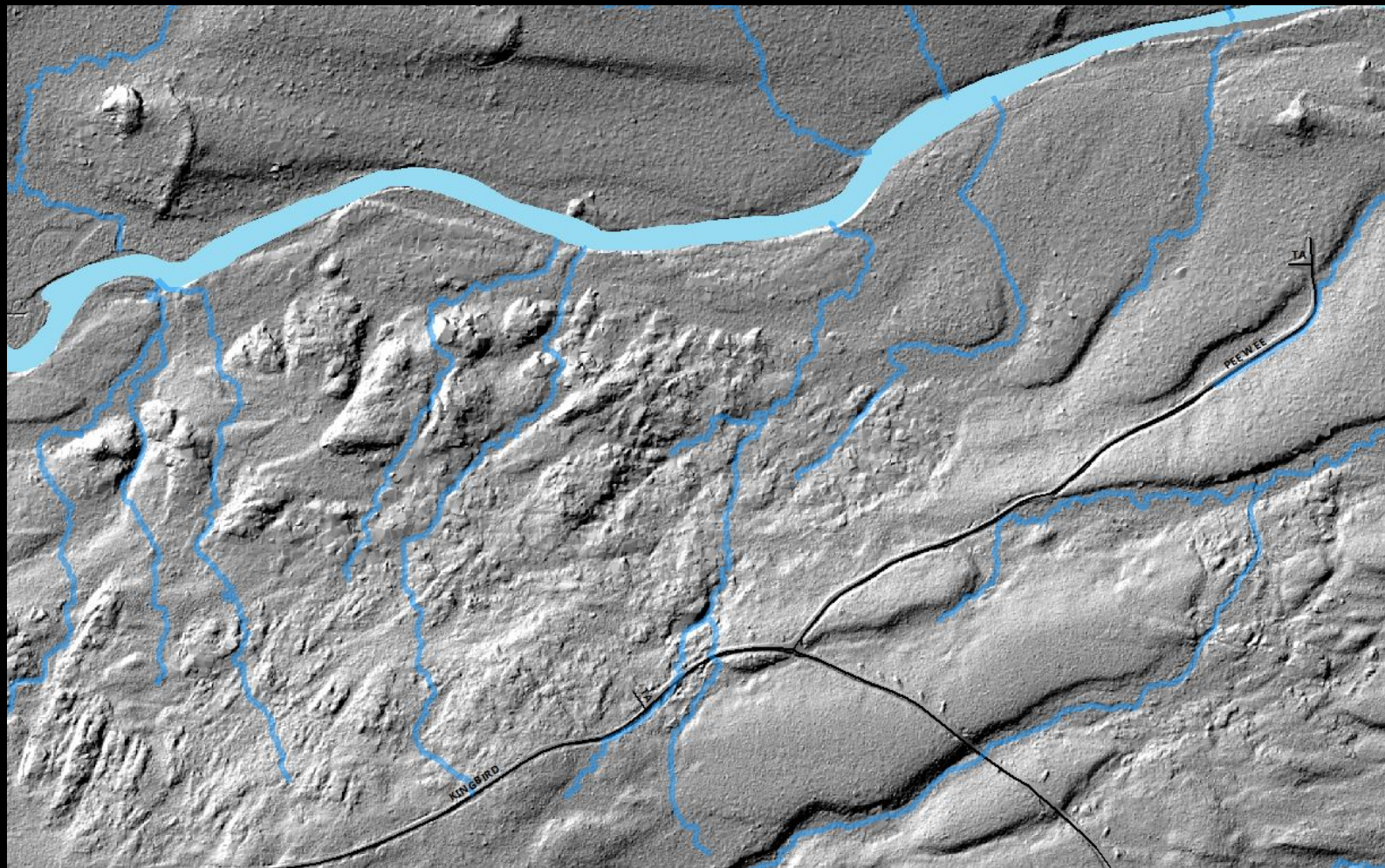


Digital  
Elevation  
Model  
30m->1m

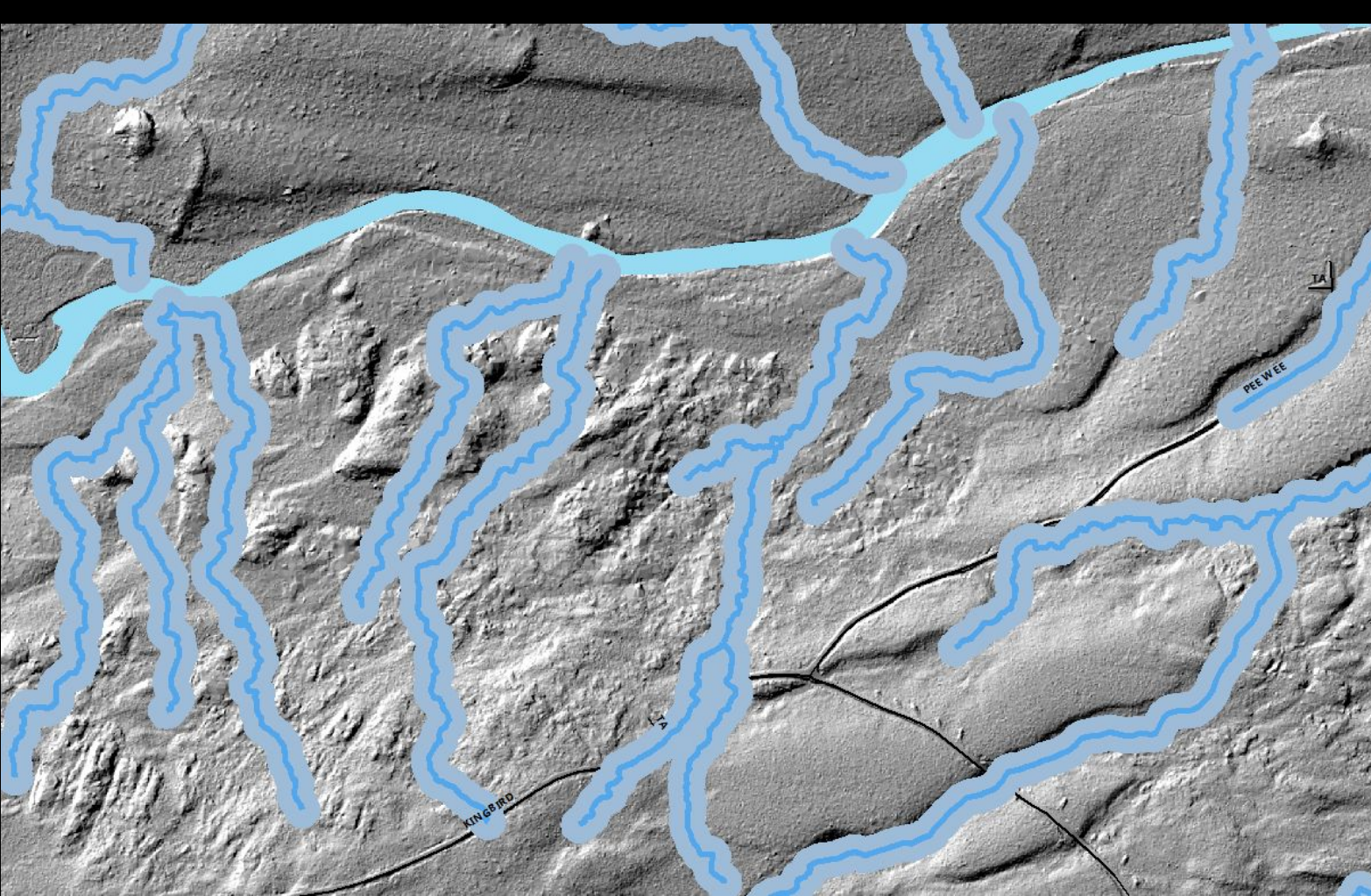
stump  
dumps



Digital  
Elevation  
Model  
30m->1m



stream (over)  
detection



stream (over)  
detection

-enables stream  
buffer specificity  
in our riparian  
guidelines

# Enhanced Forest Inventory

### Layer Properties

General Source Selection Display Symbology **Fields** Definition Query Labels Joins & Relates Time HTML Popup

