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Digital phenotyping : Strategy and Challenge for a breeding company
Stephanie Thepot

Alteia

Streamline custom solution for digital phenotyping
Julien Zator

Journée PHENOME-EMPHASIS **April 13th 2023**

Digital Field Phenotyping
Business Value for a breeding company

Expectations

Cost reduction

- replace labor intensive field observations
- skip other activities (e.g. selections based on other traits than yield – no harvest)

Increase quality of field trial **data and decision making/selection**

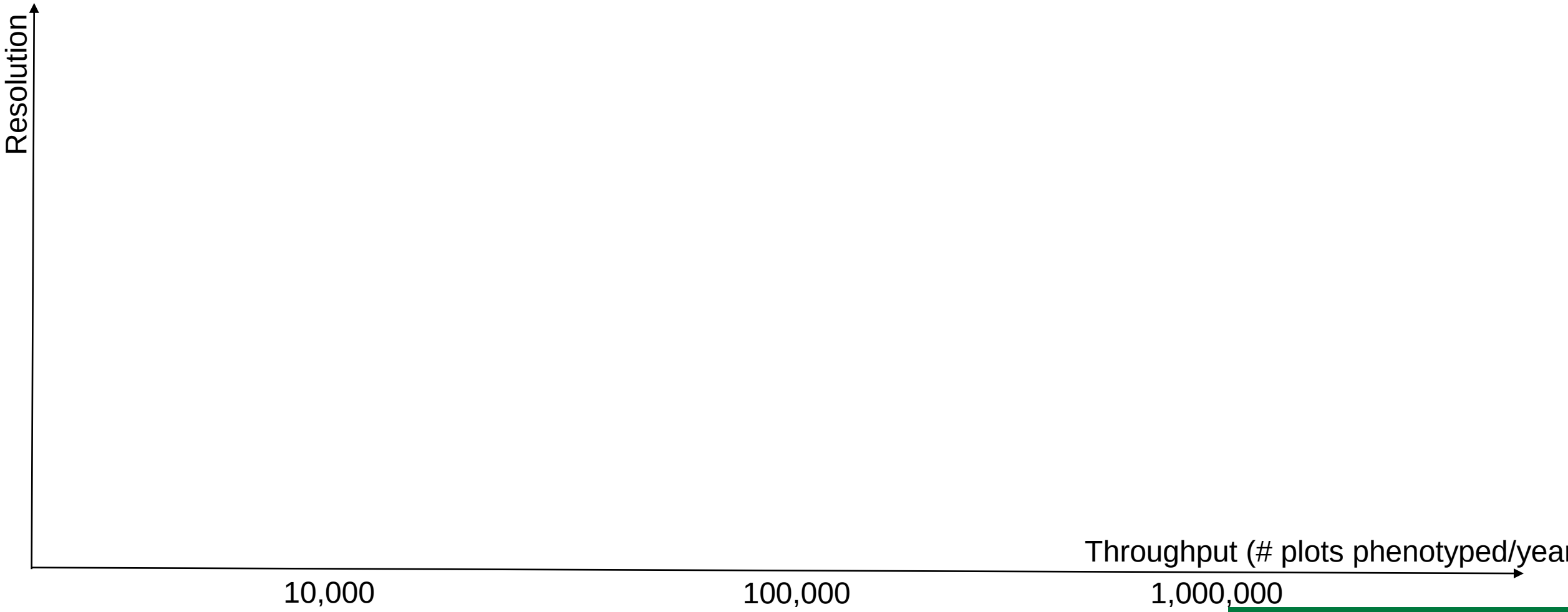
- reducing error rates
- using standardized, objective phenotyping methods
- additional/new information (e.g. traits today not quantifiable)

Increase speed of selection

- better quality, robust selection (in early phases) increases selection intensity and yearly throughput

Gain in

Digital Field Phenotyping
Business needs



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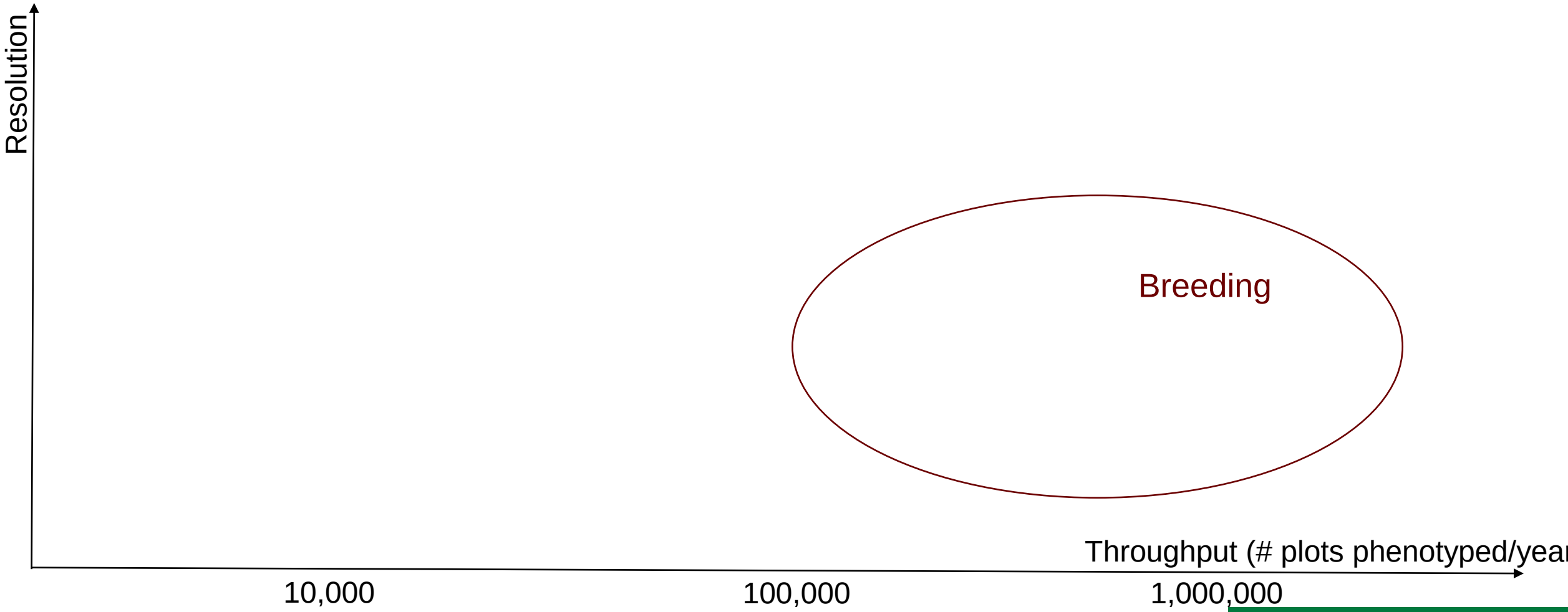
Digital Field Phenotyping
Business needs



