

Mapping pecan orchards in South Africa

Craig Shephard & Abbie Rankin – University of New England

SAPPA 2024 Symposium



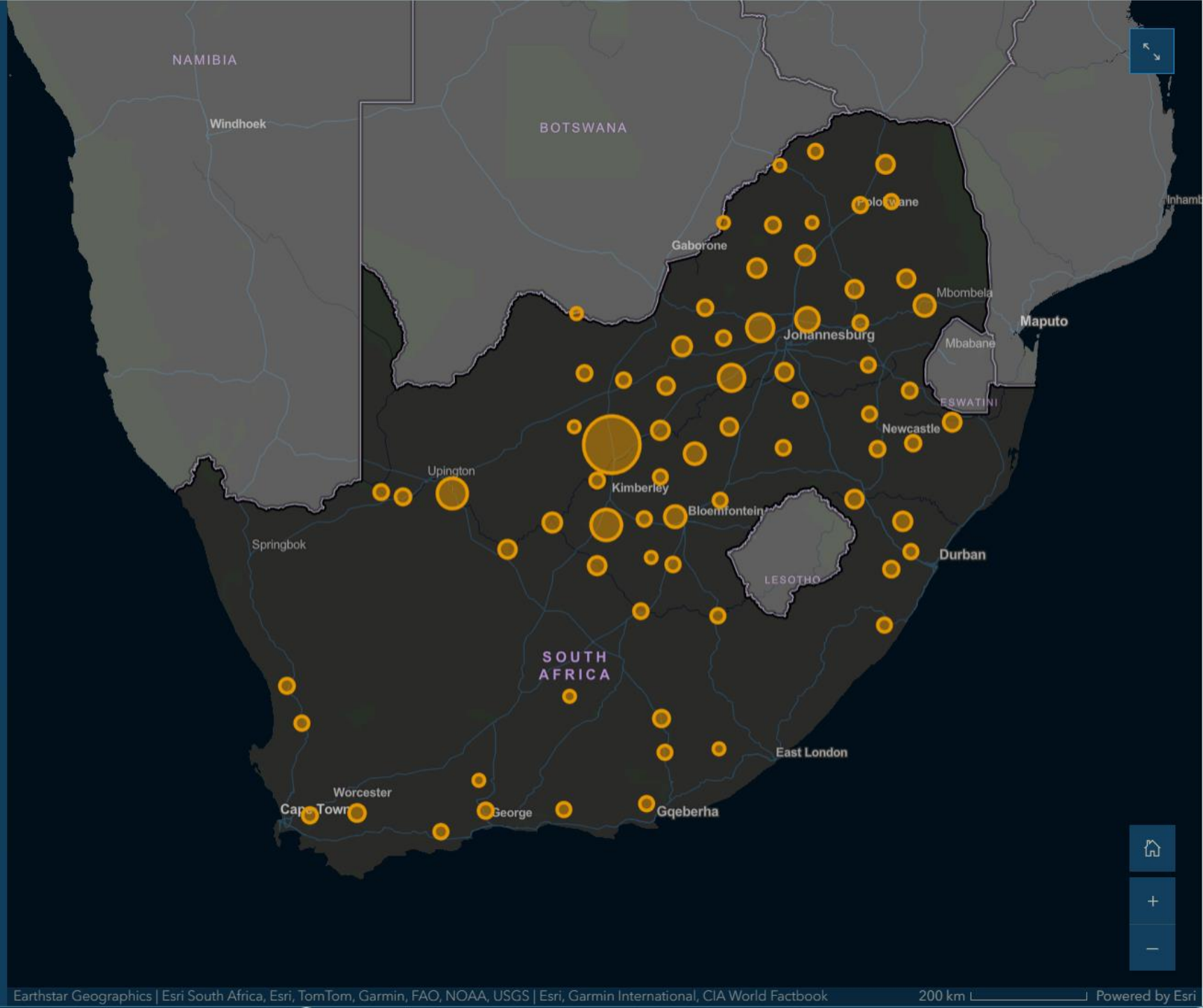
AARSC have completed the draft map of Pecans!

What does the map show?

“
*Just the location and extent
of all commercial pecan
orchards...*

The map is **dynamic**. It does
not show **individual** orchards.

“
*No personal or commercial
information is included in the
map, it doesn't need it!*



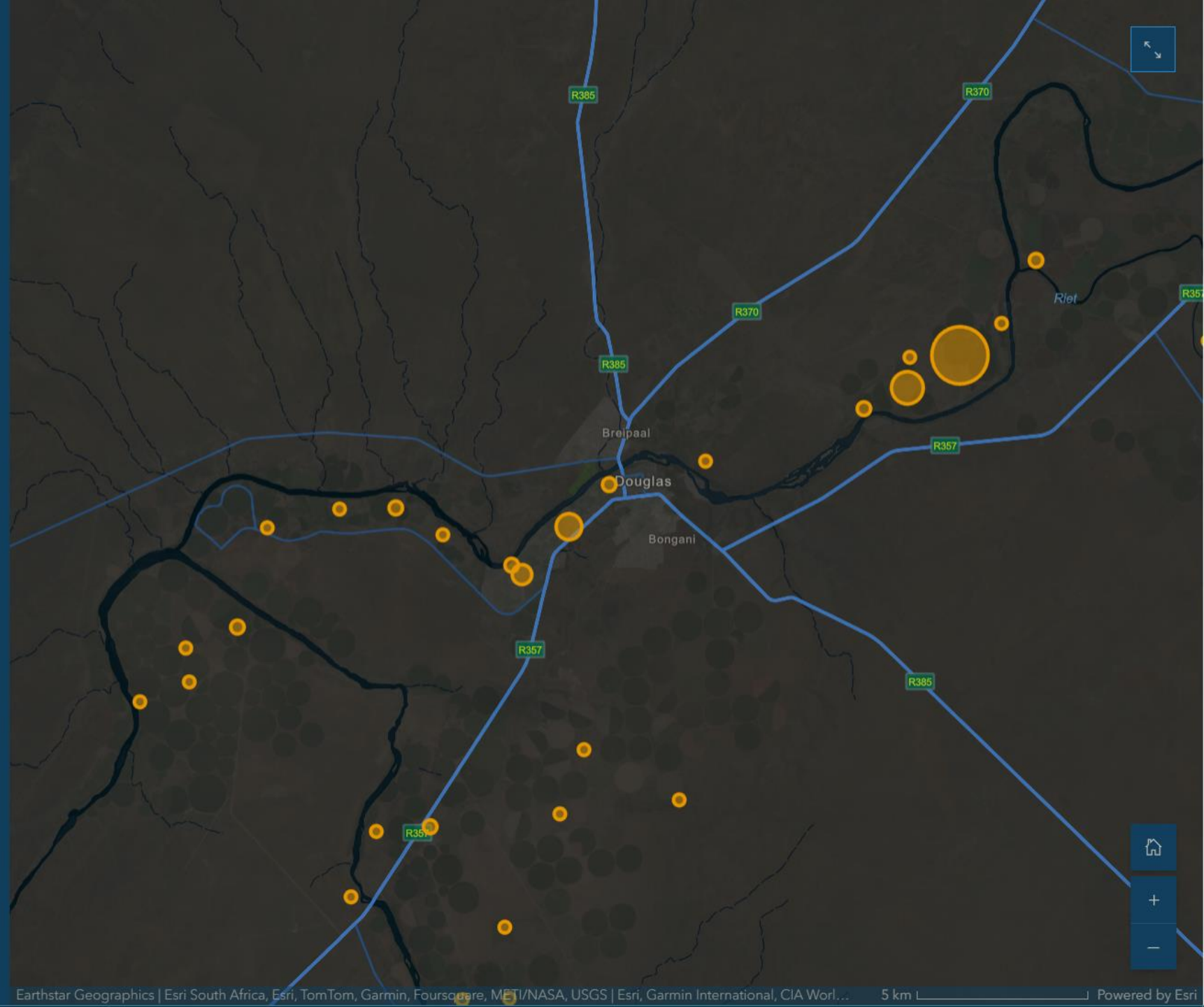
AARSC have completed the draft map of Pecans!

What does the map show?

“
Just the location and extent of all commercial pecan orchards...

The map is ⊗ **dynamic**. It does not show ⊕ **individual** orchards.

“
No personal or commercial information is included in the map, it doesn't need it!



AARSC have completed the draft map of Pecans!

What does the map show?

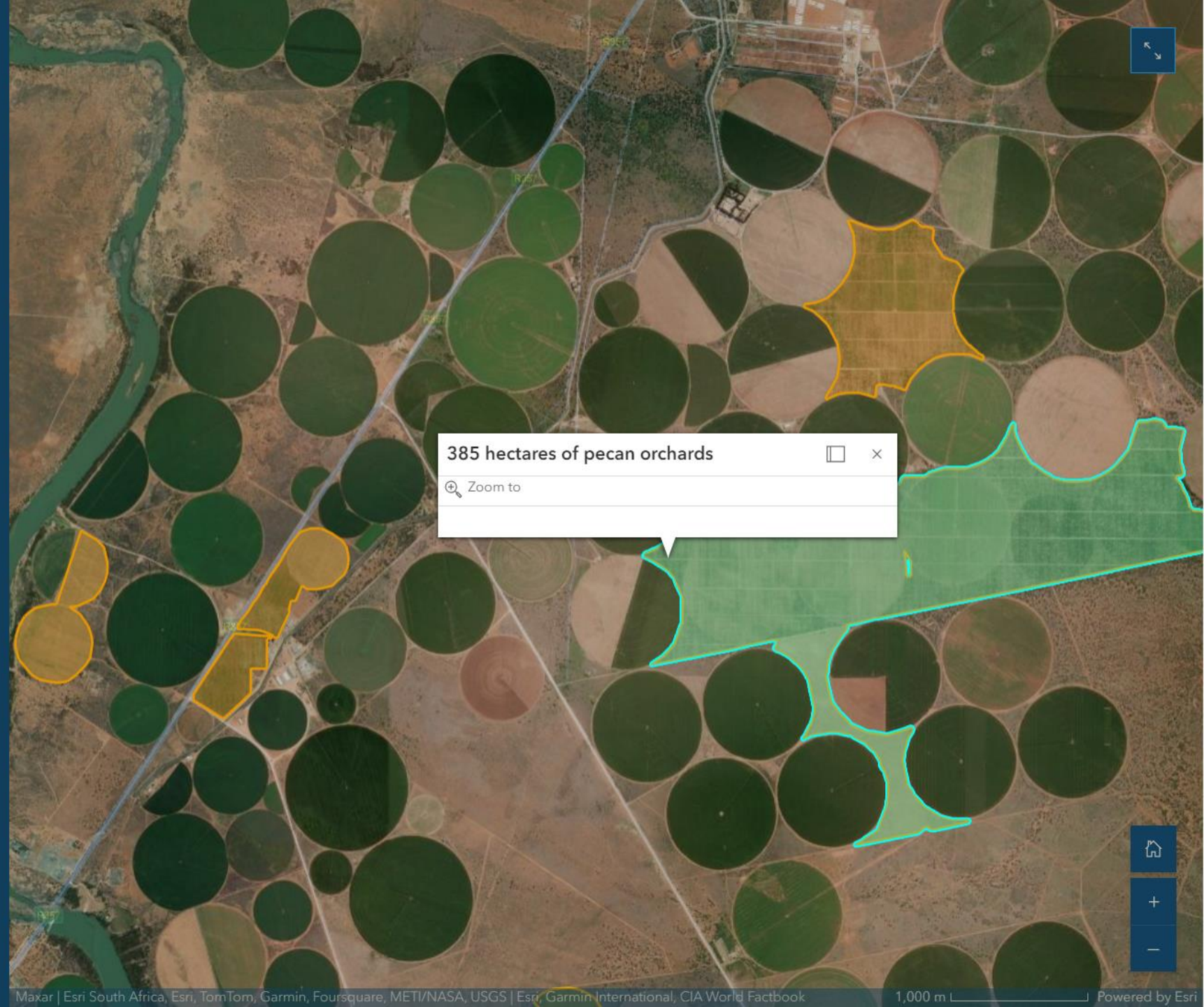
“

Just the location and extent of all commercial pecan orchards...

The map is **dynamic**. It does not show **individual** orchards.

“

No personal or commercial information is included in the map, it doesn't need it!



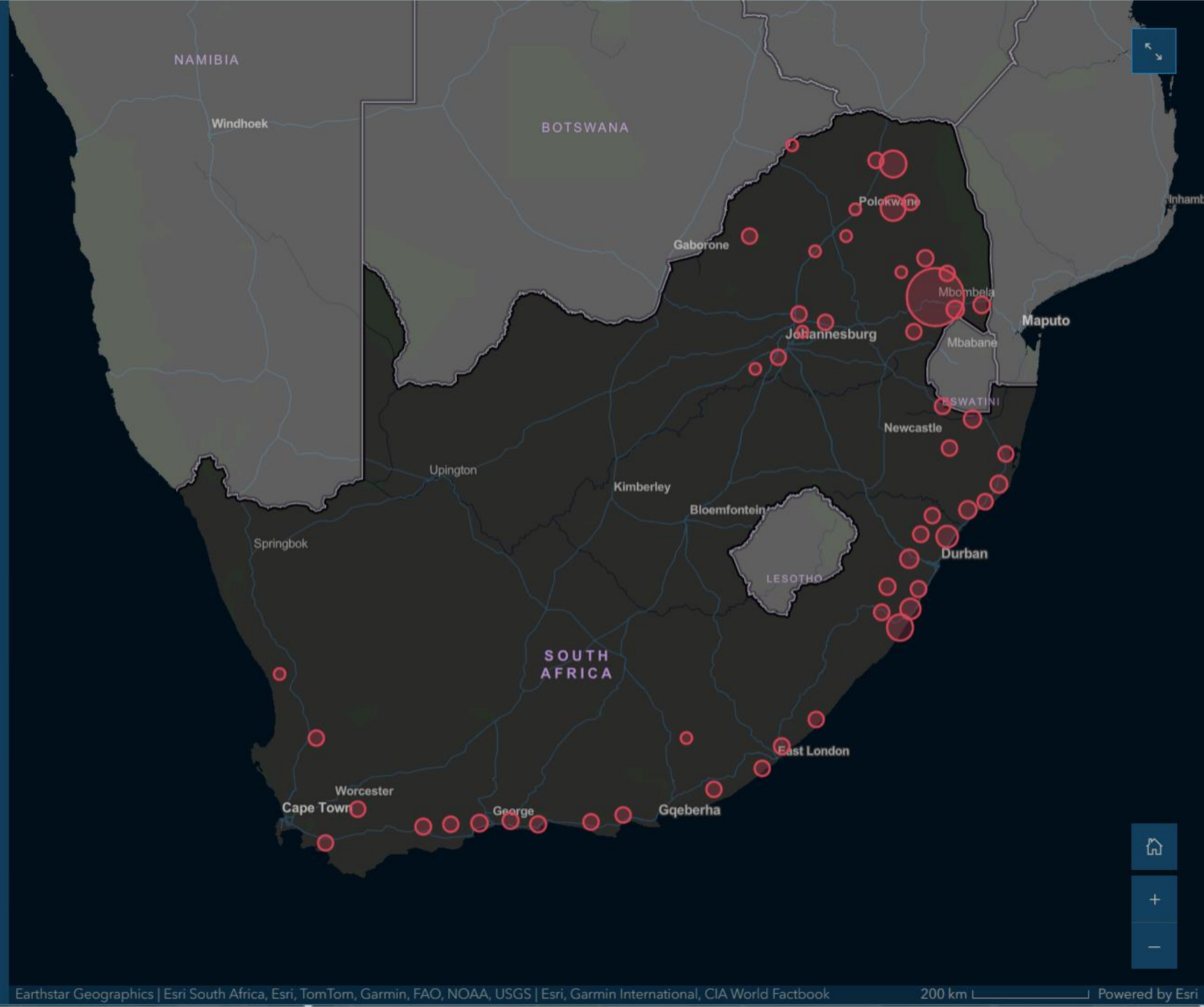
Mapping tree crops in South Africa is not new...