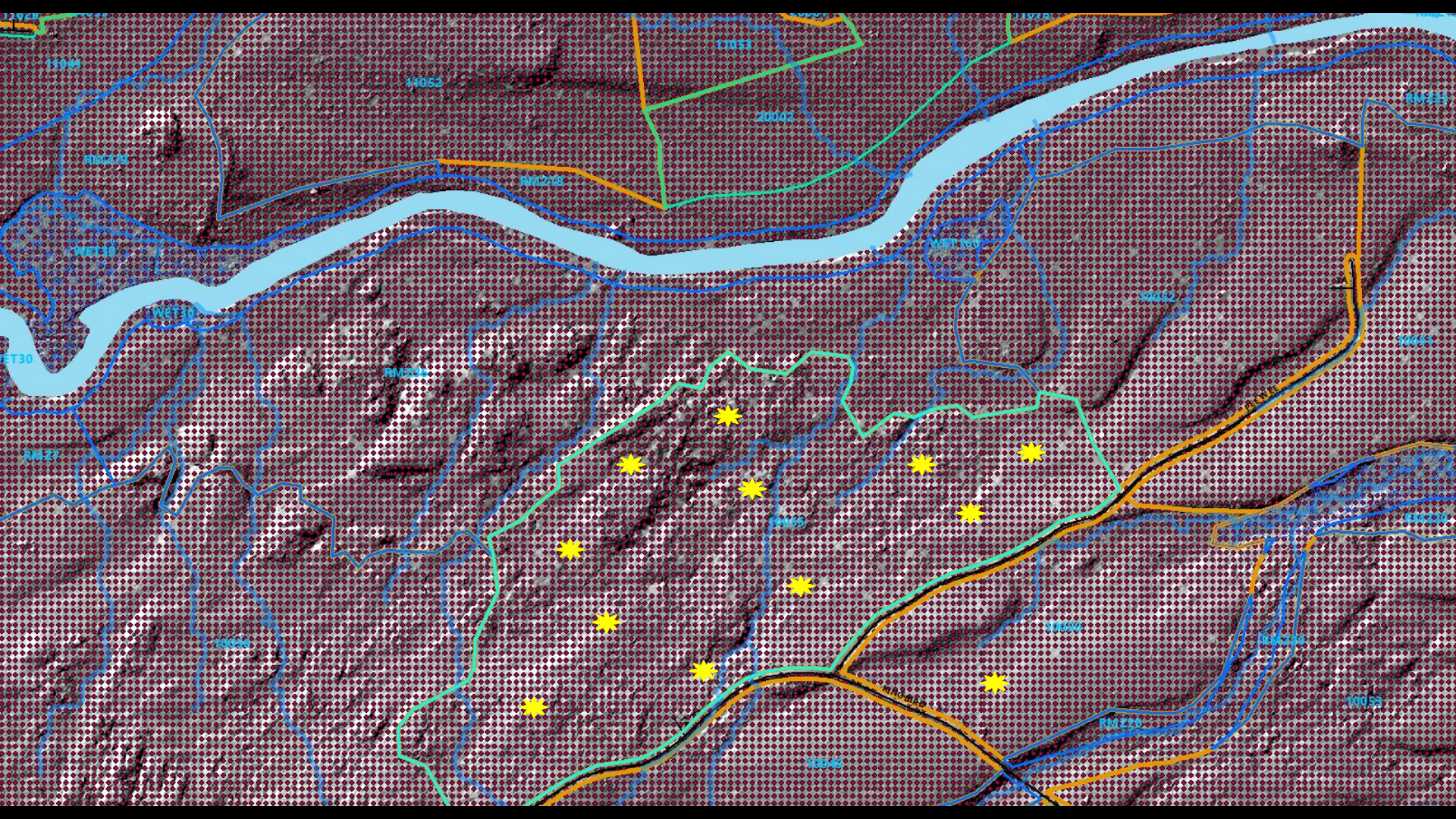
Options

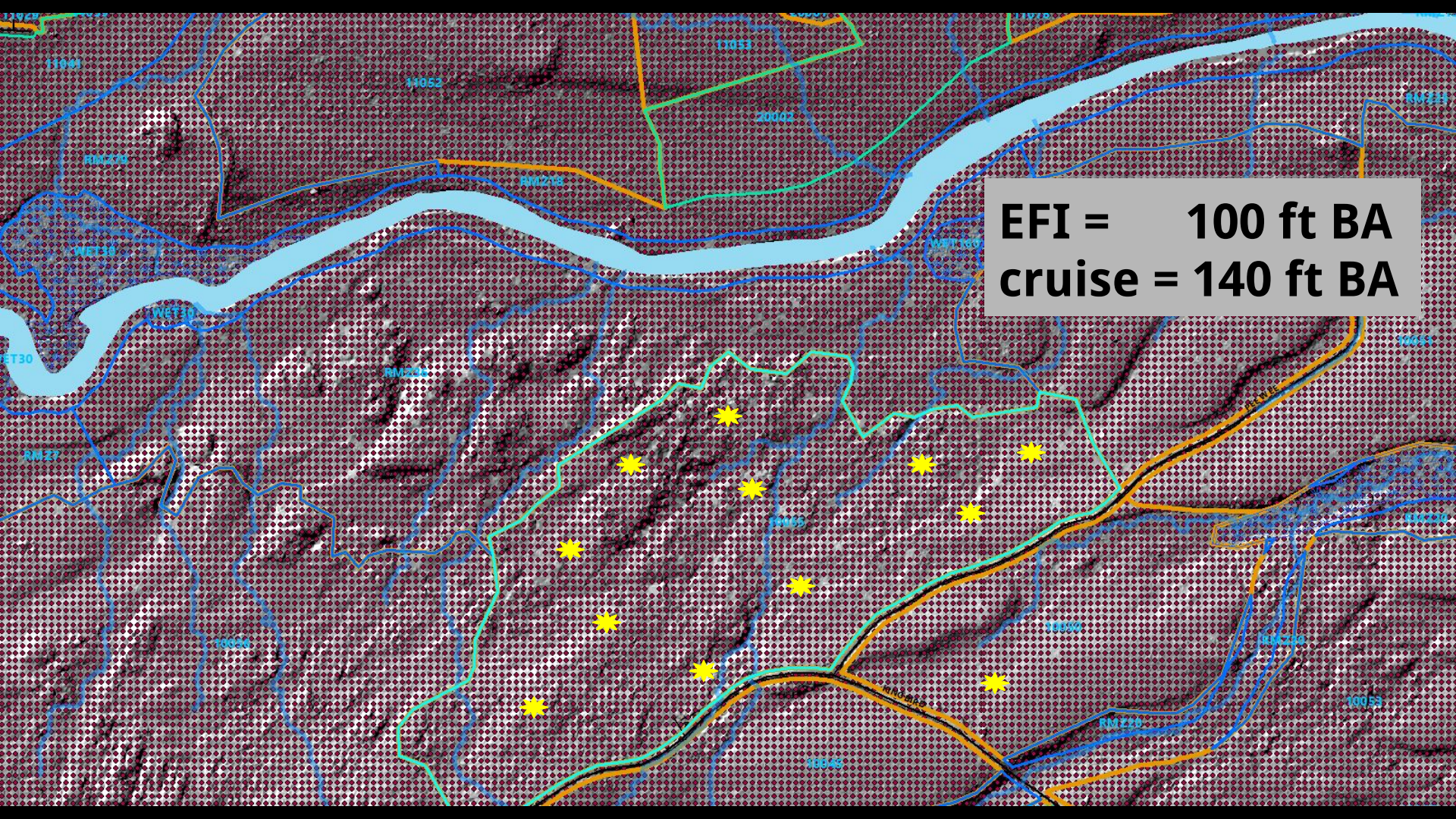
Choose which fields will be visible

- Shape
- Mean\_Ht
- Max\_Ht
- Plot
- Volume
- Biomass
- Basal\_Area
- QMD
- Tree\_Count
- Percent\_WP
- Percent\_SF
- Percent\_SW
- HW\_Per\_Vol
- SF\_Per\_Vol
- WP\_Per\_Vol
- vol

| Appearance |     |
|------------|-----|
| Alias      | FID |
| Highlight  | No  |

| Field Details     |           |
|-------------------|-----------|
| Data Type         | Object ID |
| Name              | FID       |
| Allow NULL Values | No        |





**EFI = 100 ft BA**  
**cruise = 140 ft BA**



# a few different modeling attempts....

UMO

| Model                               | R <sup>2</sup> |
|-------------------------------------|----------------|
| Volume (m <sup>3</sup> )            | .64            |
| Height (m)                          | .69            |
| Biomass (kg)                        | .64            |
| Basal Area (m <sup>2</sup> )        | .61            |
| QMD (cm)                            | .54            |
| Tree Count                          | .43            |
| Percent Softwood (%)                | .66            |
| Percent Spruce/Fir (%)              | .53            |
| Percent White Pine (%)              | .43            |
| Hardwood Volume (m <sup>3</sup> )   | .65            |
| Spruce/Fir Volume (m <sup>3</sup> ) | .66            |
| White Pine Volume (m <sup>3</sup> ) | .39            |