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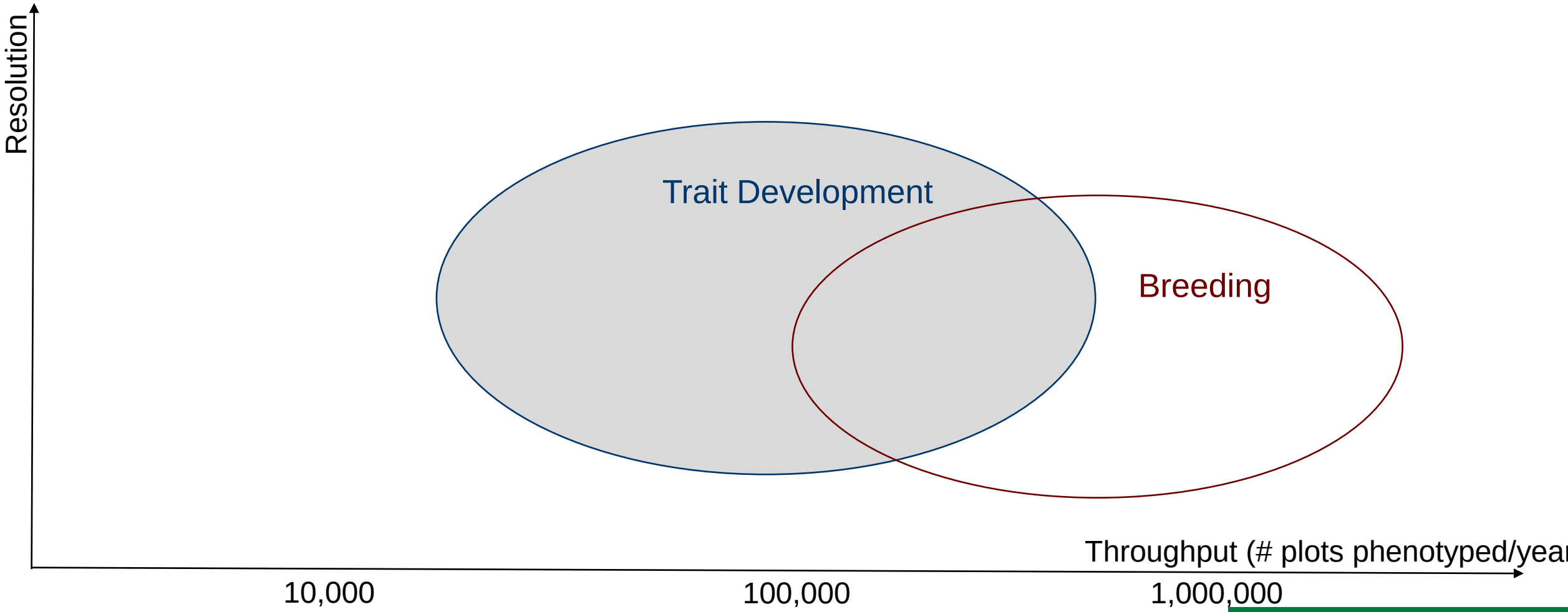
Digital Field Phenotyping
Business needs



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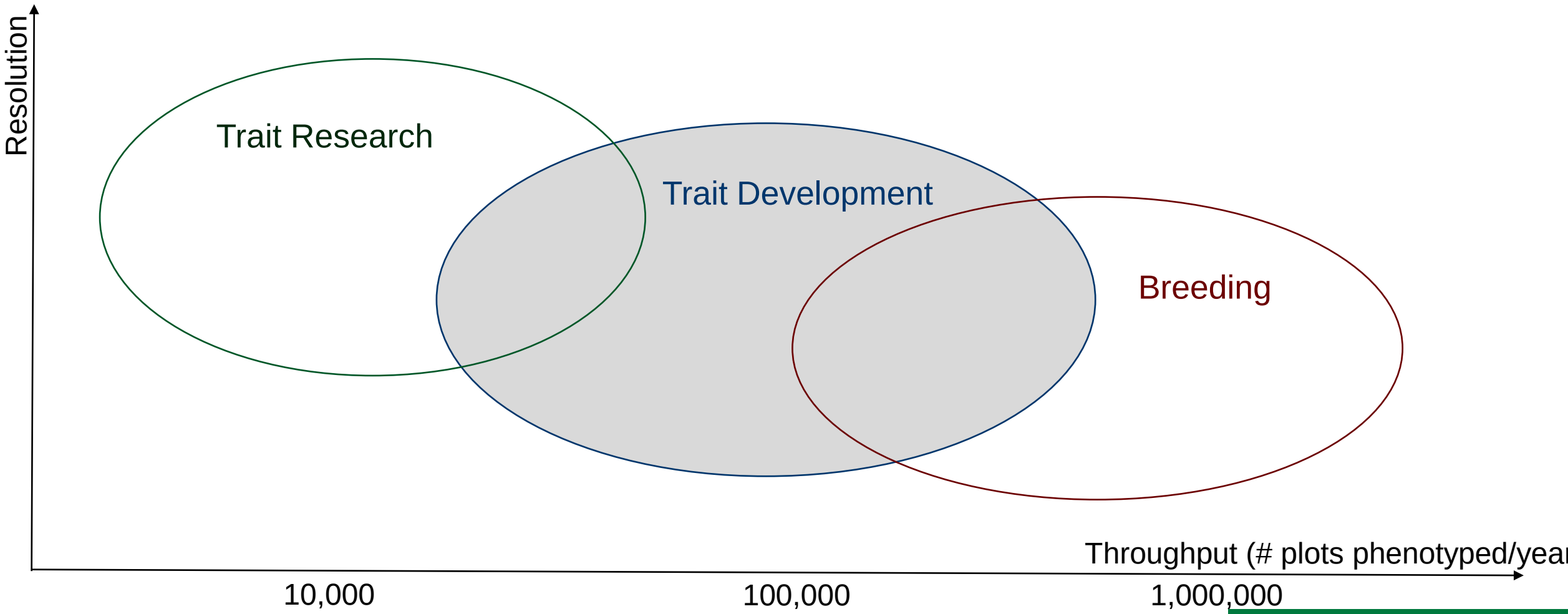
Digital Field Phenotyping
Business needs



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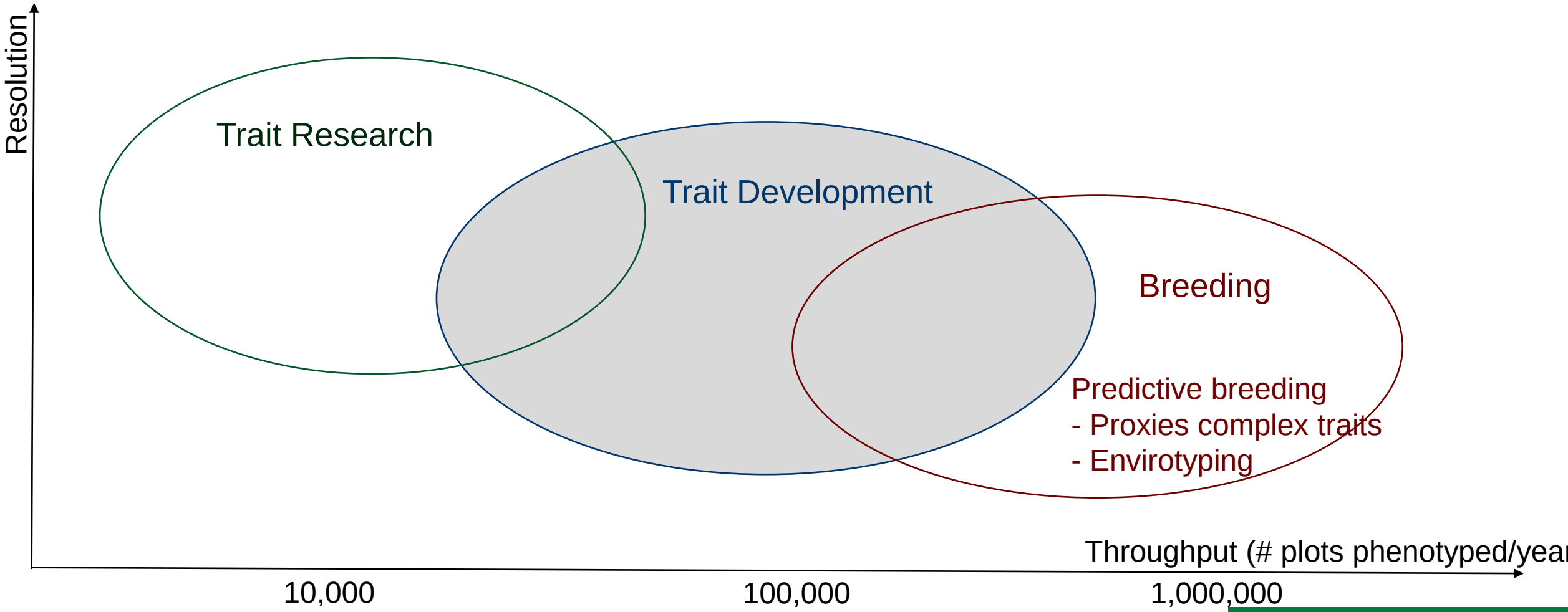
Business needs