AARSC have built the first baseline map of **macadamia** orchards for SAMAC.



1st published in February 2023

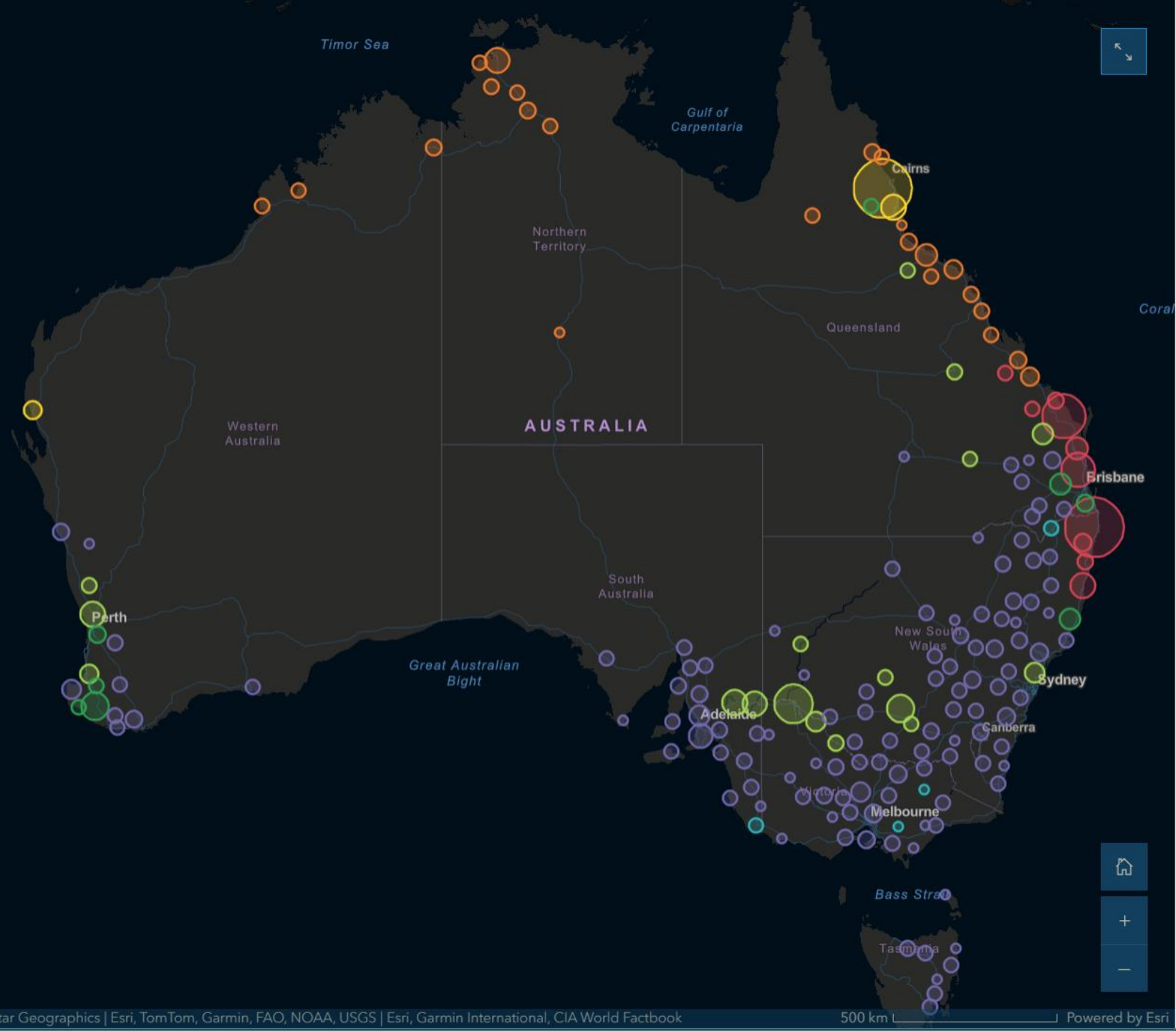
And follows the same work in Australia...



The Australian Tree Crop Map
was first published in 2017, and
now includes:

- avocado
- banana
- citrus
- macadamia
- mango
- olive
- truffle

“
*These maps inform decisions
that solve problems – at
national, regional and local
scales. But first...*



Why do you need a map?

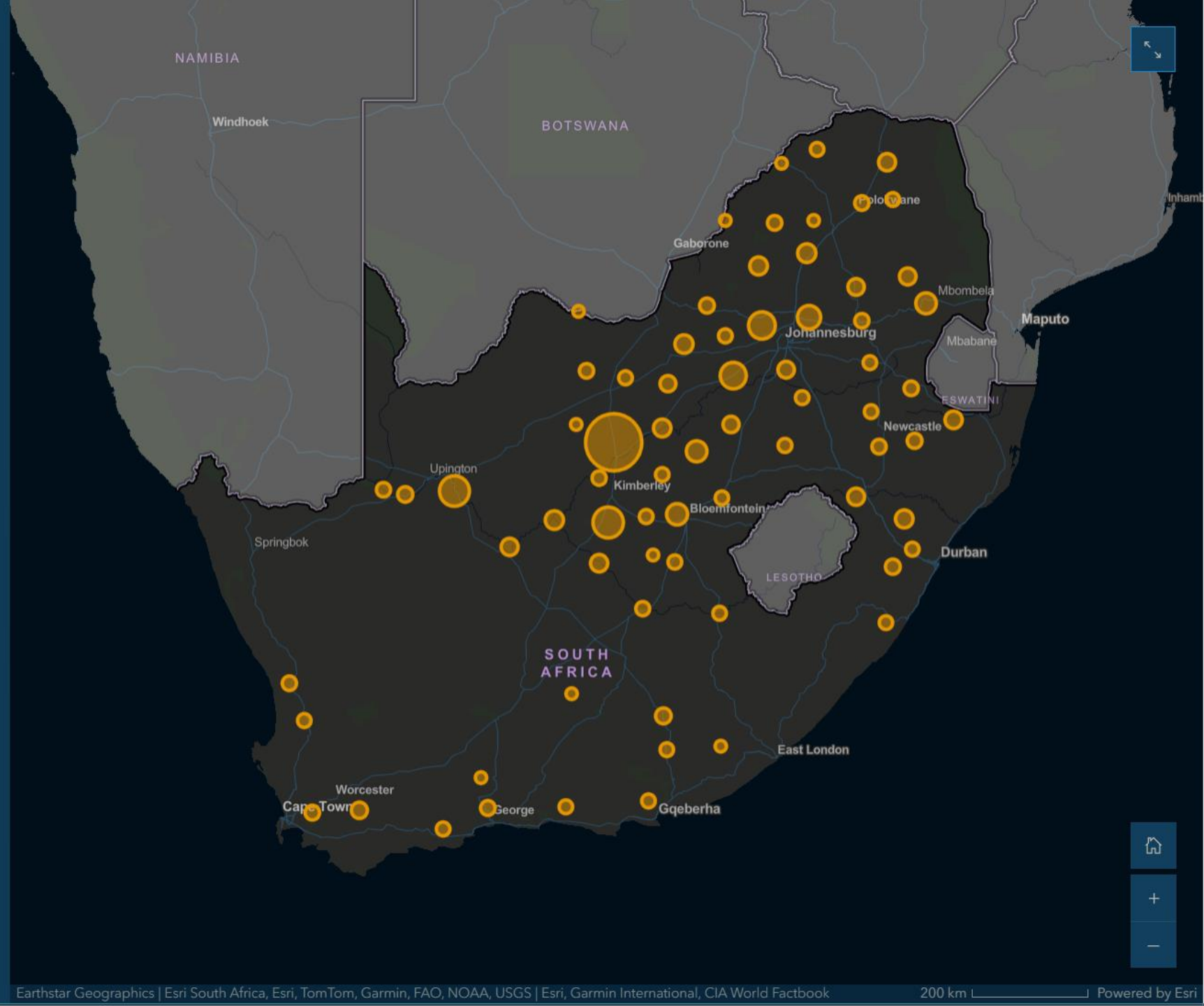
Industry know where you –
their growers are, but what
about your orchards?

“

*How can industry effectively
manage their crop without
knowing **where** the orchards
are?*

Making data-driven decisions
requires a geographical
approach...

You need a map!



How many pecans in RSA?

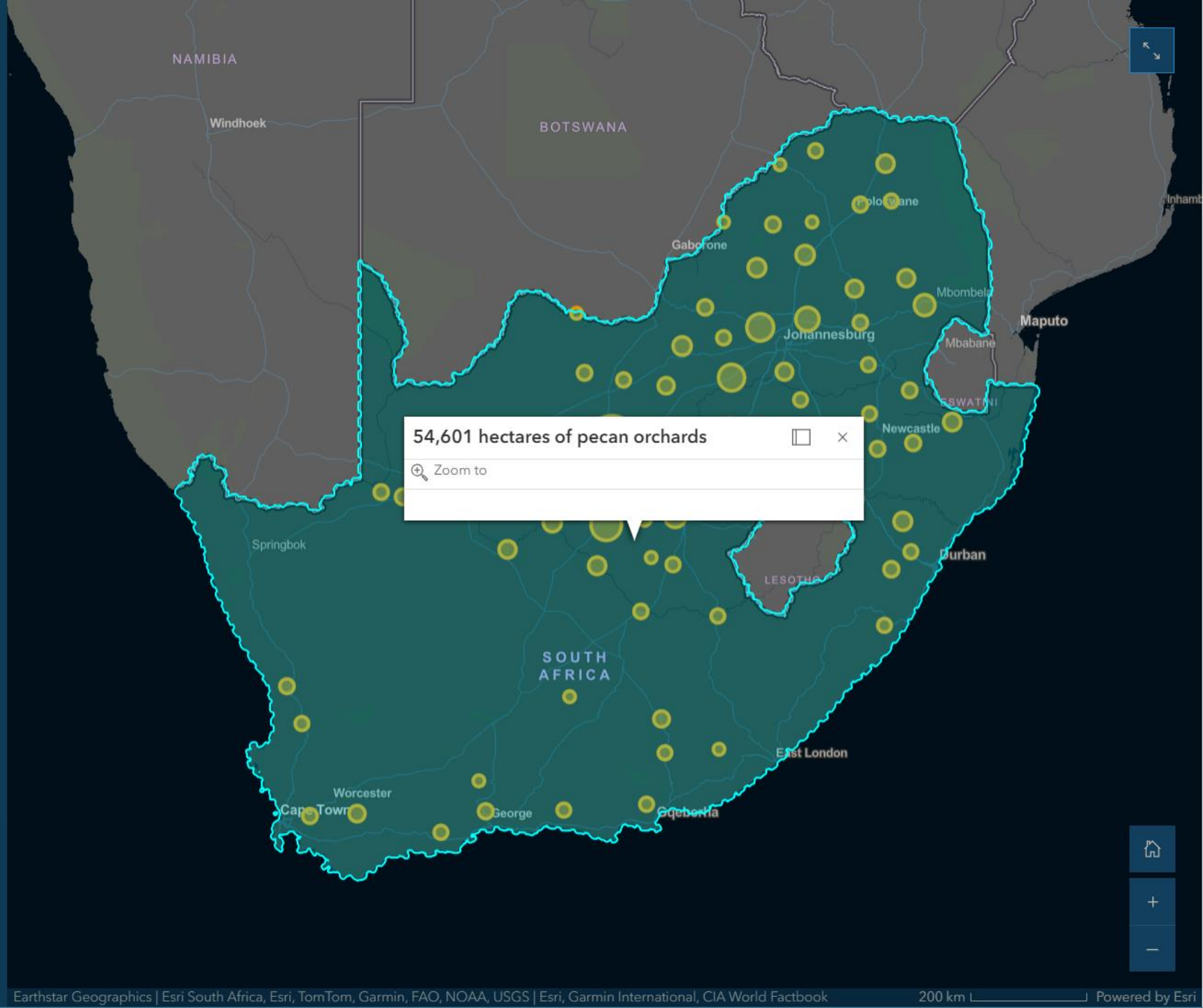
SAPPA's estimate for size of the industry was:

~42,000 – 45,000 hectares

AARSC have **drafted...**

– Area of production by

⊕ region



How many pecans in RSA?