Sewall

almost all below .33

**tabled for now....**

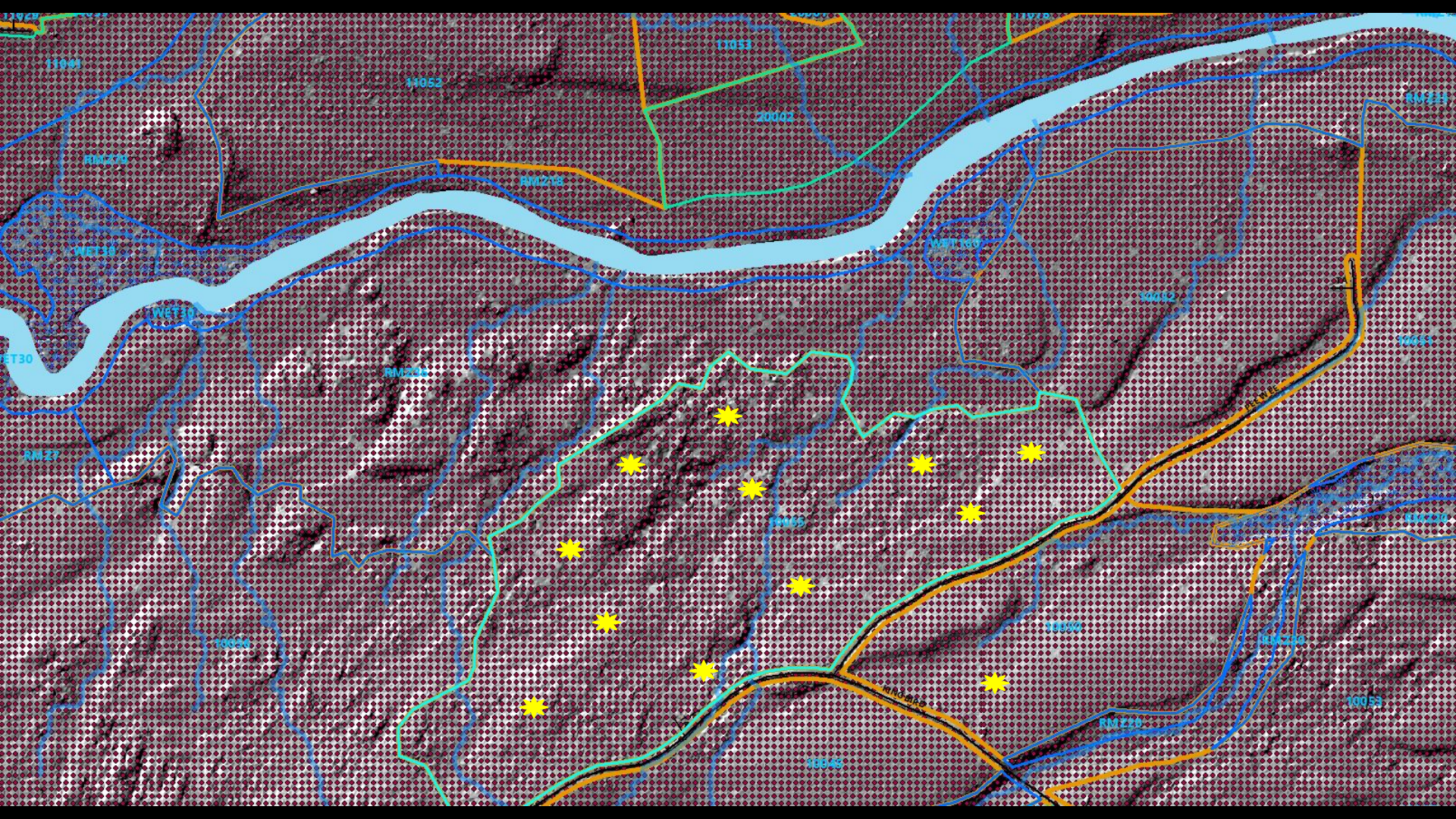
eventually

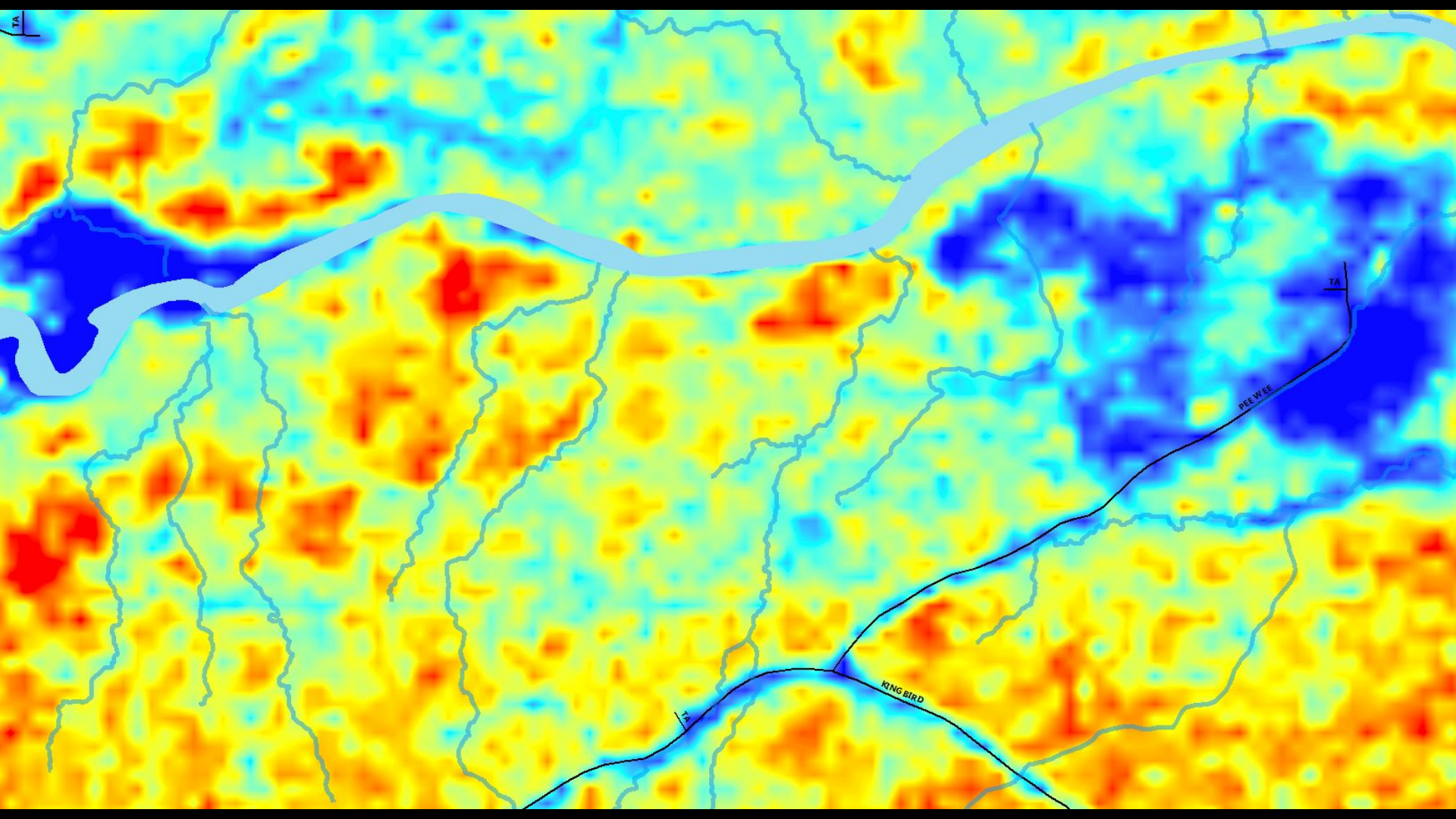