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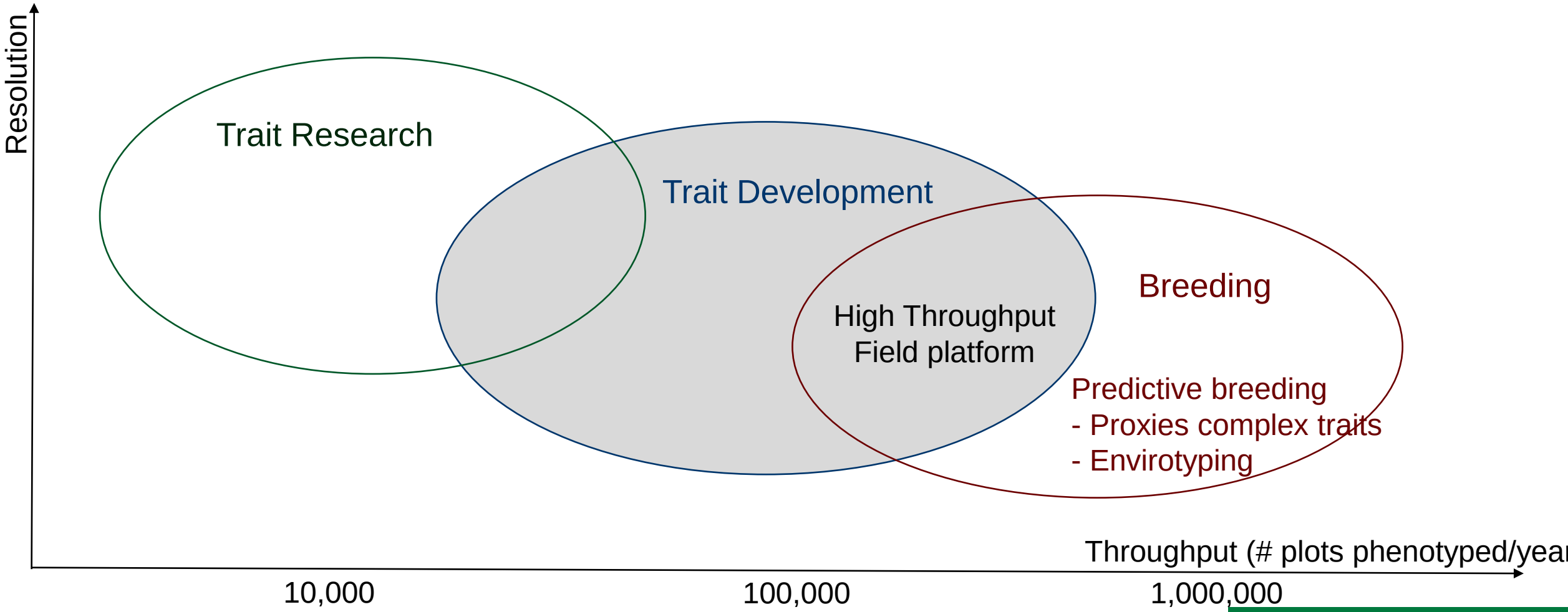

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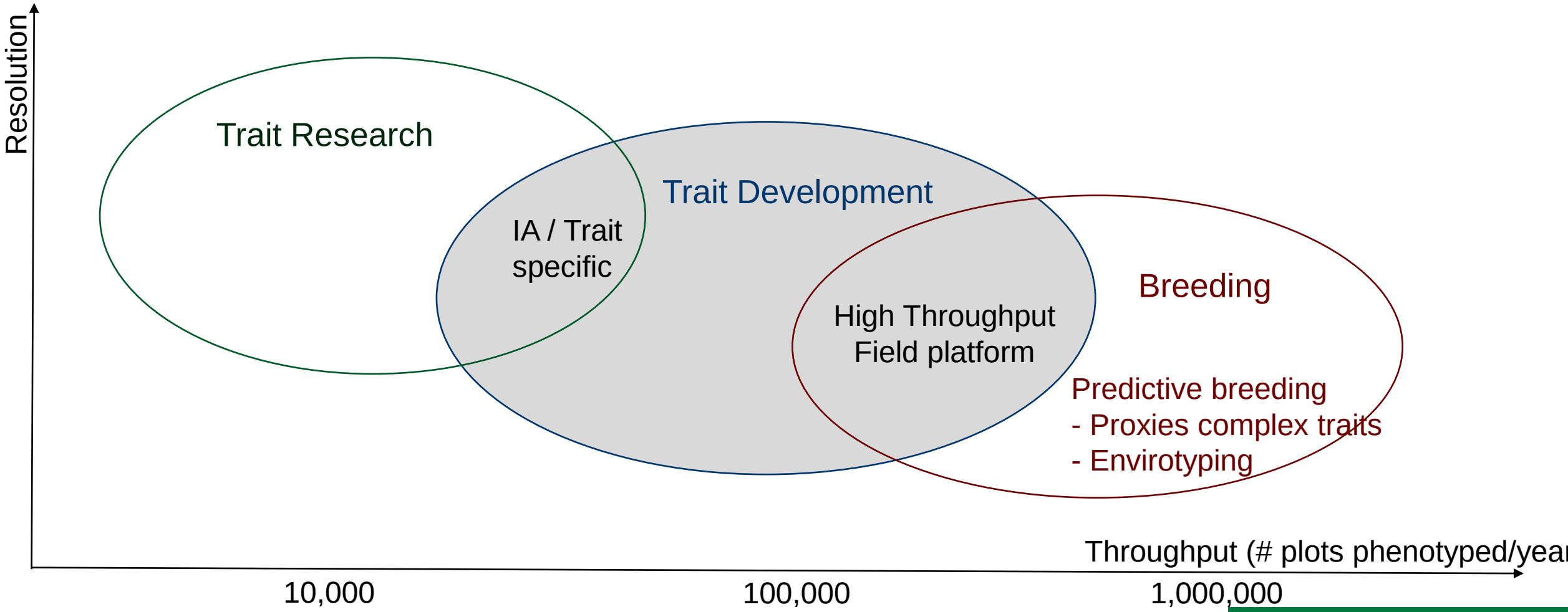