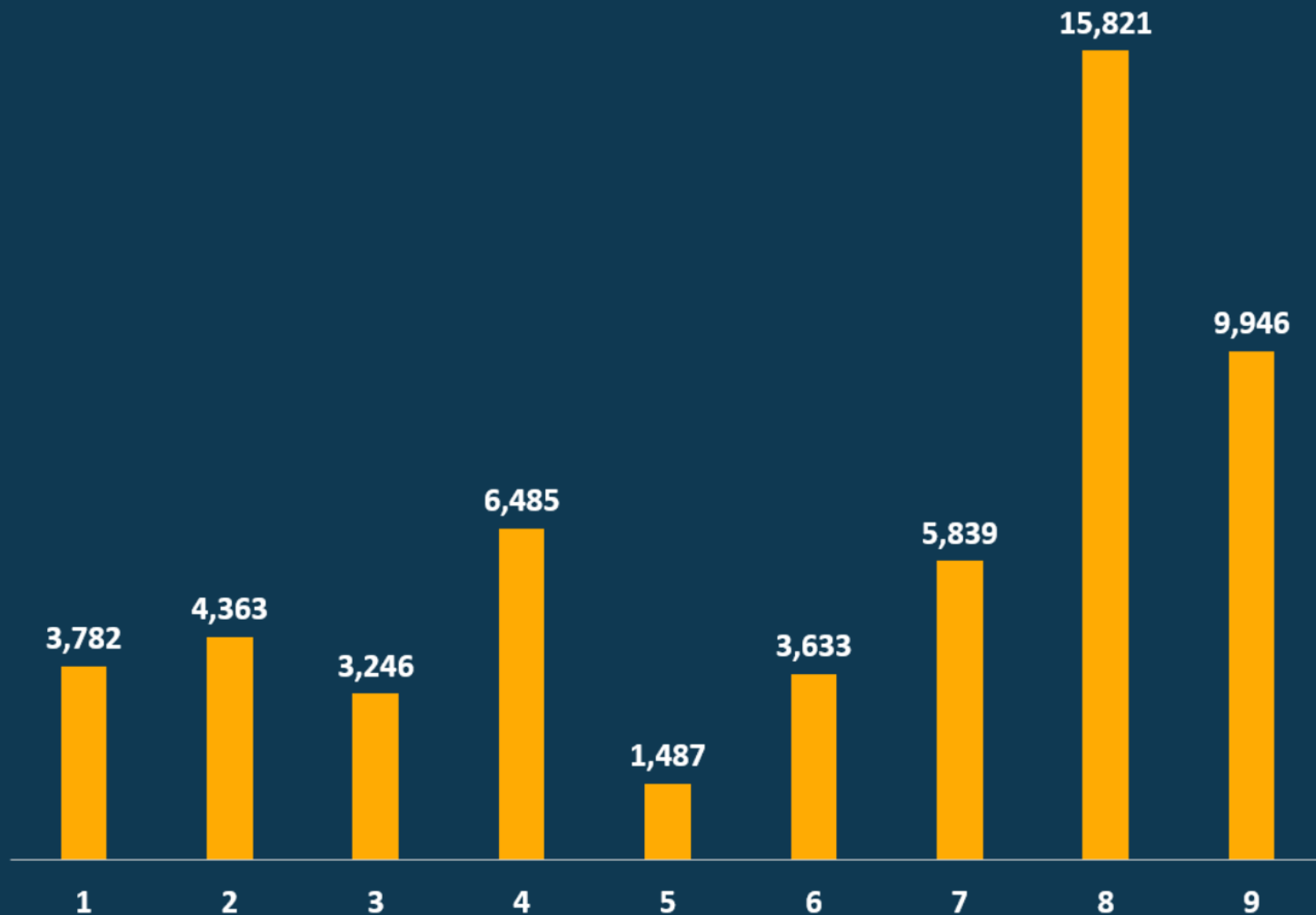
SAPPA's estimate for size of the industry was:

~42,000 – 45,000 hectares

AARSC have drafted...

– Area of production by

⊗ region



Mapping methodology

Variations in tree crop type, age, cultivar and land management practice (e.g. row/tree spacing, hedging) greatly influence the appearance of tree crops in imagery...

“

*Is it a pecan orchard...? Or
avocado, almond,
macadamia, pistachio, citrus,
etc...?*



How do we do it?

“

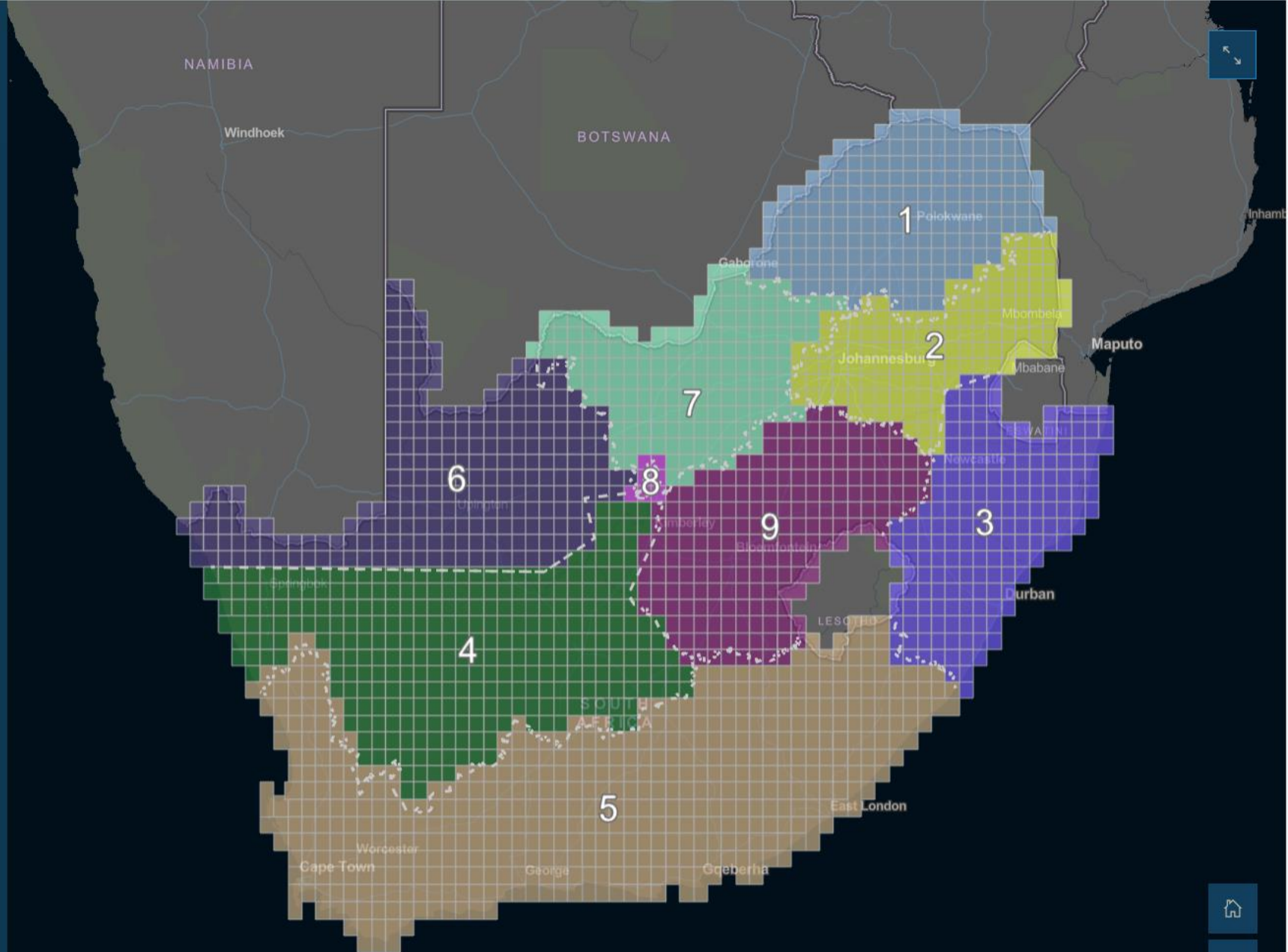
To accurately classify tree crops we use multiple-sources of evidence to inform the map.

Progress is managed by a map-tile grid, prioritised by

⊗ **SAPPA Region**

Sources:

1. ⊕ **Imagery**
2. Ancillary data
3. Peer review
4. Field validation



How do we do it?

“
To accurately classify tree
crops we use multiple-sources
of evidence to inform the
map.”

Progress is managed by a map-
tile grid, prioritised by
+ **SAPPA Region**

Sources:

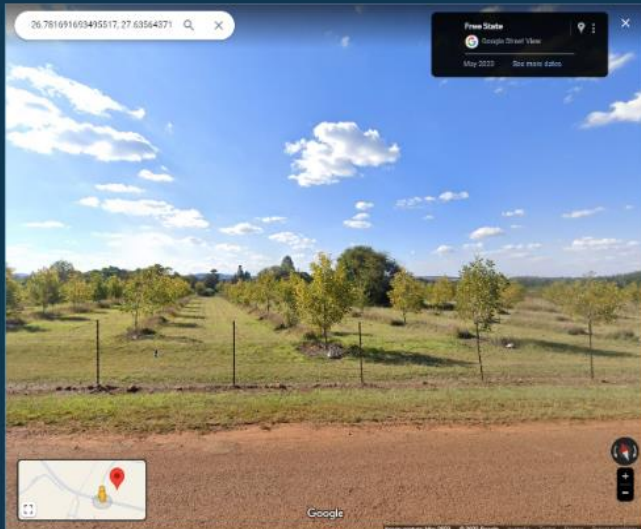
1. ⊗ **Imagery**
2. Ancillary data
3. Peer review
4. Field validation



Imagery

Publicly accessible (free) high-resolution imagery, including:

- Google Earth
-  **Esri Basemaps** (as shown here)
- and even Google  **Street-view!**



© Google Street-view (May 2023) – Free State, RSA



Imagery

Publicly accessible (free) high-resolution imagery, including:

- Google Earth
- **Esri Basemaps** (as shown here)
- and even Google **Street-view!**



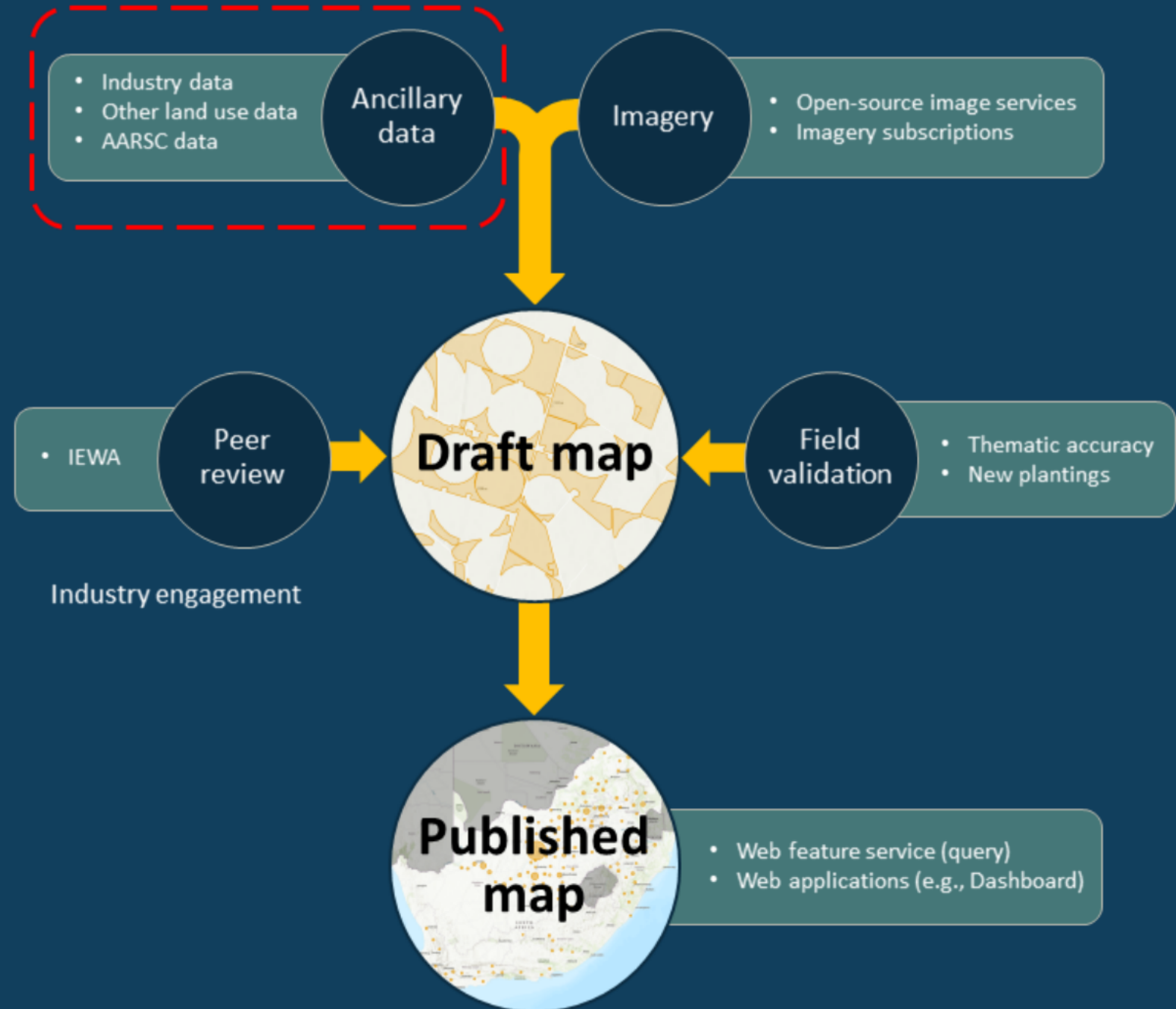
© Google Street-view (May 2023) – Free State, RSA



How do we do it?

Sources:

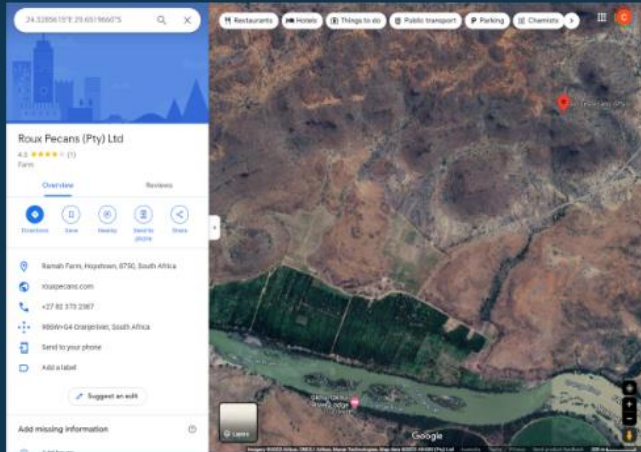
1. Imagery
2. Ancillary data
3. Peer review
4. Field validation