density

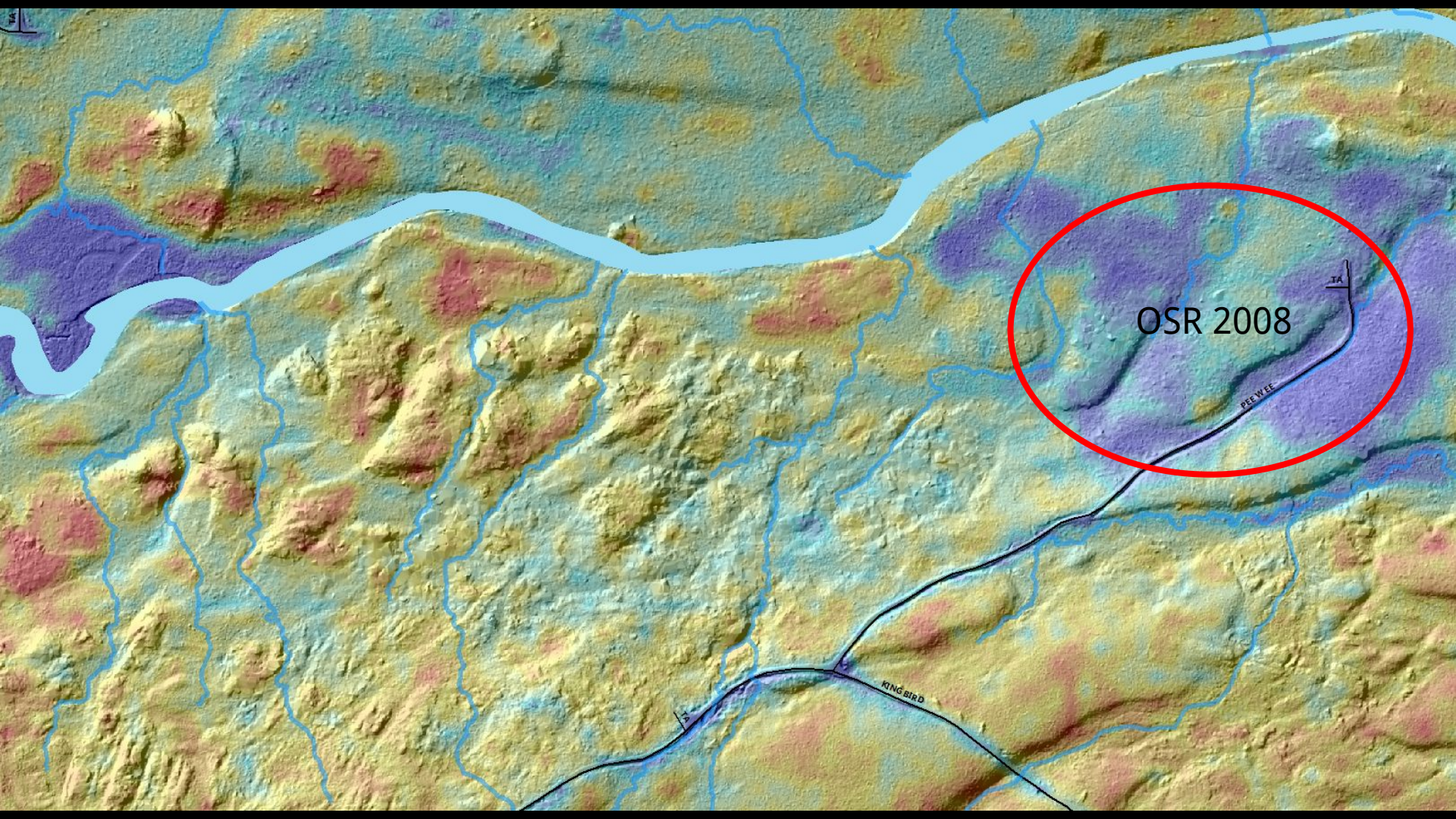
volume

regeneration height

wildlife structural characteristics