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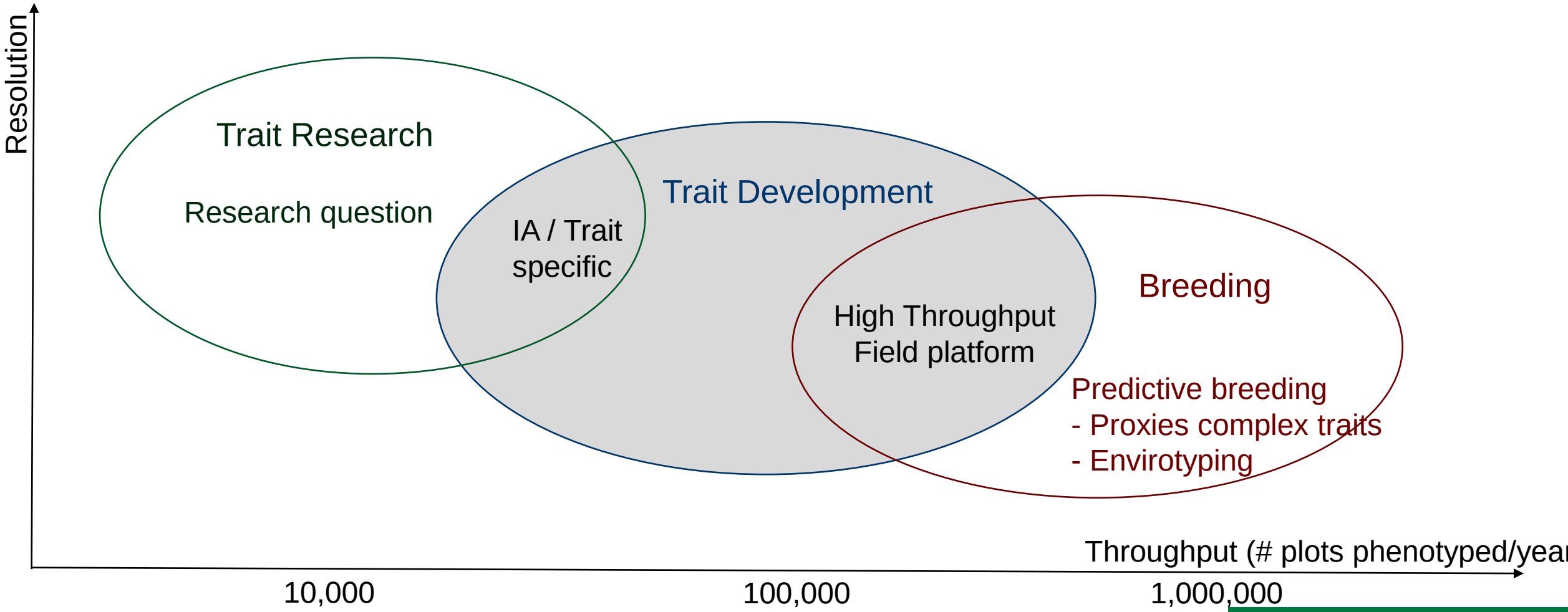
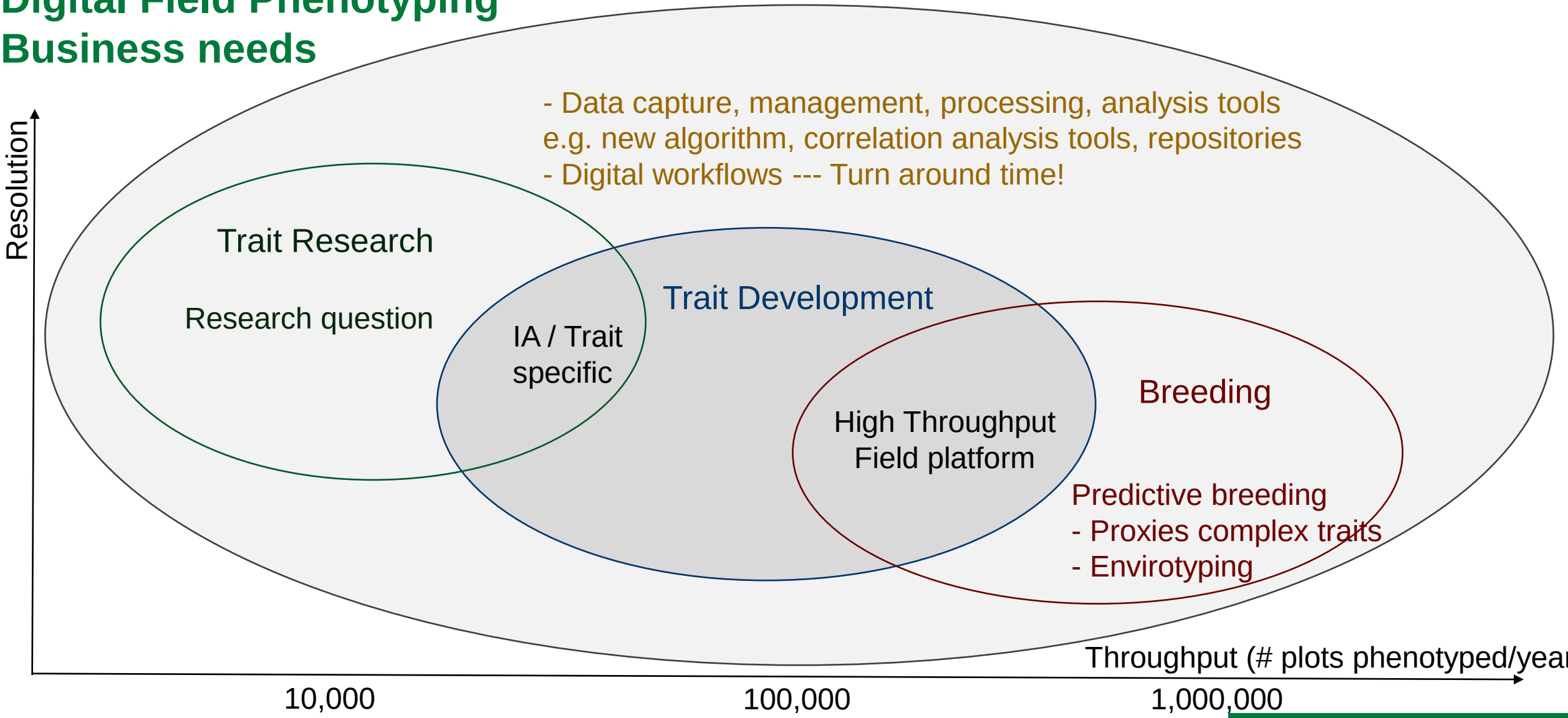