Google Maps

Q. Which tree crop is it?

A. Google Maps!



© Google Maps – Northern Cape, RSA

www.rouxpecans.com

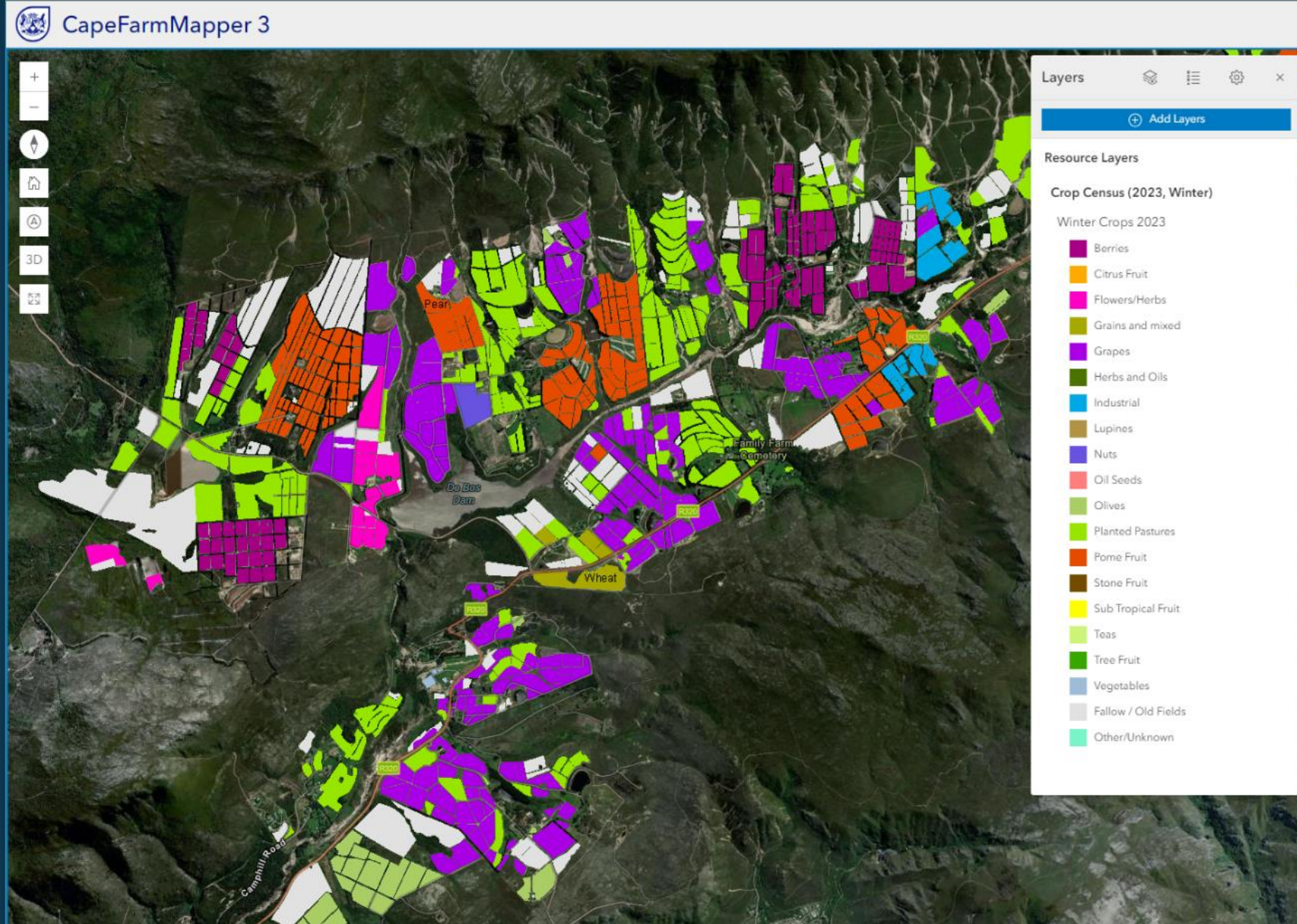


Other land use data

Cape Farm Mapper

Ag Census, c/o Western Cape
Dept. of Agriculture

“
Includes Pecan nuts...”

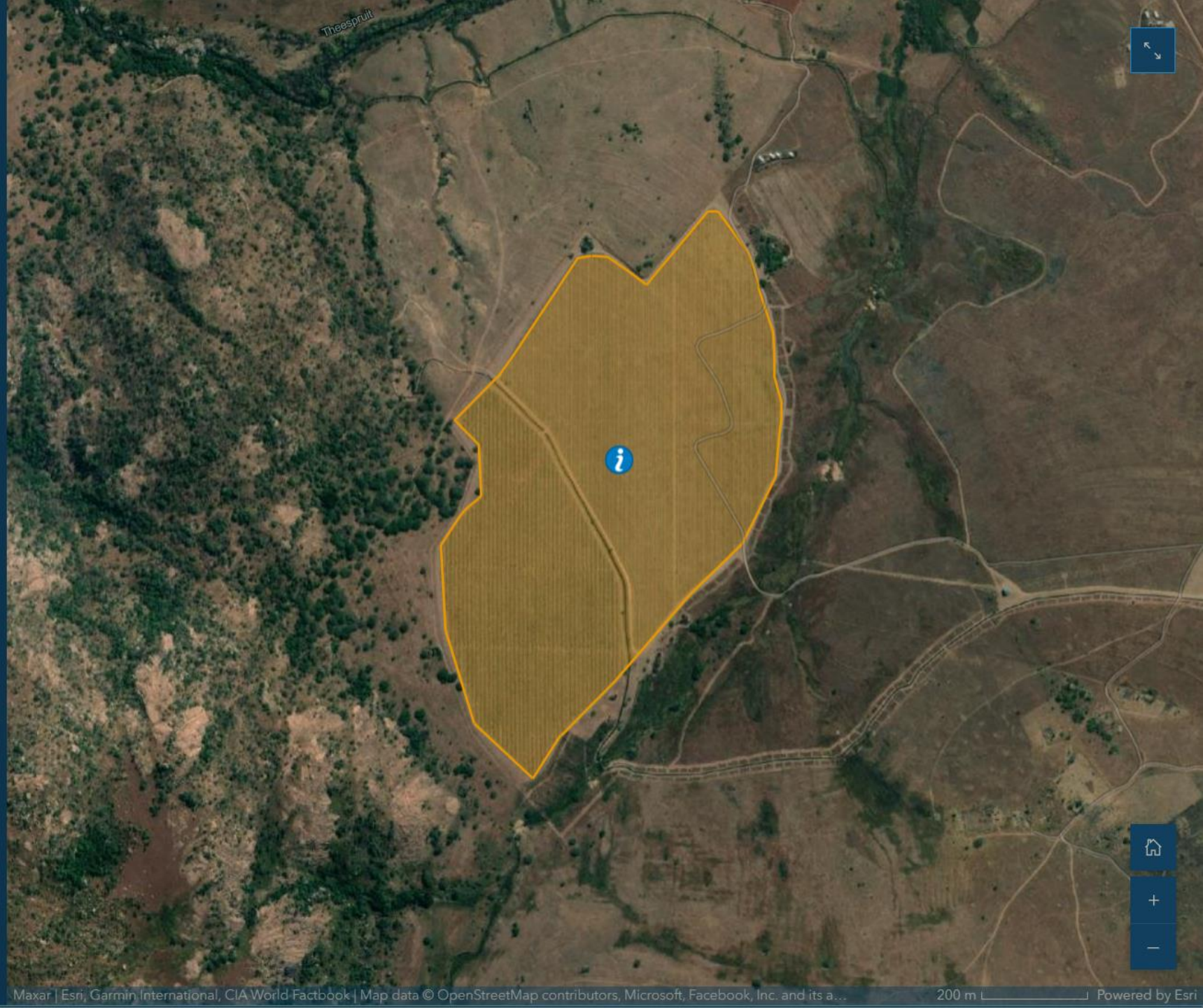


Other AARSC data

e.g., SAMAC Macadamia Map

“

These are pecans, not macs!



How do we do it?

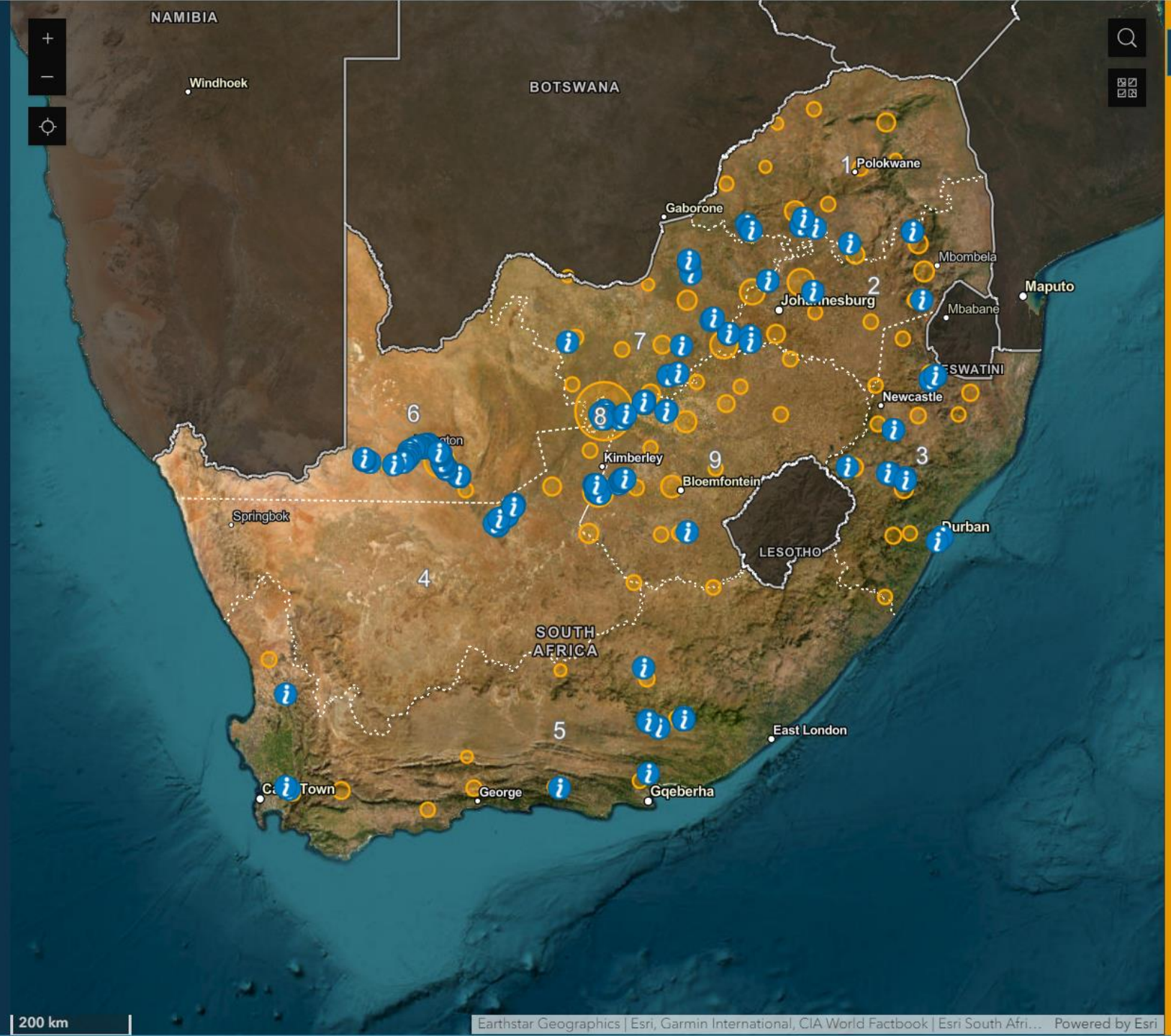
Sources:

1. Imagery
2. Ancillary data
3. **Peer review**
4. Field validation



Peer review

“
*Peer review is critical for
scientific research, and
spatial science is no
different...*”



Is your orchard on the map?

Using location-based tools developed by AARSC, anyone can review the map. If your orchard is missing, add a comment to bring it to our attention.

“

We've already received over 280 comments!

The SAMAC map has over 1,100!



Industry engagement

“

To map new plantings we need very current high-res imagery – which is not an option at national scale...

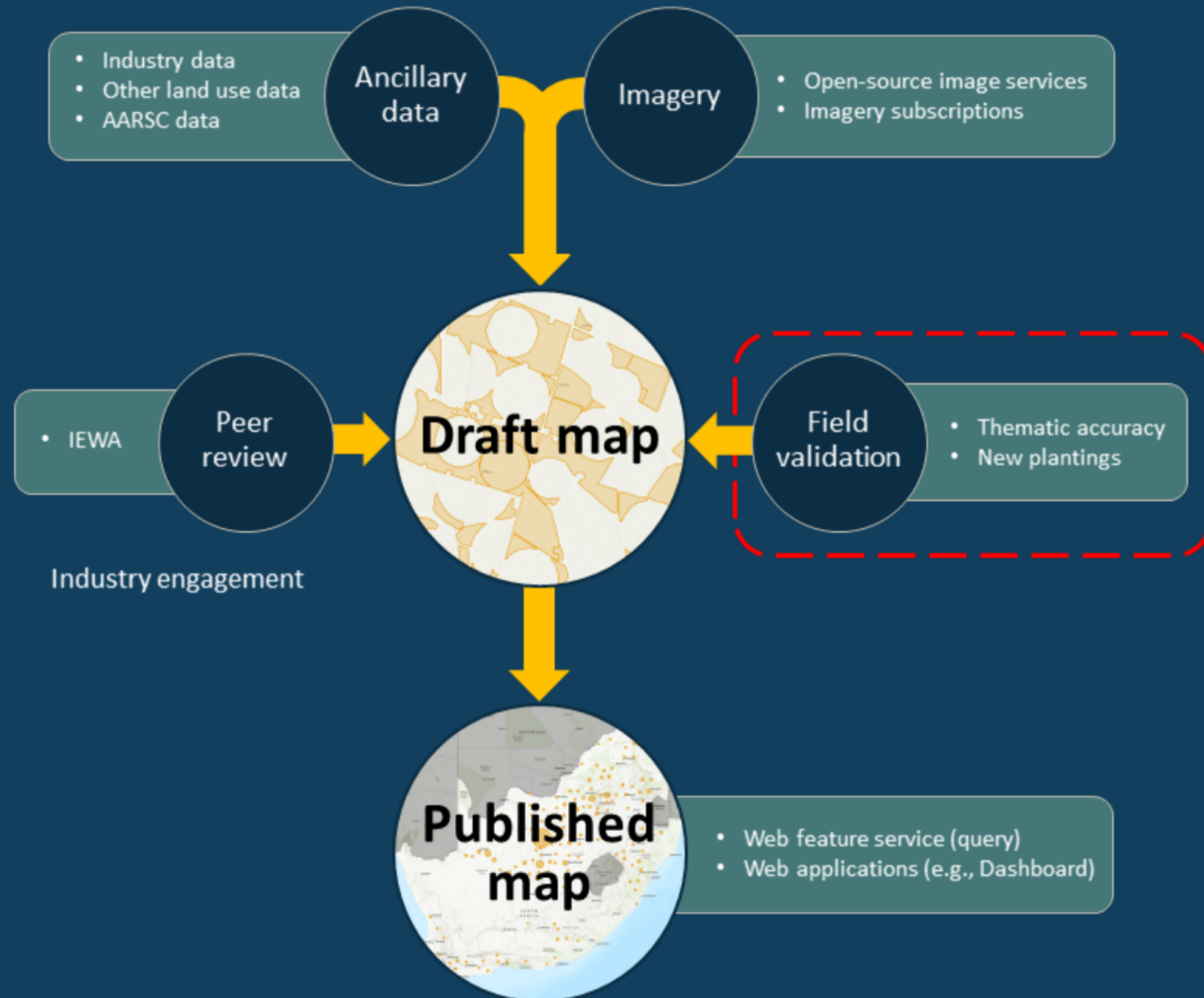
We rely in on your feedback to bring ⊗ **new plantings** to our attention, we can't map them with satellite imagery alone!



How do we do it?