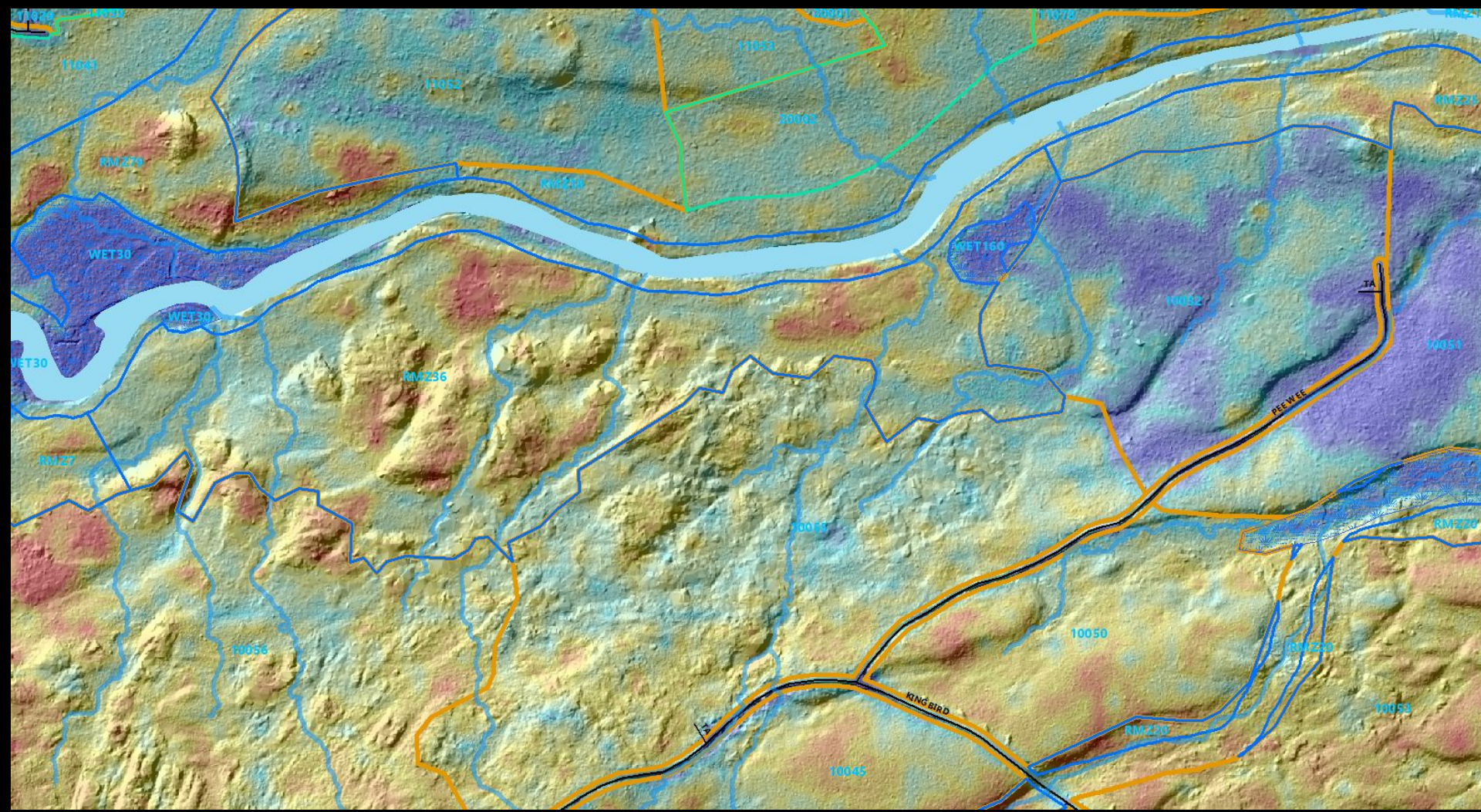
OSR 2008

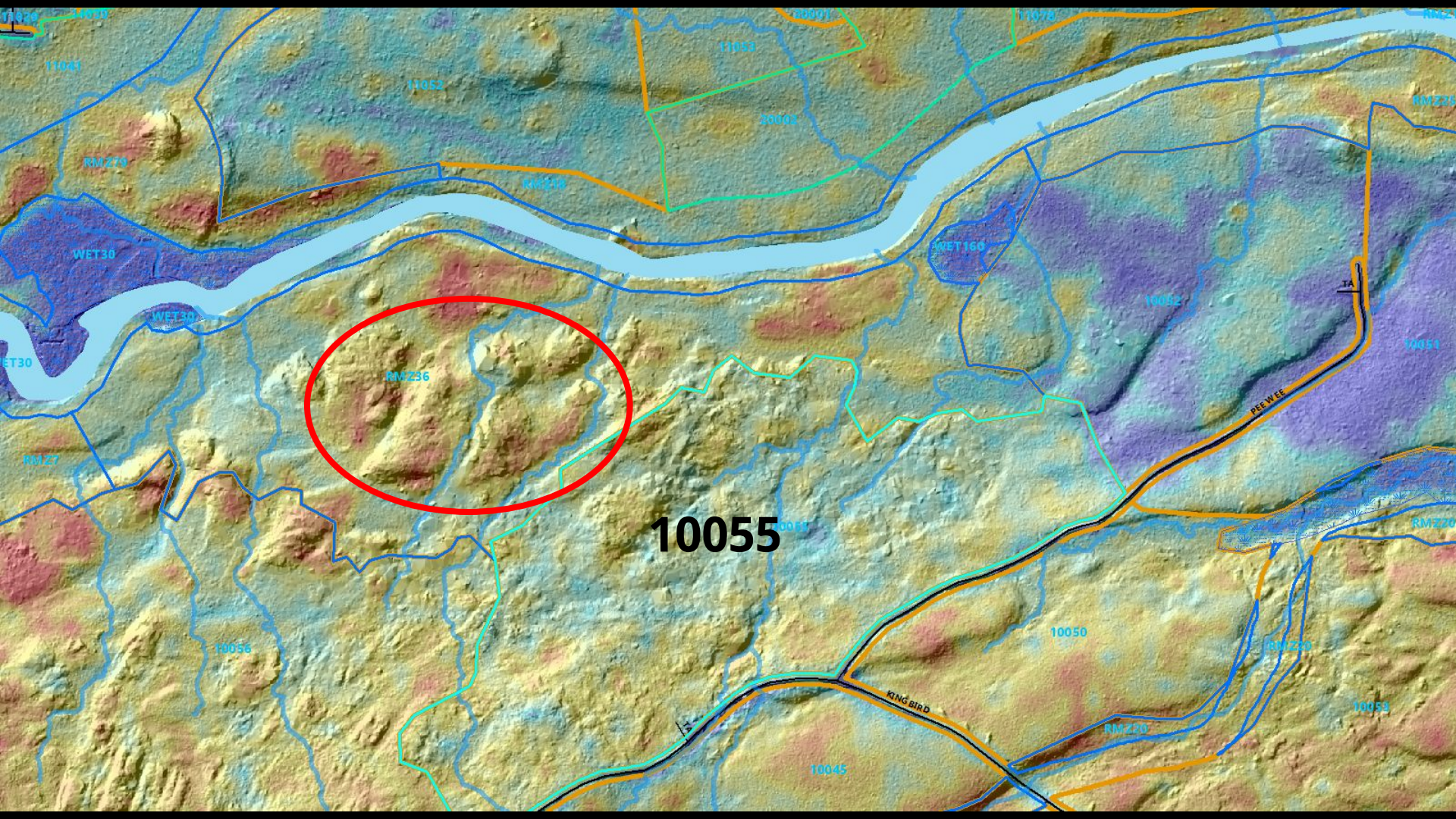
PEE WEE

RING BIRD

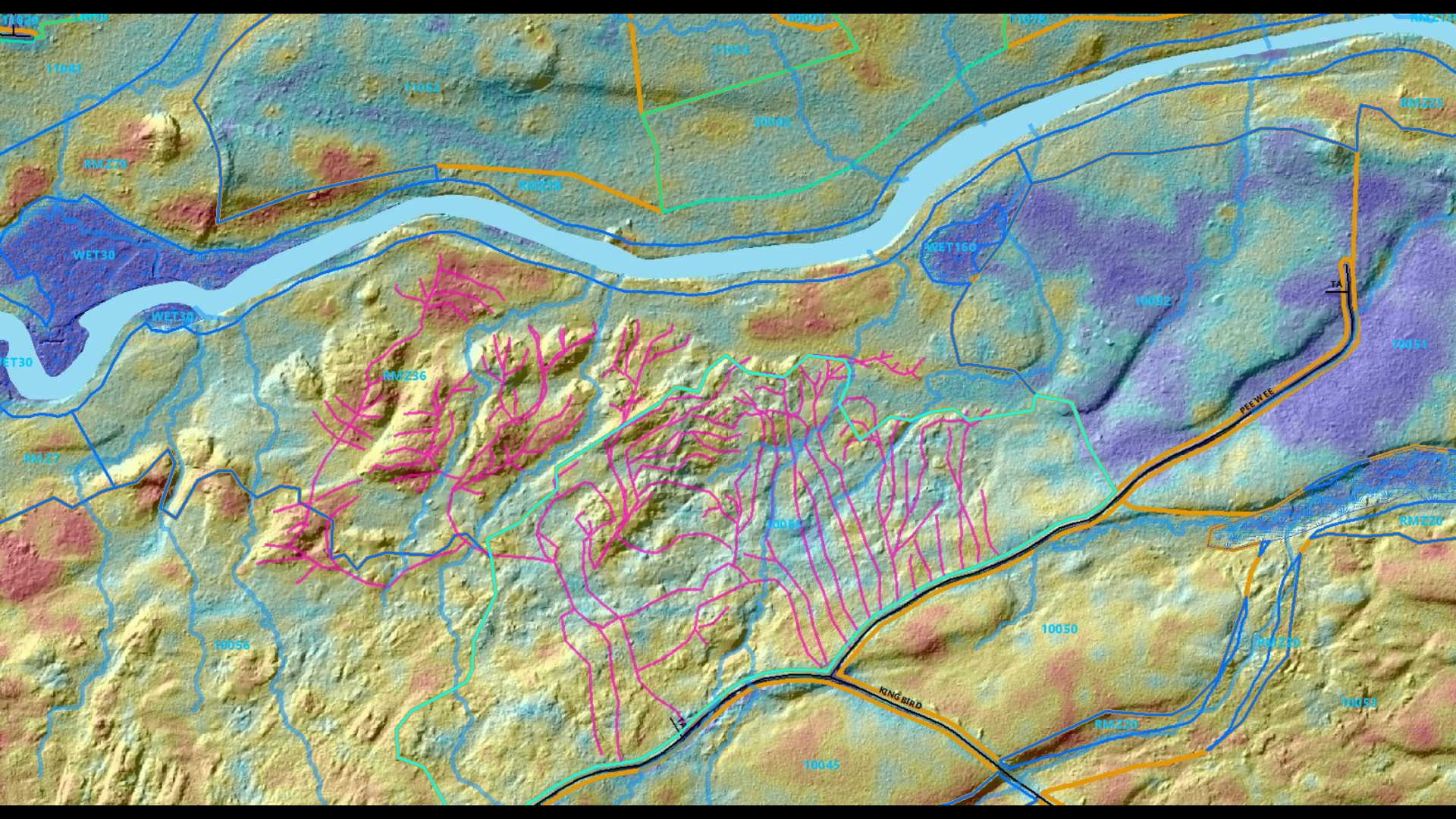