Digital Field Phenotyping
Business needs



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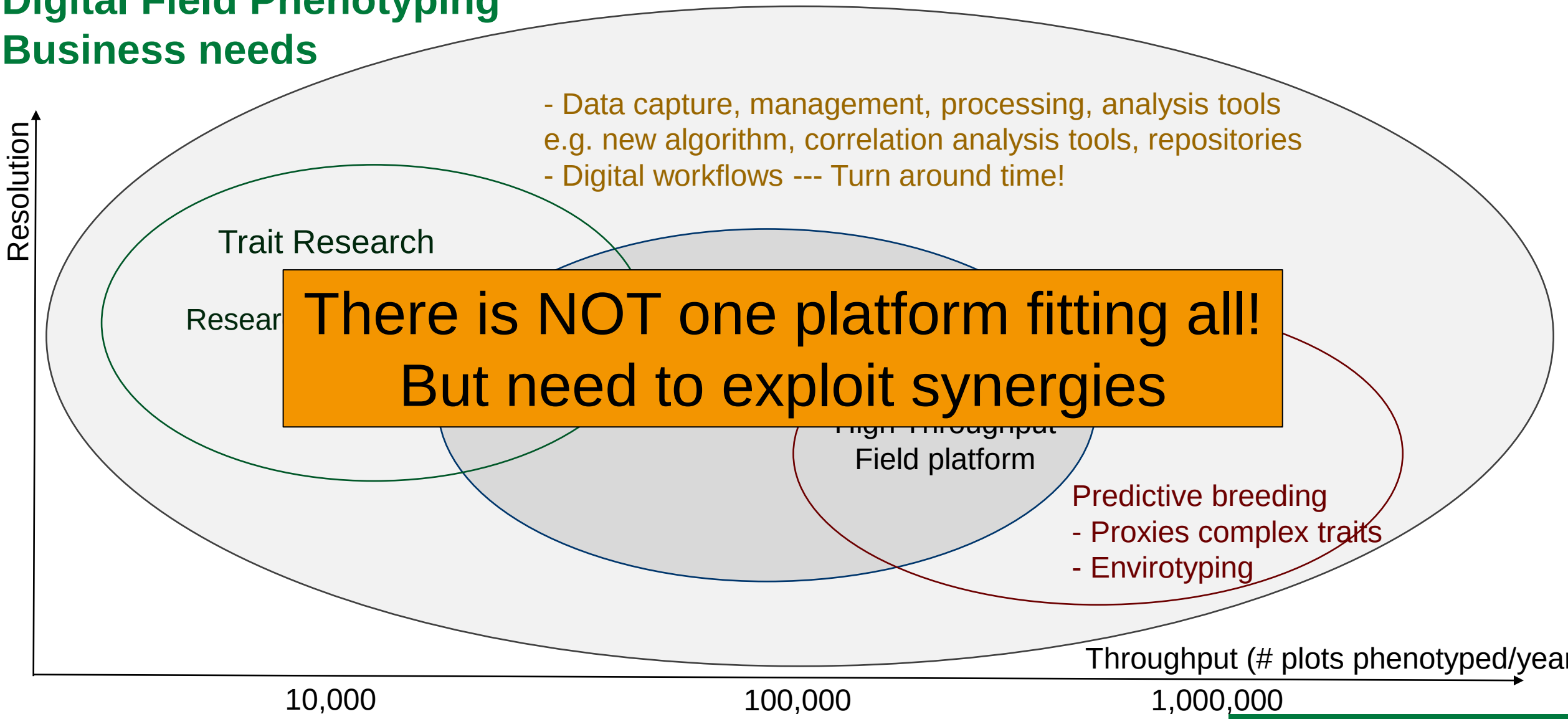

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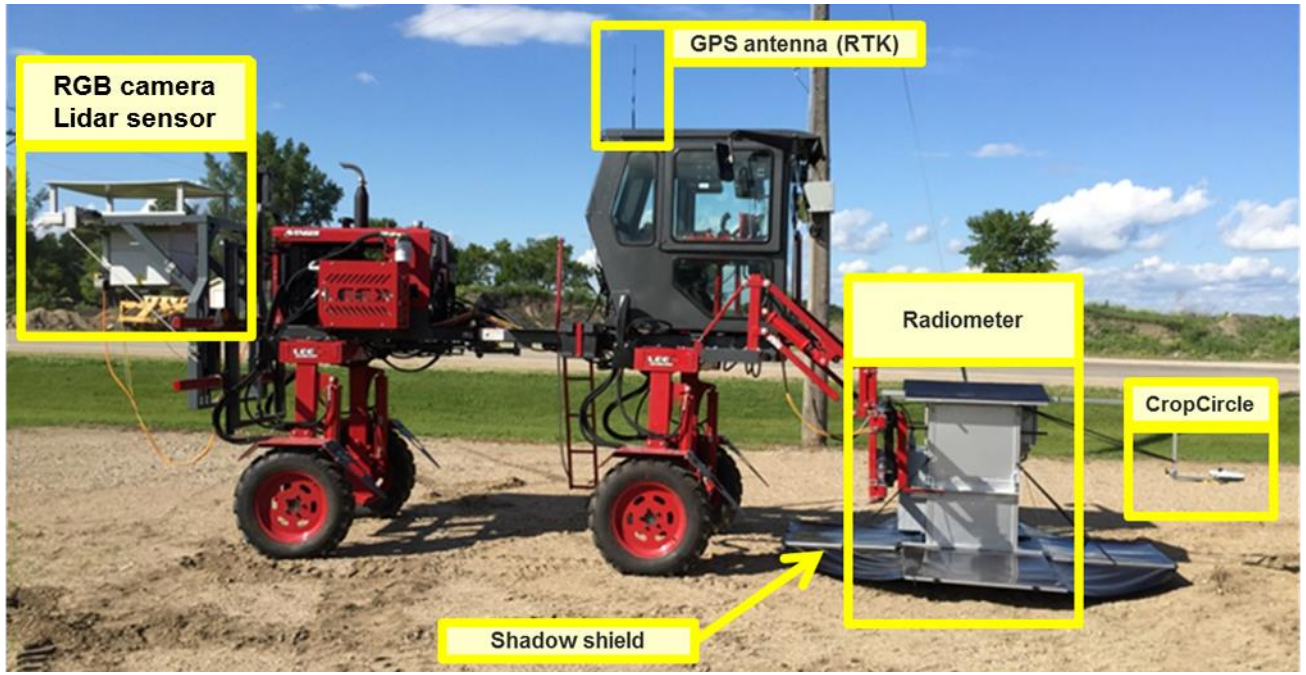
Digital Field Phenotyping
Phenotracker sensors and uses

Location of measurements

Green coverage
Spike counts

Canopy height
Height distribution (Lidar)
Biomass Index



Vegetation indices
(e.g. NDVI, NDRE)
(Multispectral)