Sources:

1. Imagery
2. Ancillary data
3. Peer review
4. **Field validation**



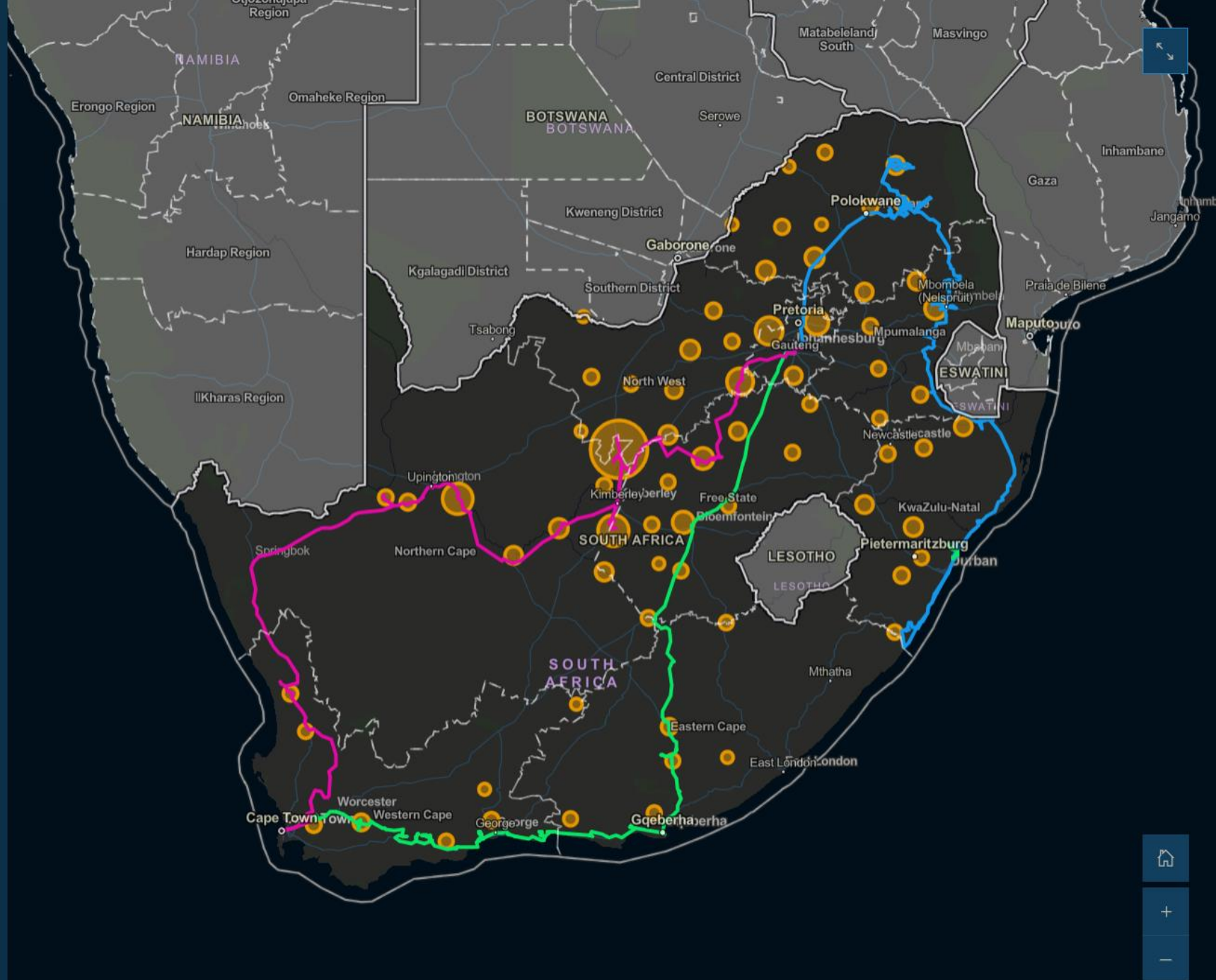
Field Validation

Targeting areas of known

+ uncertainty, plus discover and map new plantings.



Guernsey, Eastern Cape



Field Validation

Targeting areas of known

⊗ uncertainty, plus discover and map new plantings.