TA

TA



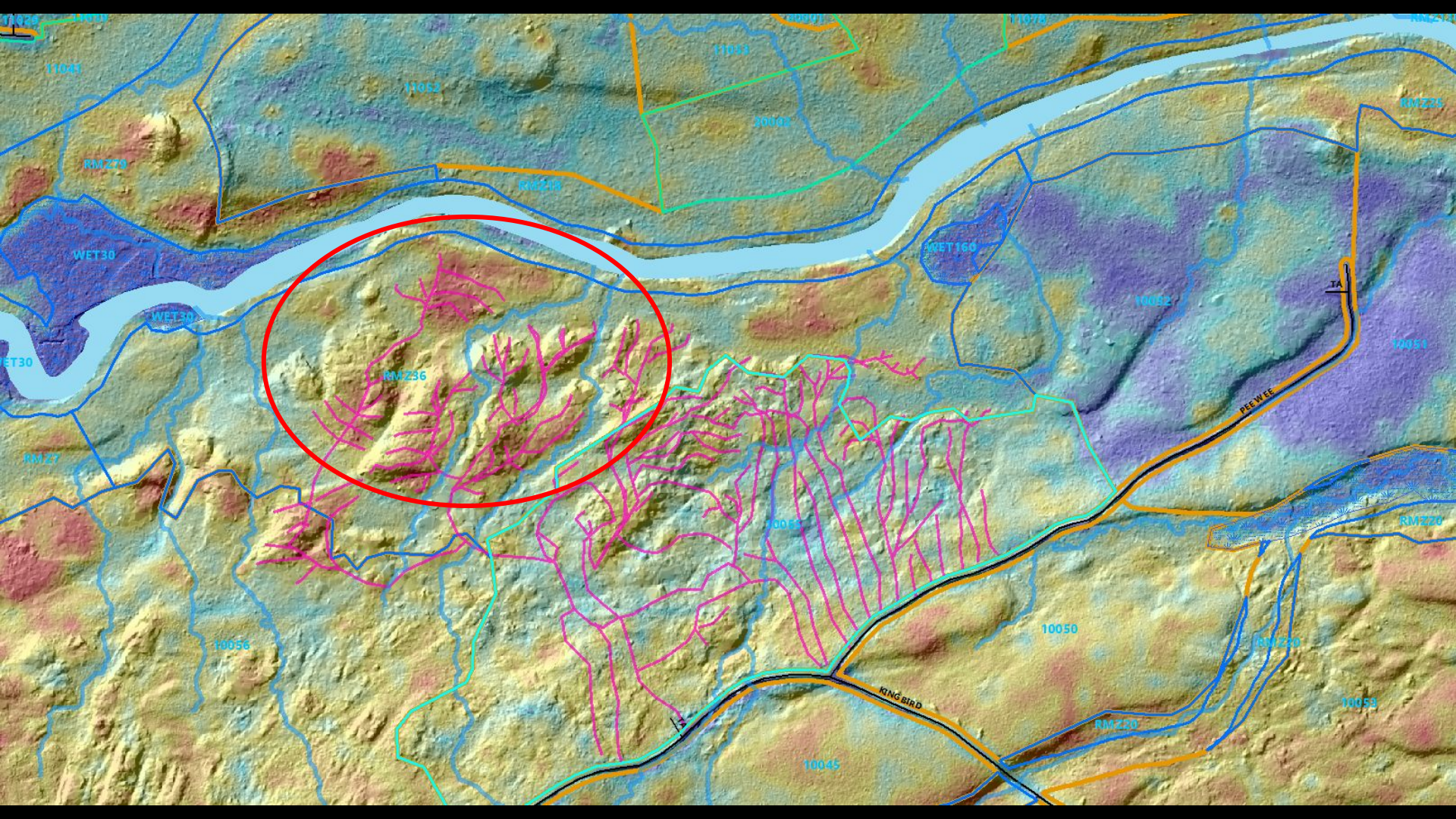


10055





used this to find volume handy to the stand we were in.