Minimize effect of specific light conditions

Hyperspectral indices

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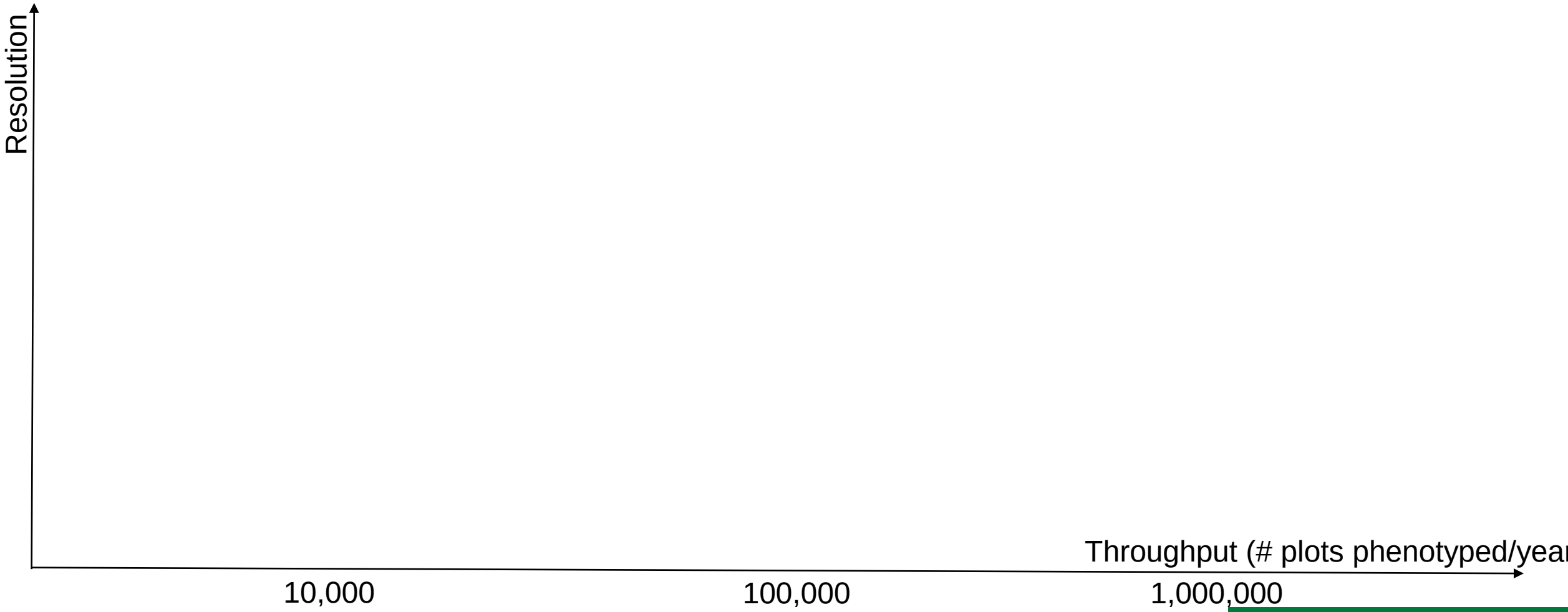
Digital Field Phenotyping Vectors



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Digital Field Phenotyping Vectors

Resolution

Throughput (# plots phenotyped/year

10,000

100,000

1,000,000

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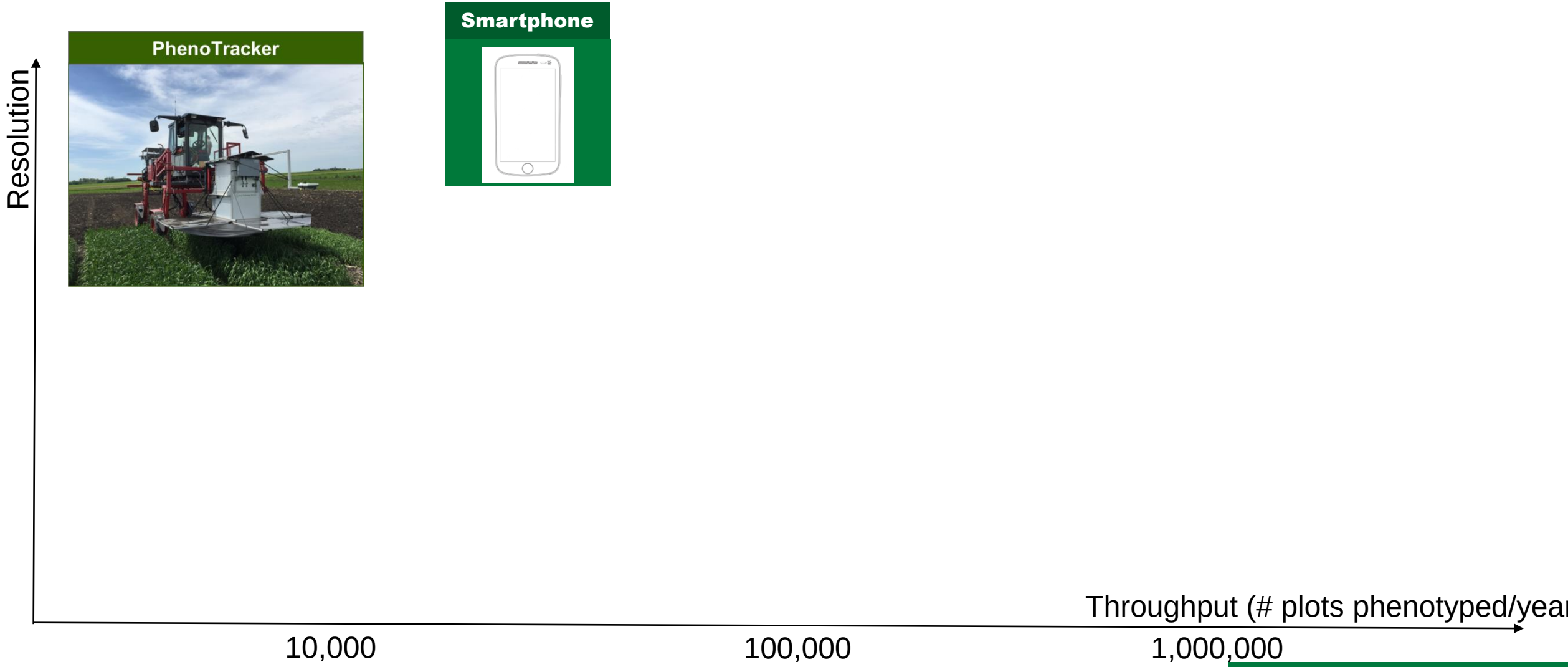
Digital Field Phenotyping Vectors



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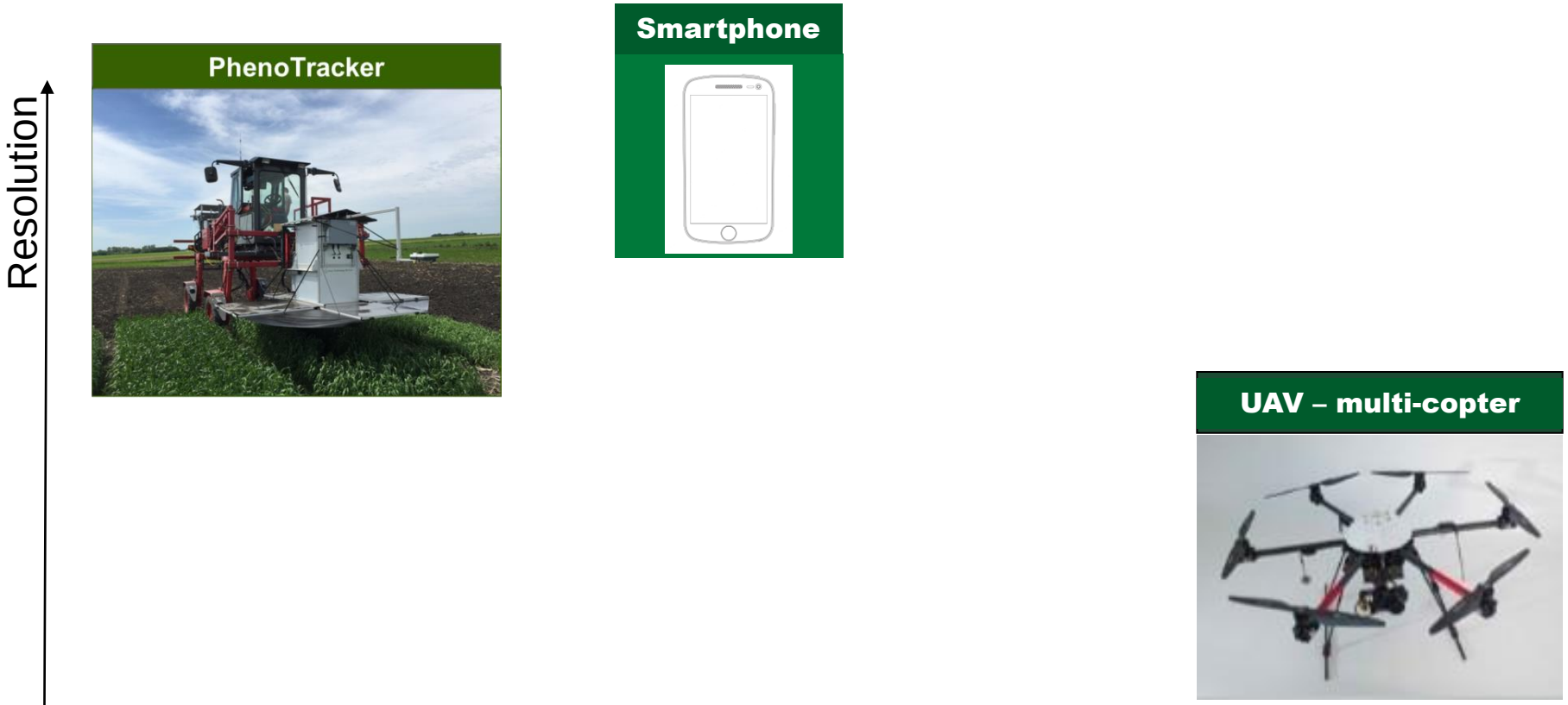