Guernsey, Eastern Cape

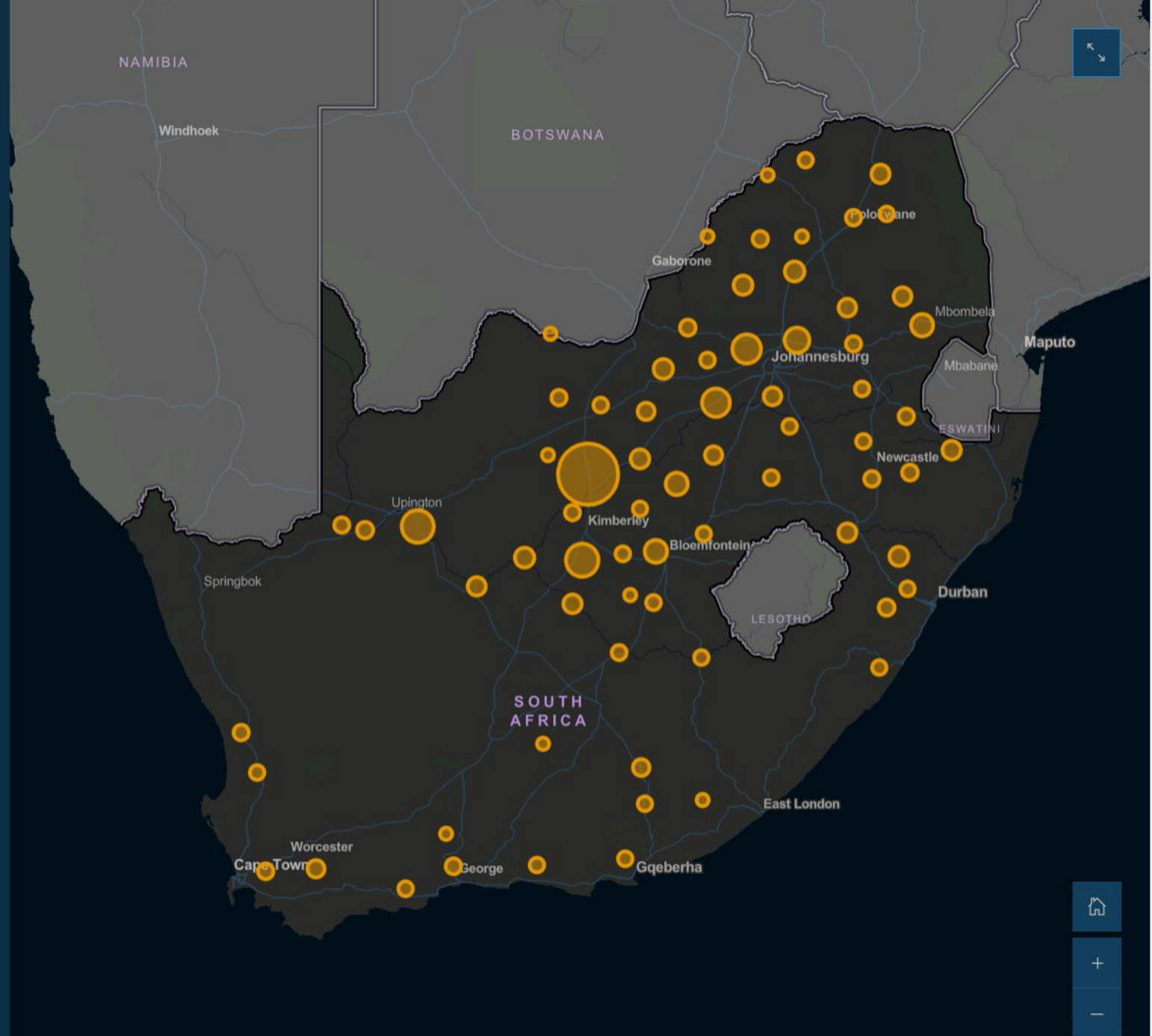


Map tour of pecan orchards

- ⊕ SAPPA regions - essential!
- ⊕ The more info... the better



© Google Street-view (August 2024) – Blyvooruitsig, Northern Cape

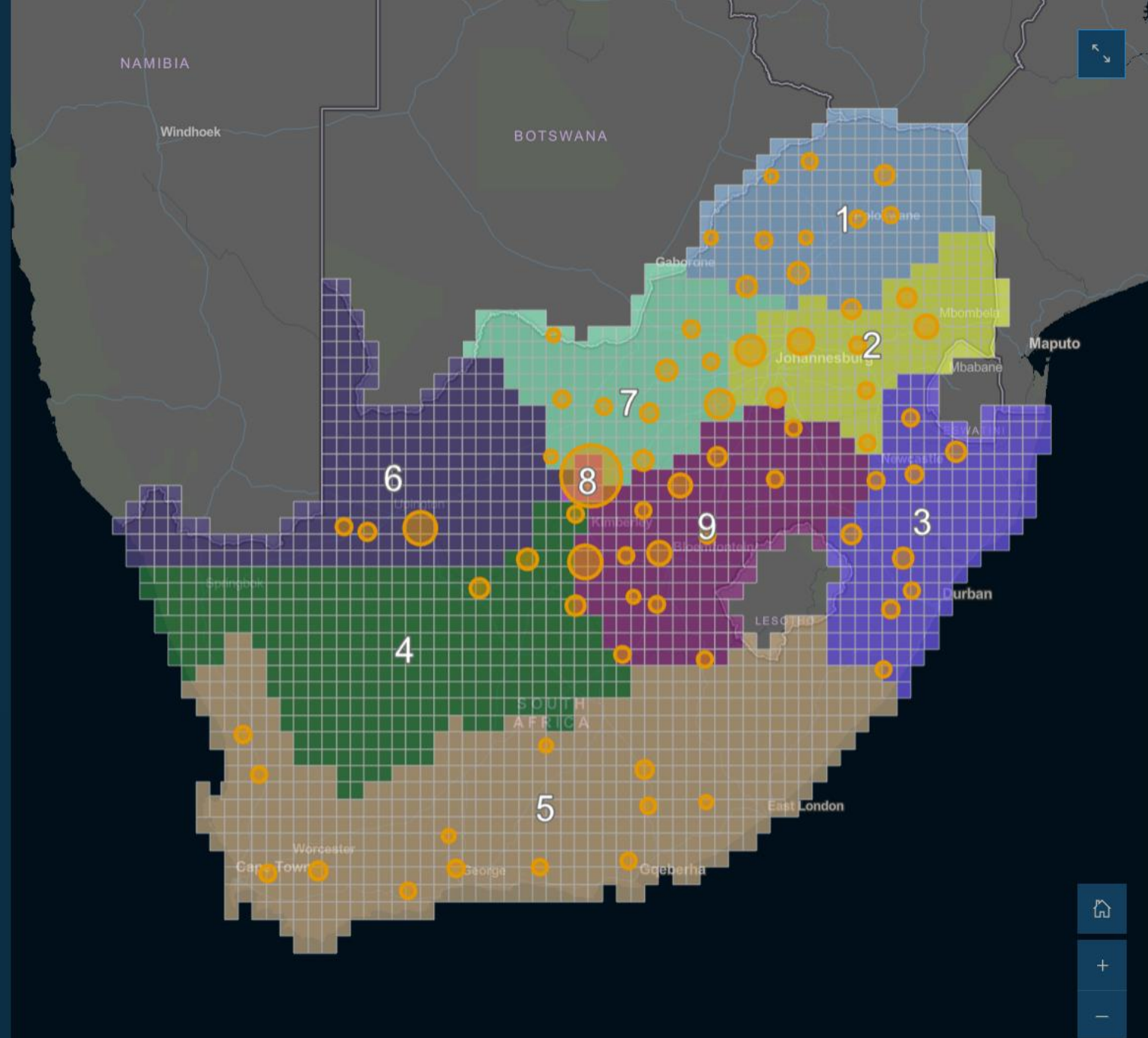


Map tour of pecan orchards

- ⊗ SAPPA regions - essential!
- ⊕ The more info... the better



© Google Street-view (August 2024) – Blyvooruitsig, Northern Cape

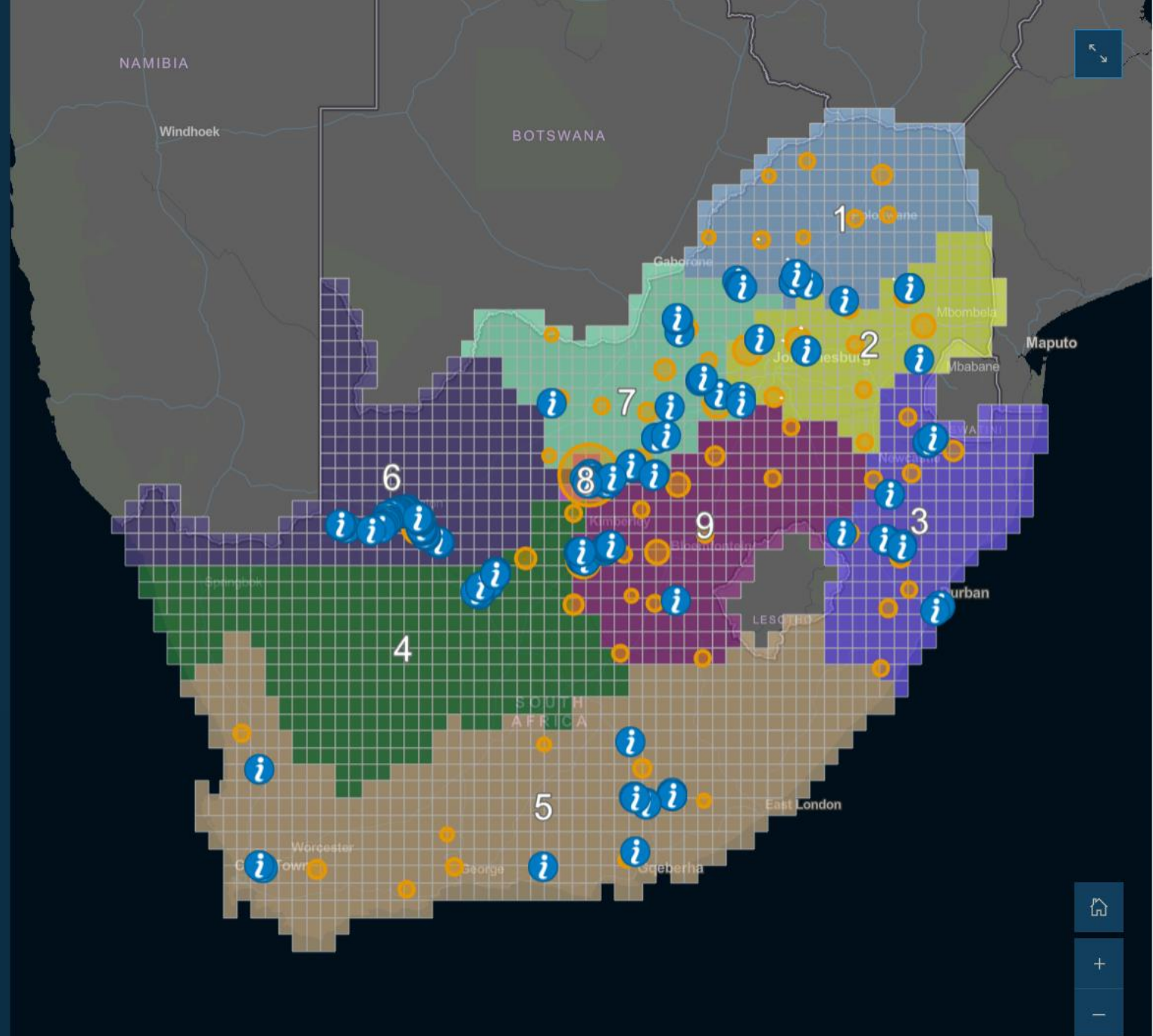


Map tour of pecan orchards

- ⊕ SAPPA regions - essential!
- ⊗ The more info... the better



© Google Street-view (August 2024) – Blyvooruitsig, Northern Cape





© Google Street-view (August 2024) – Blyvooruitsig, Northern Cape

Pecan's physical characteristics

- ⊗ Foliage colour changes



© Google Street-view (June 2024) – Douglas, Northern Cape



- ⊗ Deciduous



© Google Street-view (September 2021) – Douglas, Northern Cape



- ⊗ Change over-time



- ⊗ Orchard Management



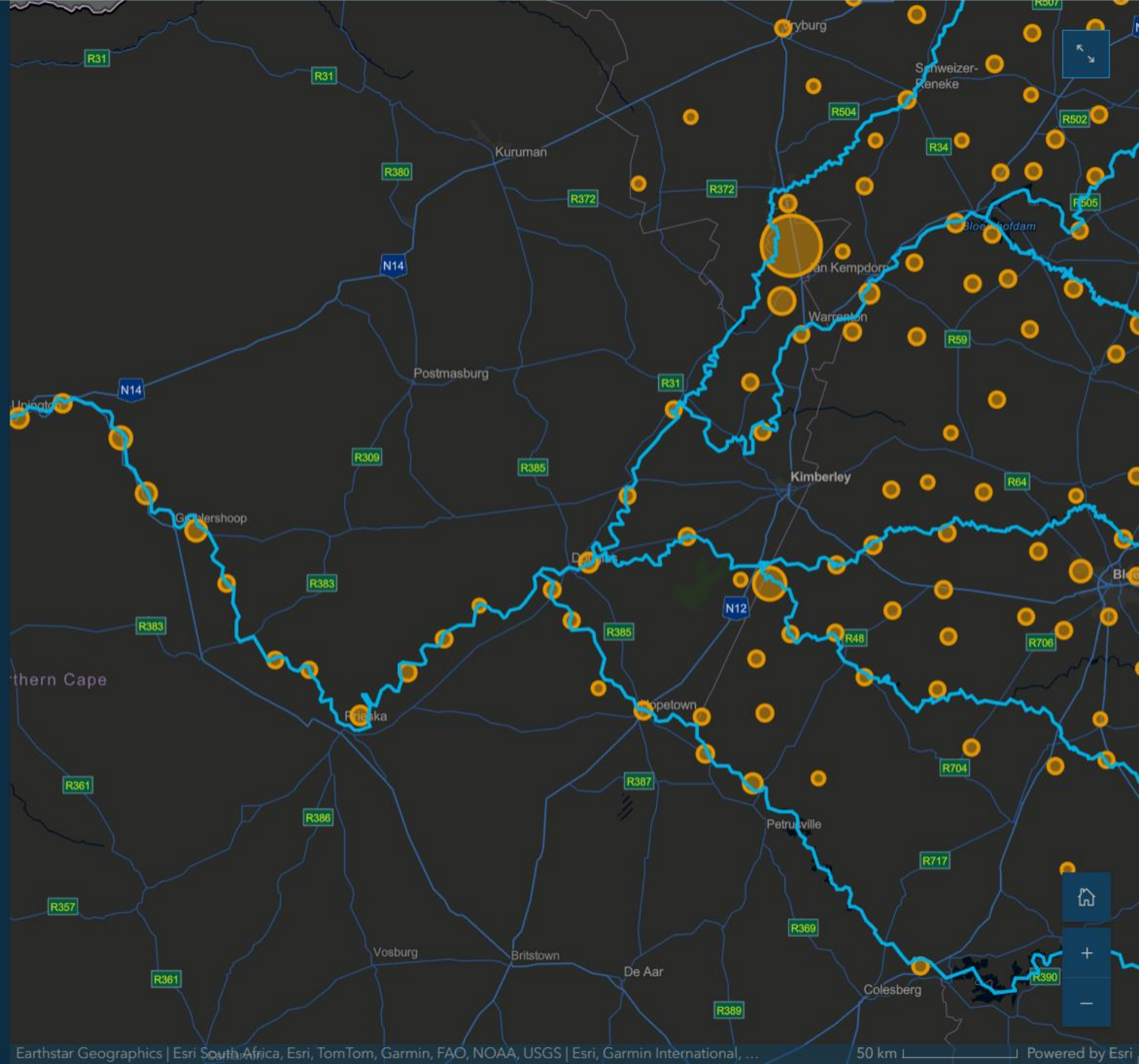
© Esri Basemaps (2023) - Edenfield, Eastern Cape



- ⊗ Geographical clues



© Google Earth



Other findings...

- ⊗ 600 ha + feature
- ⊕ Rural residential
- Lots of newly planted blocks



Other findings...

- ⊕ 600 ha + feature
- ⊗ Rural residential
- Lots of newly planted blocks



Other findings...

- ⊕ 600 ha + feature
- ⊗ Rural residential
- Lots of newly planted blocks



Applications

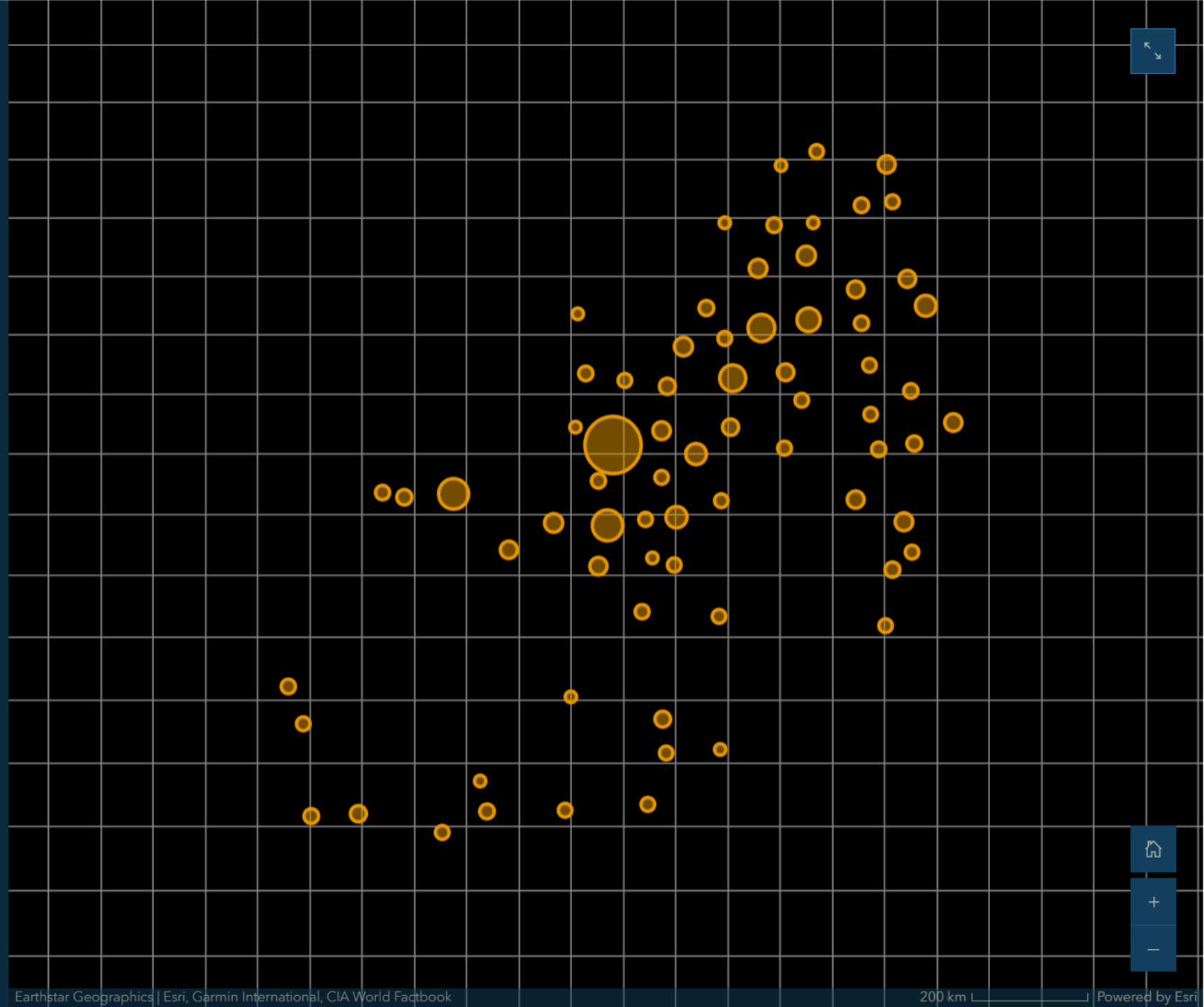
Because the map is ⊗ spatial,
we can analyse it based on
⊕ location.

“

*Location is the foundation for
bringing information
together...*

“

*Let's look at some real
examples!*

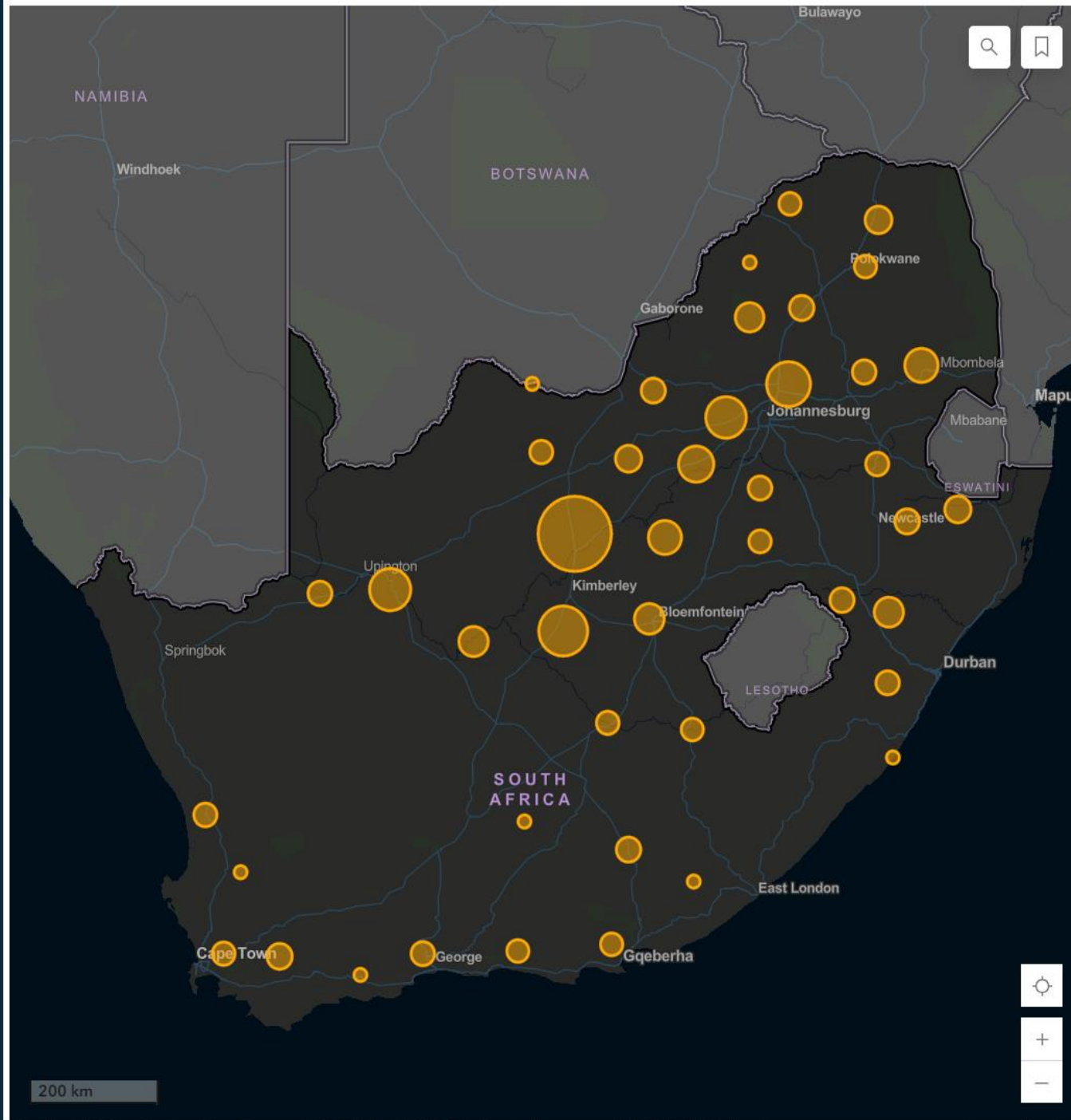


SAPPA Dashboard Map

Deliver industry metrics at multiple-scales...

“
How many hectares?”

Summarise the map (e.g., by SAPPA region) and dynamically based on the maps view extent!



Navigate the map by growing region using the bookmark tool, search for a location or simply zoom/pan around the map.

Something missing?
Click here and tell us!