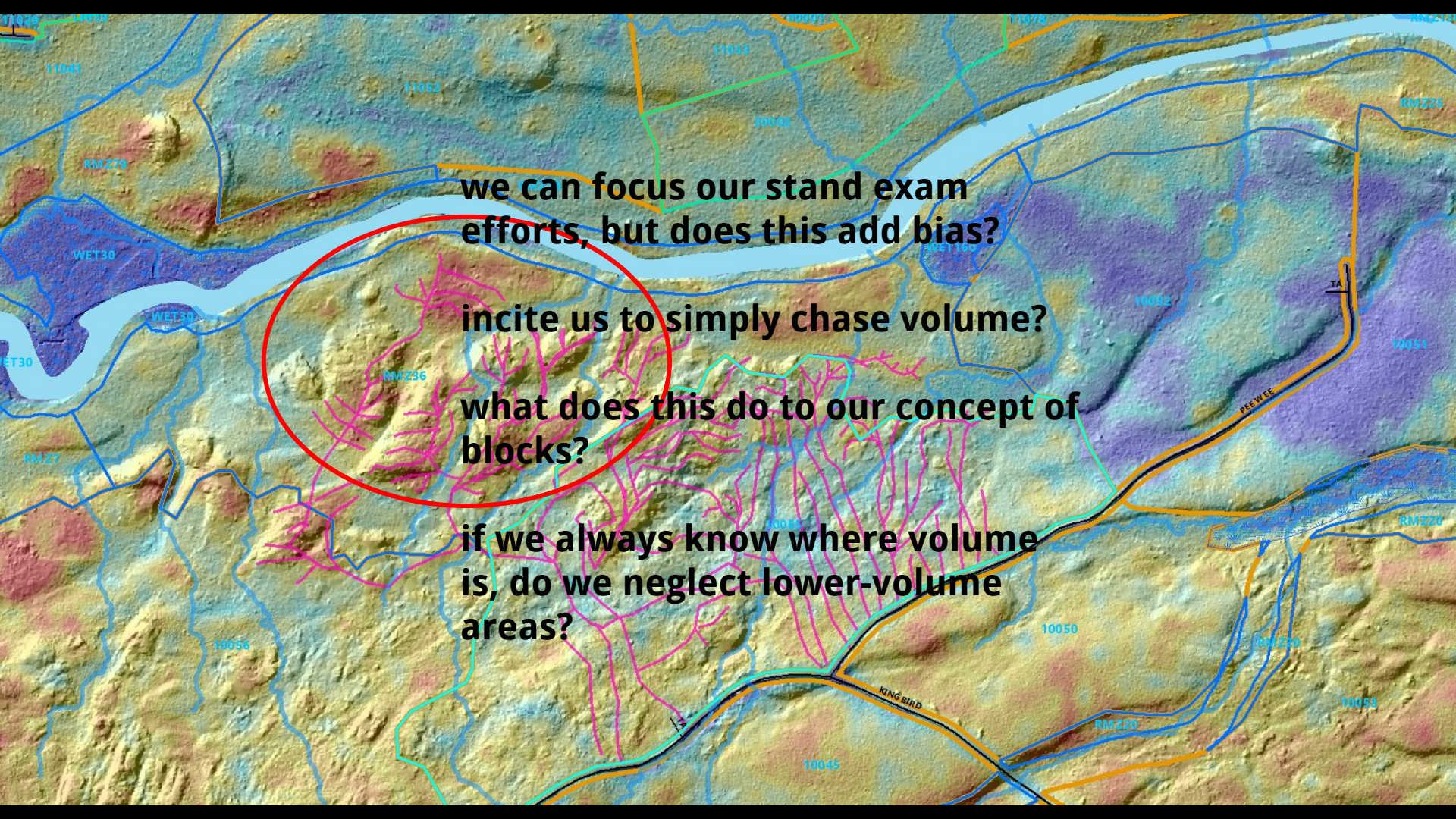


using this to identify areas of a stand to examine pre-harvest.

when particular chunks determined to be uniform  
in composition, regen, and structure,  
we have used this to reduce layout time by putting a trail into a  
microstand, and allowing the operator to create trail structure  
within microstand (with limits).

**what are the unintended  
consequences of using these  
images to focus our**

**stand exams  
harvest queue selection  
layout  
?**

A topographic map showing terrain elevation with various contour lines and labels. A red circle highlights a specific area in the center-left. Overlaid on the map are four lines of bold black text, each followed by a question mark. The text is centered horizontally and vertically within the map's frame. The map features labels such as 'WET30', 'RM236', '10052', '10051', '10050', '10045', '10056', '10043', '11043', '11041', '11042', '11044', '11045', '11046', '11047', '11048', '11049', '11050', '11051', '11052', '11053', '11054', '11055', '11056', '11057', '11058', '11059', '11060', '11061', '11062', '11063', '11064', '11065', '11066', '11067', '11068', '11069', '11070', '11071', '11072', '11073', '11074', '11075', '11076', '11077', '11078', '11079', '11080', '11081', '11082', '11083', '11084', '11085', '11086', '11087', '11088', '11089', '11090', '11091', '11092', '11093', '11094', '11095', '11096', '11097', '11098', '11099', '11100', '11101', '11102', '11103', '11104', '11105', '11106', '11107', '11108', '11109', '11110', '11111', '11112', '11113', '11114', '11115', '11116', '11117', '11118', '11119', '11120', '11121', '11122', '11123', '11124', '11125', '11126', '11127', '11128', '11129', '11130', '11131', '11132', '11133', '11134', '11135', '11136', '11137', '11138', '11139', '11140', '11141', '11142', '11143', '11144', '11145', '11146', '11147', '11148', '11149', '11150', '11151', '11152', '11153', '11154', '11155', '11156', '11157', '11158', '11159', '11160', '11161', '11162', '11163', '11164', '11165', '11166', '11167', '11168', '11169', '11170', '11171', '11172', '11173', '11174', '11175', '11176', '11177', '11178', '11179', '11180', '11181', '11182', '11183', '11184', '11185', '11186', '11187', '11188', '11189', '11190', '11191', '11192', '11193', '11194', '11195', '11196', '11197', '11198', '11199', '11200'.

**we can focus our stand exam  
efforts, but does this add bias?**

**incite us to simply chase volume?**

**what does this do to our concept of  
blocks?**

**if we always know where volume  
is, do we neglect lower-volume  
areas?**