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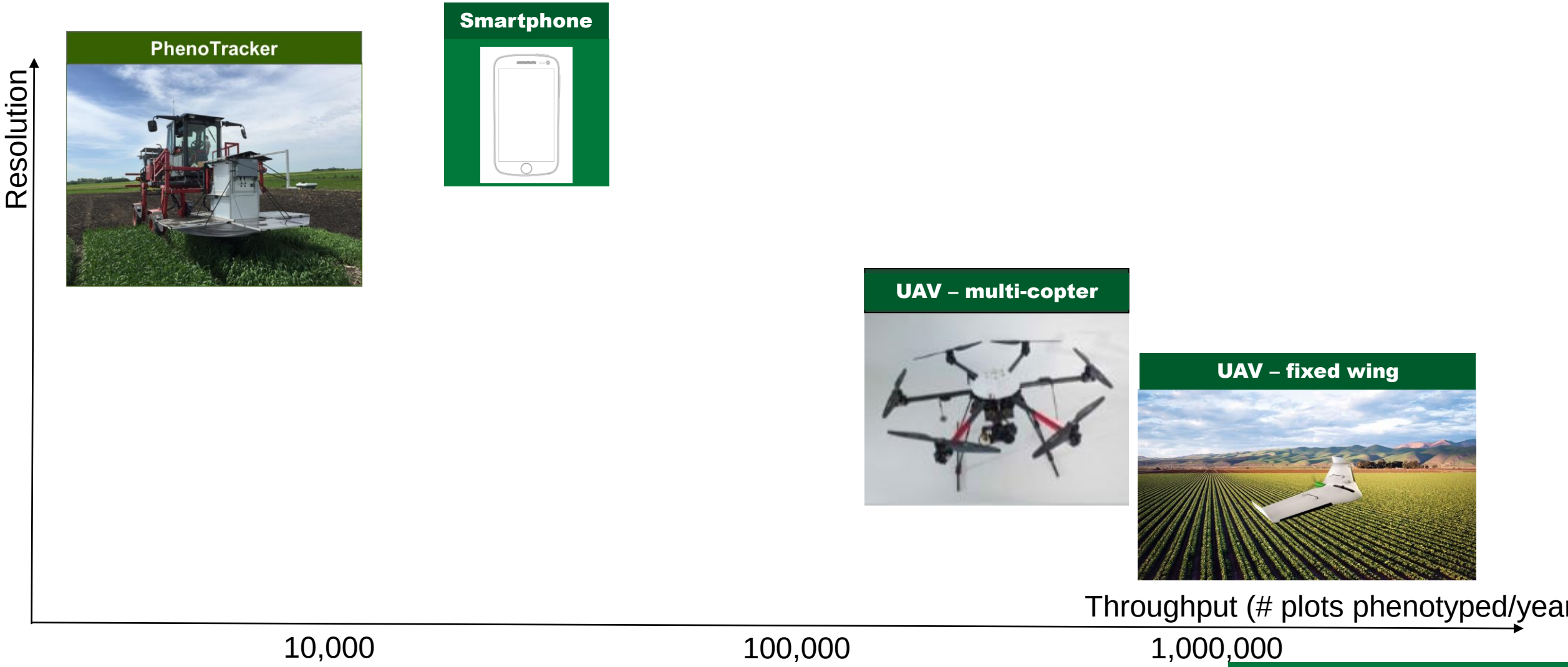
Digital Field Phenotyping Vectors



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Digital Field Phenotyping Vectors

PhenoTracker

1 picture RGB every 1m

0.2mm/pixel

6,5Mb /plot/timepoint

speed : 2km/h

Smartphone

UAV – multi-copter

UAV – fixed wing

Resolution

Throughput (# plots phenotyped/year

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Digital Field Phenotyping Vectors

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1 picture RGB every 1m
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6,5Mb /plot/timepoint
speed : 2km/h

Smartphone

1 picture RGB per plot
0.1mm/pixel
5Mb /plot/timepoint
speed : 4 km/h

UAV – multi-copter

UAV – fixed wing

Throughput (# plots phenotyped/year

10,000 100,000 1,000,000

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speed : 2km/h

Smartphone

1 picture RGB per plot
0.1mm/pixel
5Mb /plot/timepoint
speed : 4 km/h

1 picture RGB every 9m
(with 80% overlap)
1cm/pixel
2.3Mb /plot/timepoint
speed : 4 km/h – 10km/h
Battery capacity : ~ 30min

UAV – multi-copter

UAV – fixed wing

Throughput (# plots phenotyped/year

10,000 100,000 1,000,000

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5Mb /plot/timepoint
speed : 4 km/h

1 picture RGB every 9m
(with 80% overlap)
1cm/pixel
2.3Mb /plot/timepoint
speed : 4 km/h – 10km/h
Battery capacity : ~ 30min

UAV – multi-copter

1 picture RGB every 15m
(with 80% overlap)
5cm/pixel
0.8 Mb /plot/timepoint
speed : 55km/h
Battery capacity : ~1h