Map legend

-  Tree crop locations
Size = number of orchards
Visible when zoomed out
-  Tree crop extents
Click for orchard information
Visible when zoomed in

Orchards within map extent

54,601 ha

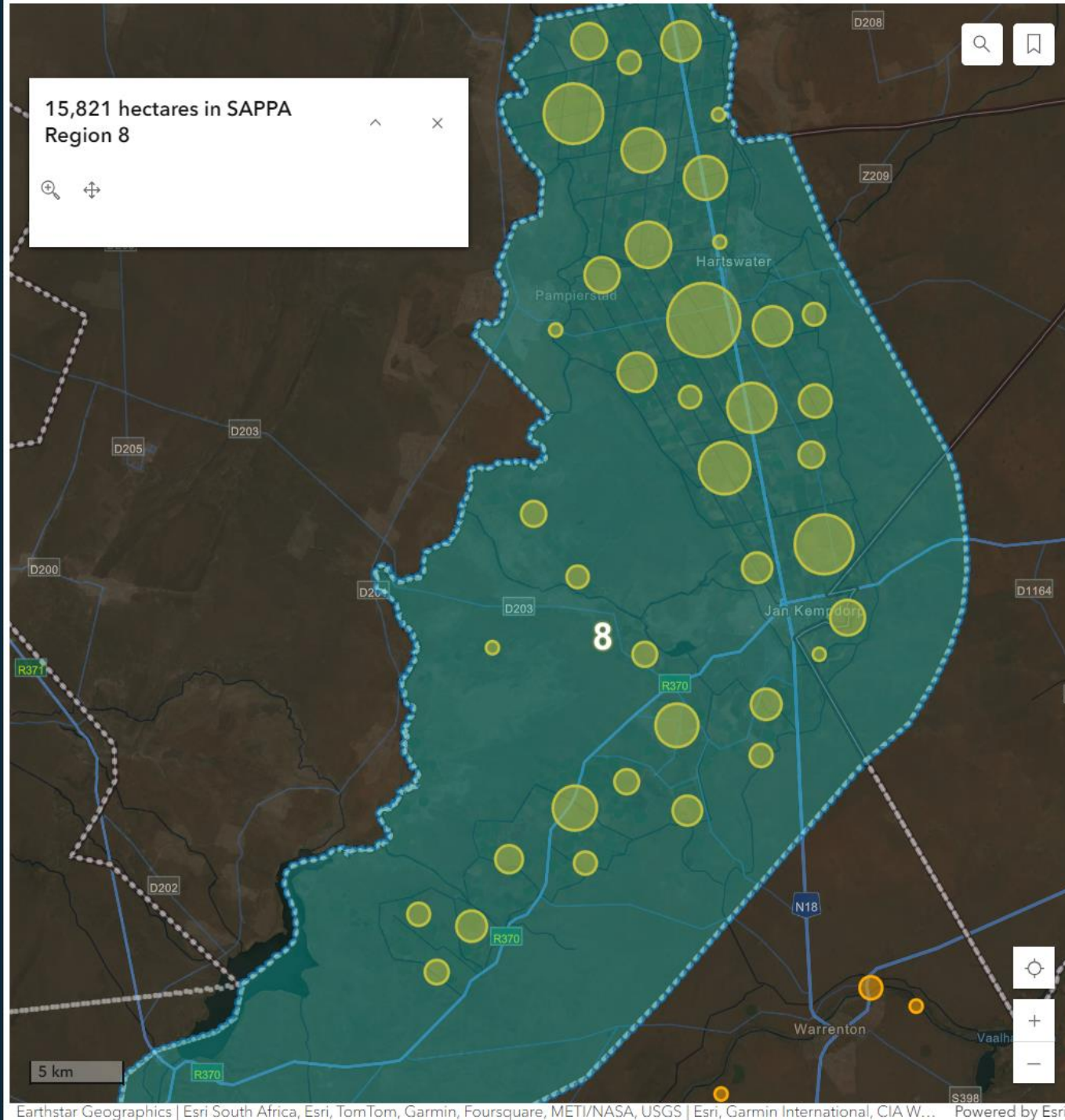


SAPPA Dashboard Map

Deliver industry metrics at multiple-scales...

“
How many hectares?”

Summarise the map (e.g., by SAPPA region) and dynamically based on the maps view extent!



Navigate the map by growing region using the bookmark tool, search for a location or simply zoom/pan around the map.

Something missing?
Click here and tell us!

Map legend

- Tree crop locations
Size = number of orchards
Visible when zoomed out
- Tree crop extents
Click for orchard information
Visible when zoomed in

Orchards within map extent

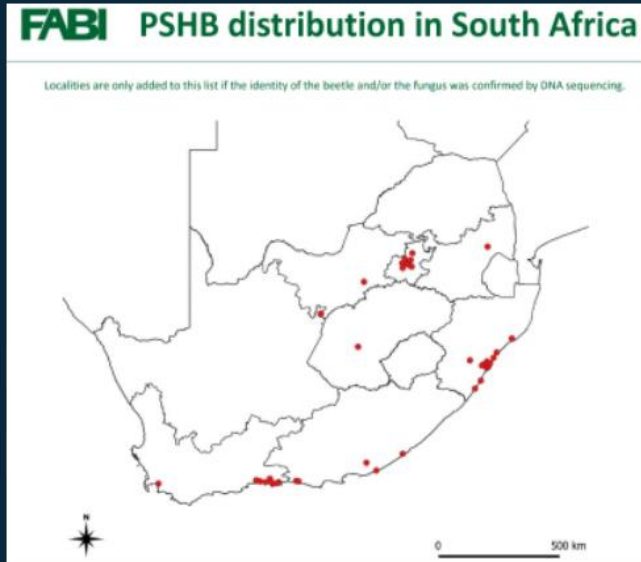
15,814 ha



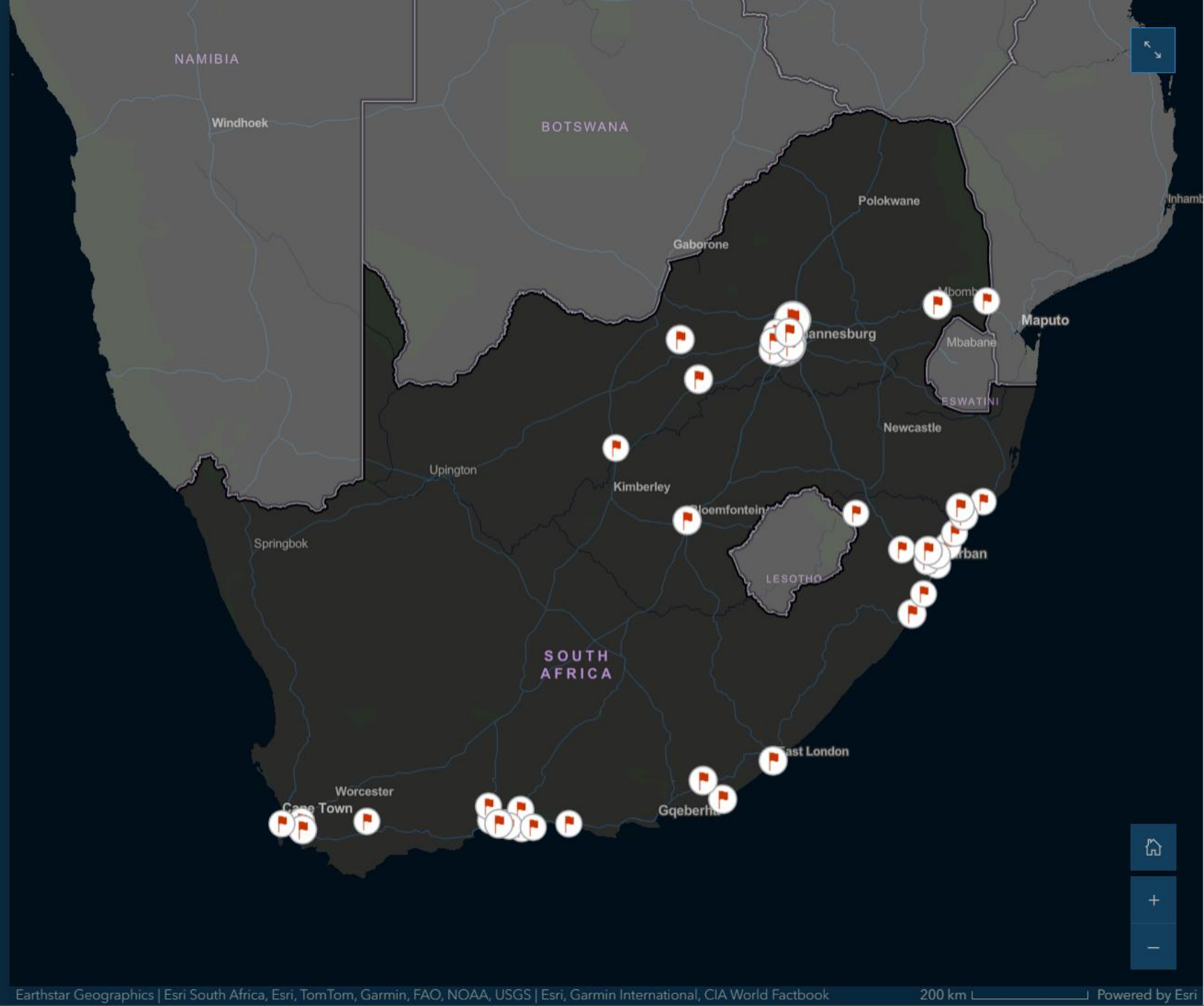
Biosecurity preparedness

e.g., Polyphagous Shot Hole Borer (PSHB)

Map shows the location of hosts — FABI.



Source: FABI



Biosecurity preparedness

e.g., Polyphagous Shot Hole Borer (PSHB)

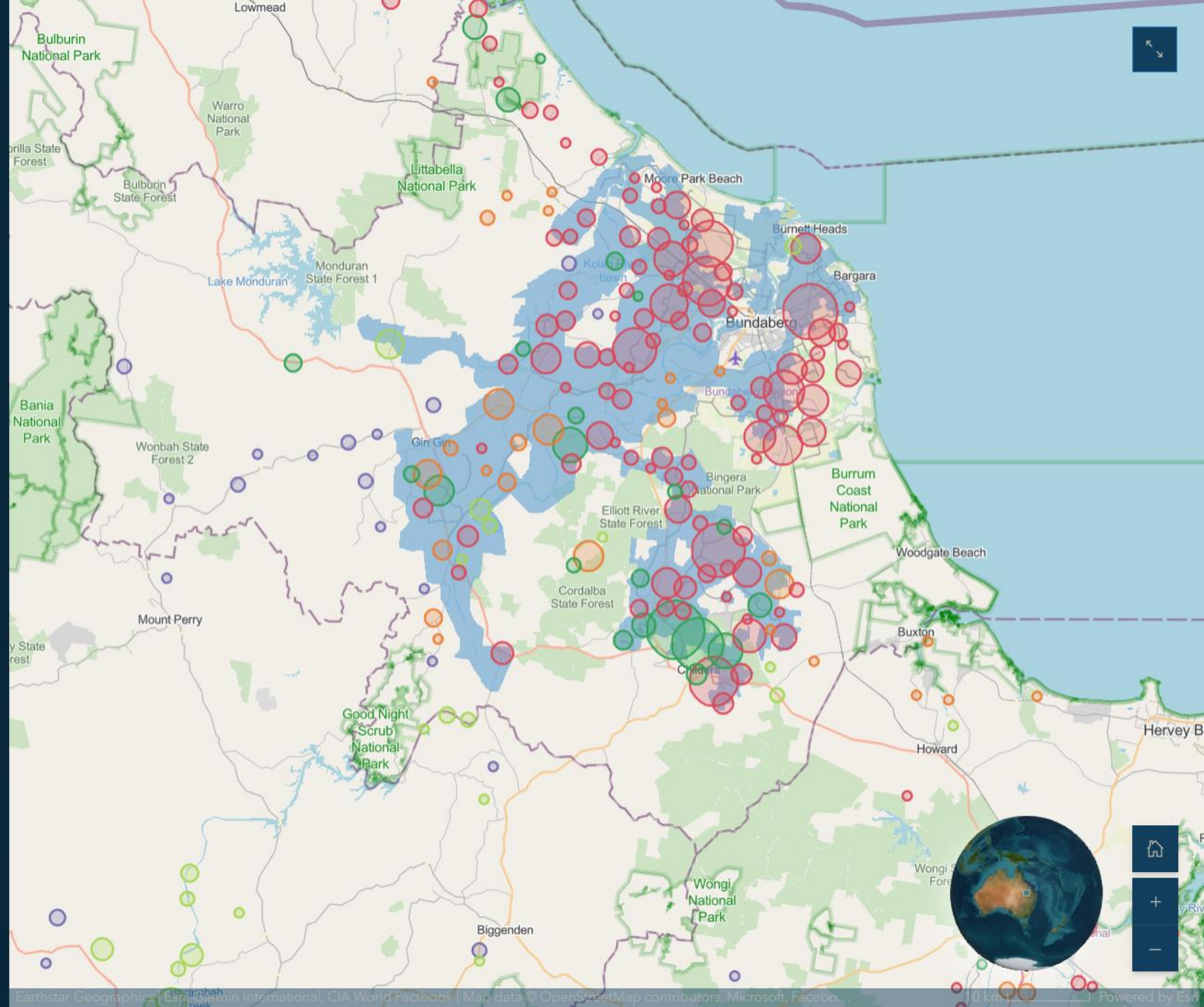
Overlay map of ⊗ pecans and analyse potential impacts, manage risks...



Water security

e.g., Paradise Dam, Bundaberg

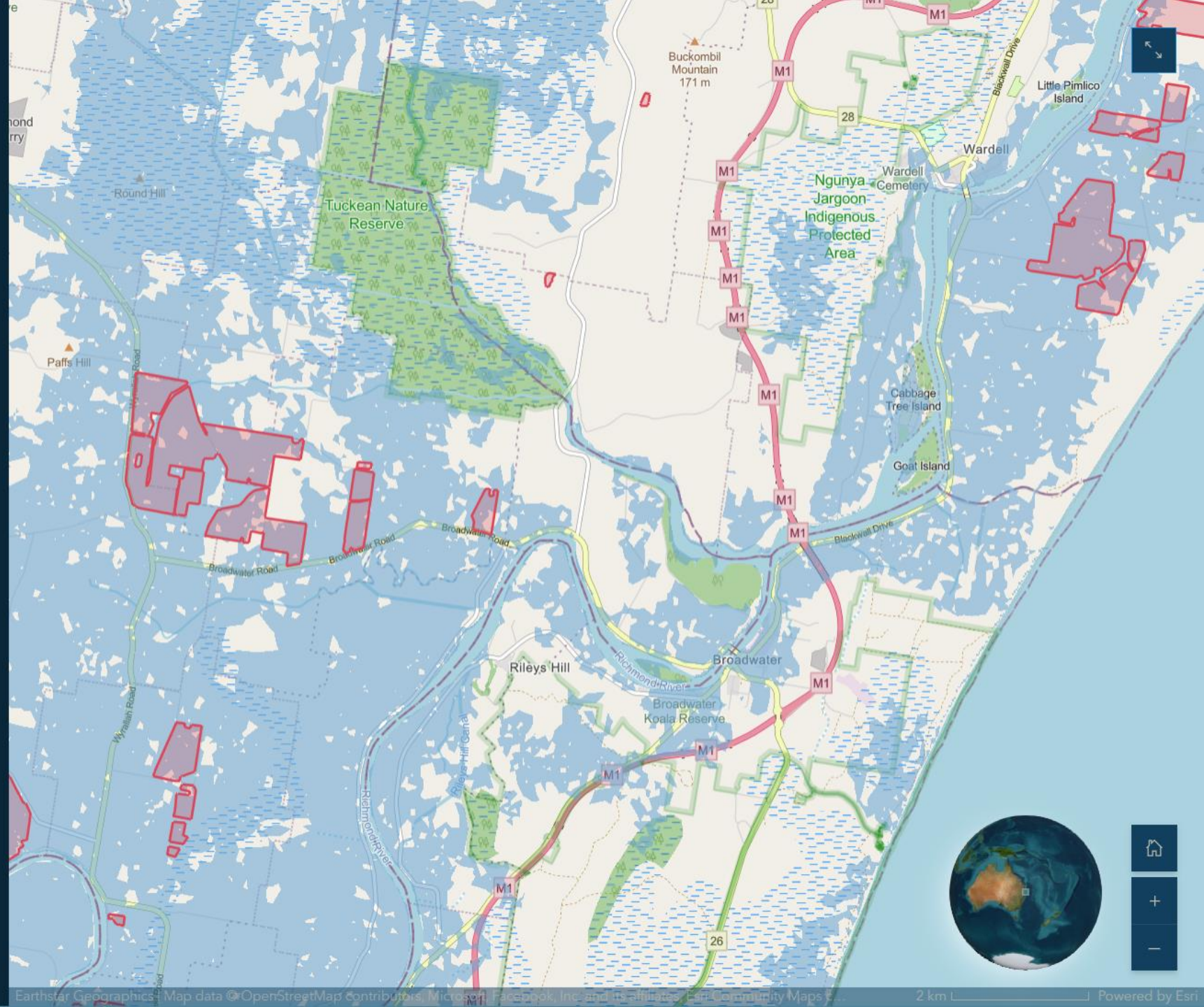
“
*In 2023, there was 13,101
hectares of macadamia
orchards within the
Bundaberg Water Supply
Scheme...*



Natural disaster recovery

e.g., Northern NSW Floods,
March 2022

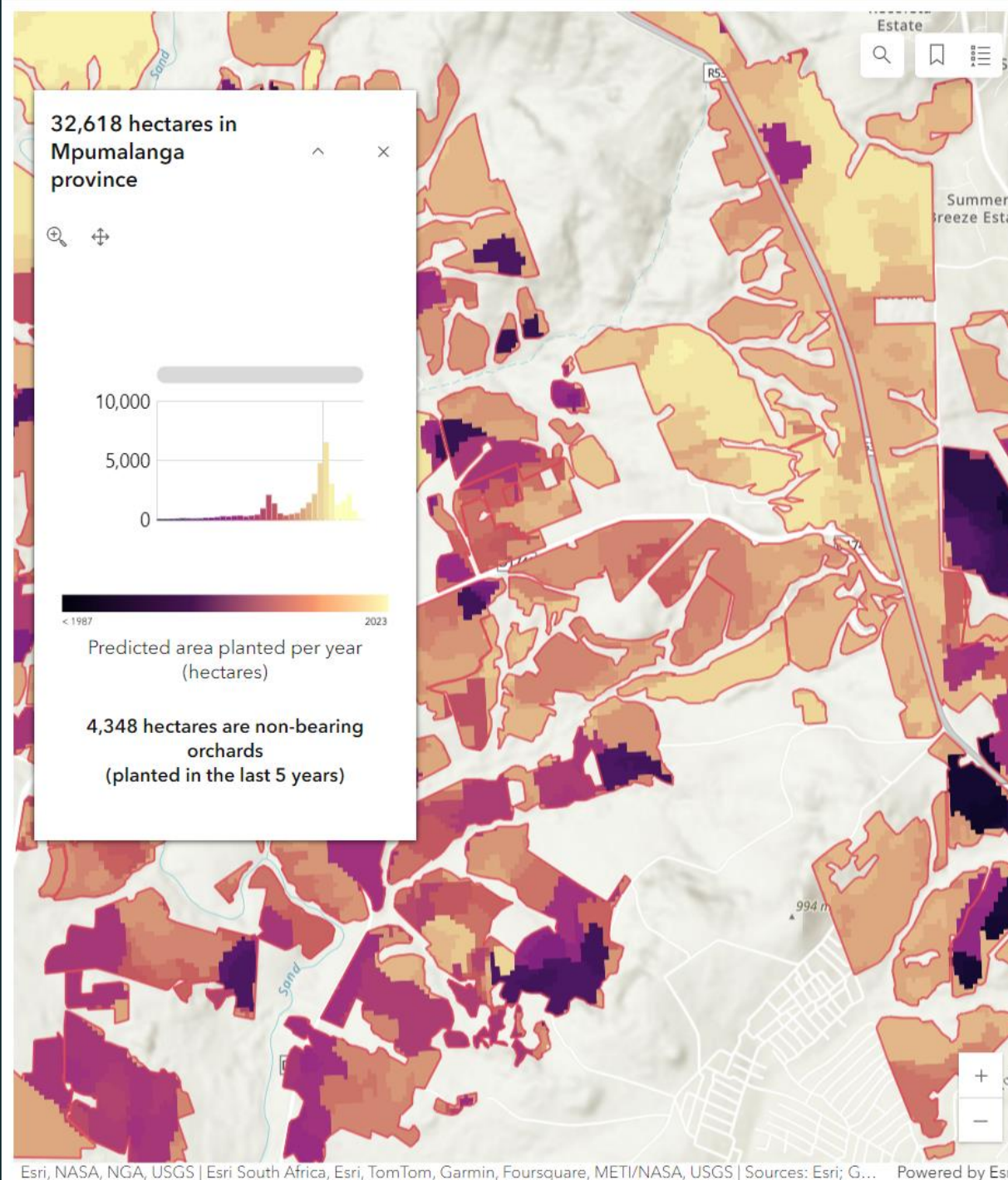
“
*Identify impacted orchards
and provide timely response
to affected growers...*



“
Building on the baseline
map!”

– Planting Year Prediction

- Avocado in Australia
- Macadamia in Australia and RSA



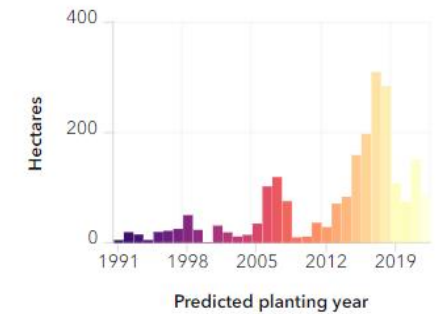
Navigate the map by growing region using the bookmark tool, search for a location or simply zoom/pan around the map.

Open the introduction

Something missing or incorrect?

Total area of orchards summarised by predicted planting year

Area statistics update interactively based on the current map extent



Total within current map extent: 2,676ha

– ⊗ **Yield forecasting**

“

AARSC has developed a time-series model of historic block-level data

- Avocado
- Citrus
- Macadamia

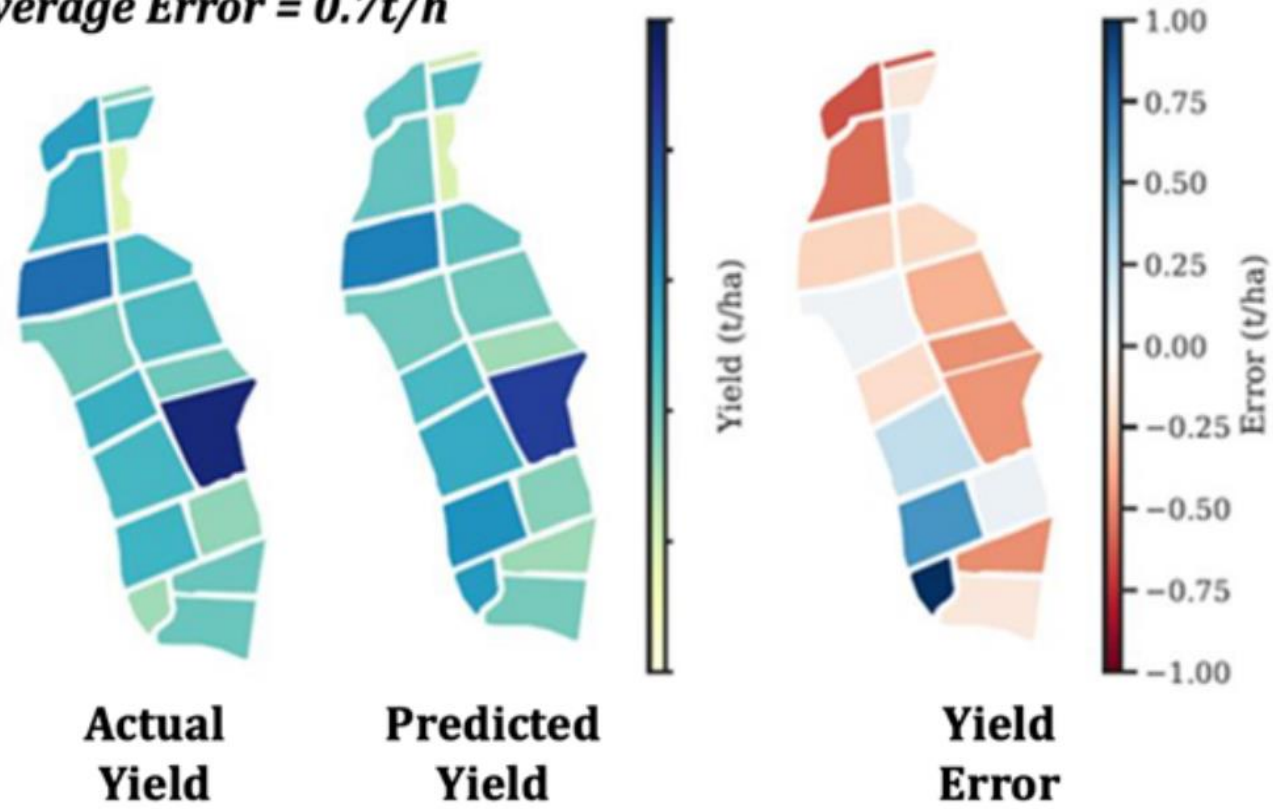
Current PhD opportunity @
AARSC (in collab. w/ Stahmann
Webster) to develop yield
forecast models for:

- Walnut
- Almond
- & Pecans! (inc. irregular
bearing)

Using Remote Sensing and Weather to predict Yield

We provide growers with block-level yield forecasts in January each year.

Average Error = 0.7t/h



Spatially enabling tree crop industry

Additional information at greater detail — Block-level maps!

Built by industry, for industry.

AARSC are supporting the avocado, banana, citrus and macadamia industries in Australia!

“
All data is secured for
industry access only.”

Block Builder



Is your orchard on the map?

“

*We need you to check the
IEWA!*

Visit: www.sappa.za.org



No GIS? No worries!

“

You too can leverage the power of the maps, access them from any device!

Visit:

www.une.edu.au/webapps



AARSC

une

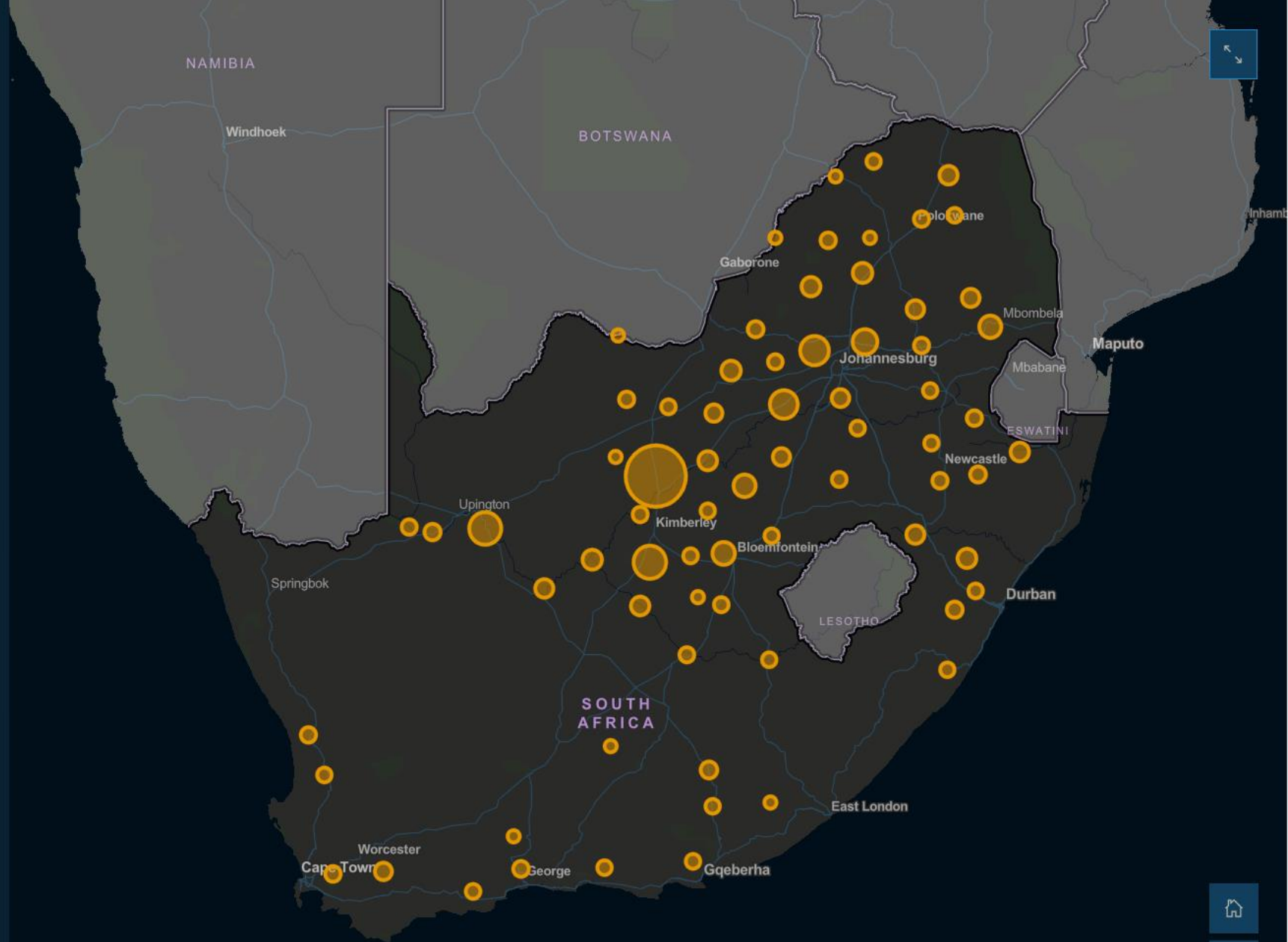
Thank you!

Our favourite feature wasn't an
⊕ orchard...



AARSC
Applied Agricultural
Remote Sensing Centre

UoNE
University of
New England



Thank you!

Our favourite feature wasn't an
⊕ orchard...