UAV – fixed wing

Throughput (# plots phenotyped/year

10,000 100,000 1,000,000

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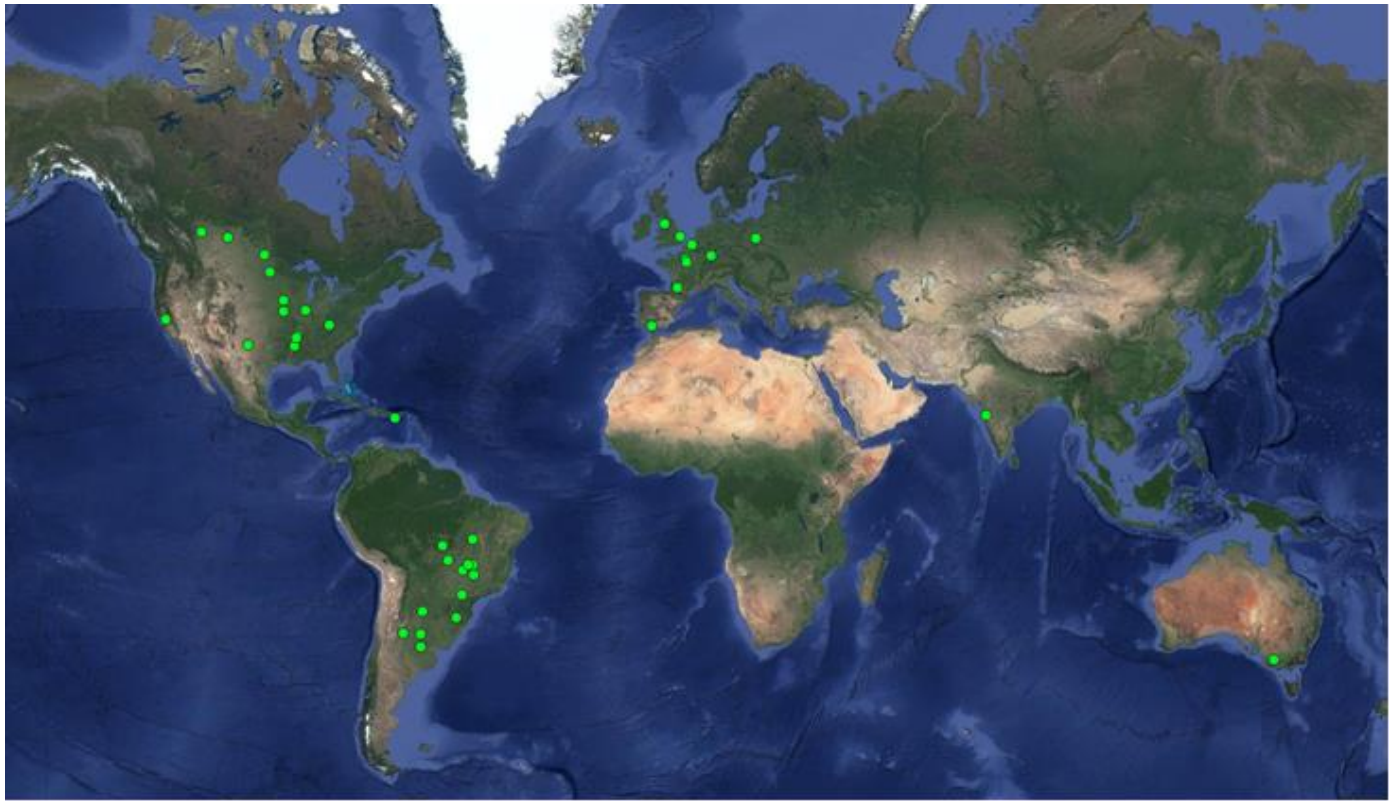
Common platform for drone images processing / analysis
Developed by Alteia

- Multiple departments : trait development, breeding, seed supply, vegetables, crop protection, ….
- Multiple locations : more than 50 stations locations accross the globe, all managing drone data
- Multiple crops :



➢ More than 300 BASF users

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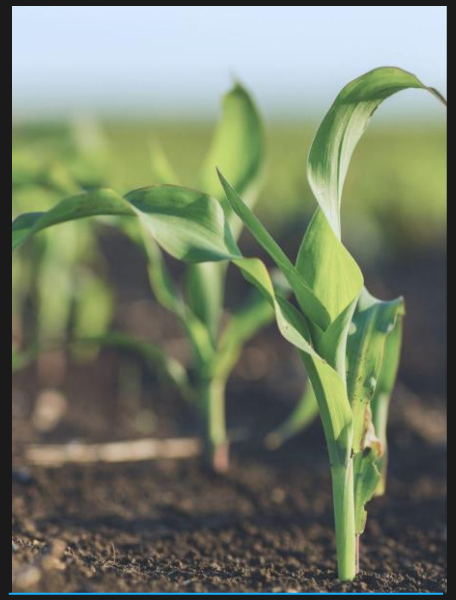
About Alteia

- **Founded in 2018**
- **Headquarters and R&D center in Toulouse** (France)
- **Sales offices in :**
  - Paris (France)
  - San Francisco (USA)
  - Dhahran (Saudi Arabia)
- **Team of 100 people**
  including 45 highly skilled engineers specialized in AI, computer vision, and geospatial data analysis
- **Strong advantage over competition based on :**
  - Our initial investment in our horizontal technology stack (fuse, build, deploy)
  - Our domain expertise in various market segments
  - The development of turnkey AI applications to solve high-value business problems

Alteia Headquarters in Toulouse



Field trial analysis

Powerful and scalable digital phenotyping solution that enables seamless data ingestion and quick data analysis, resulting in R&D cost reduction and improved data reliability.

Forest resource management

Assess the density and health of forests by leveraging satellite, Lidar or drone data and determine high-value indexes like carbon storage.

Seed production monitoring

Seed production demands accurate monitoring that relies on being able to extract seamlessly growth parameters over time. We help manage production with a precise and detailed eye.

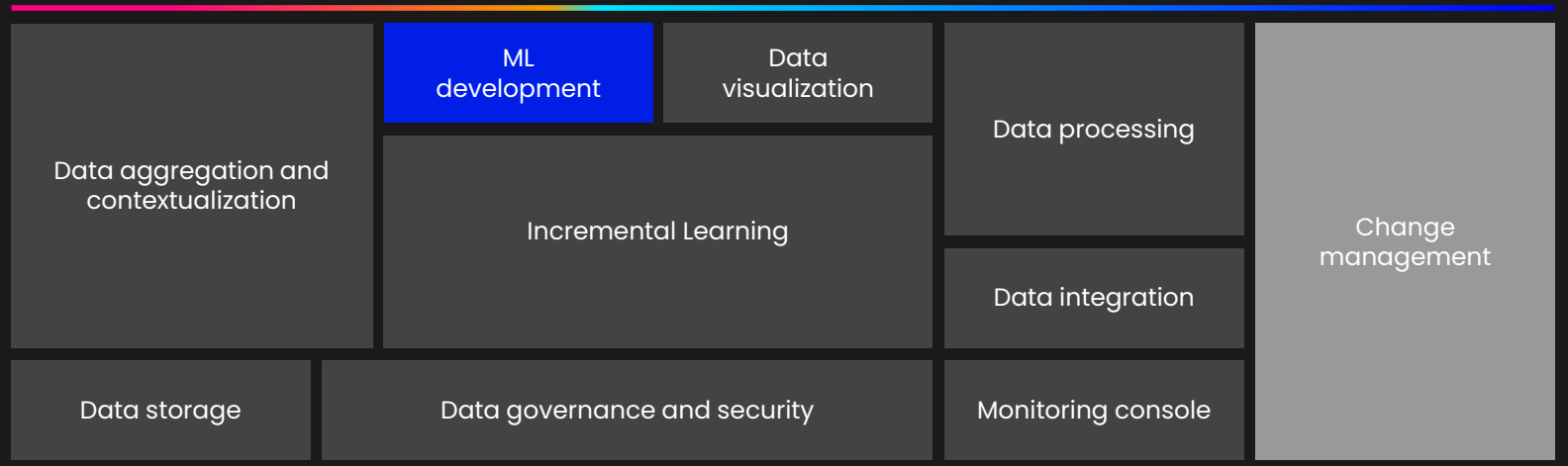
- **Why using drones & high throughput phenotyping ?**
  - Measures objectivity
  - Time saving

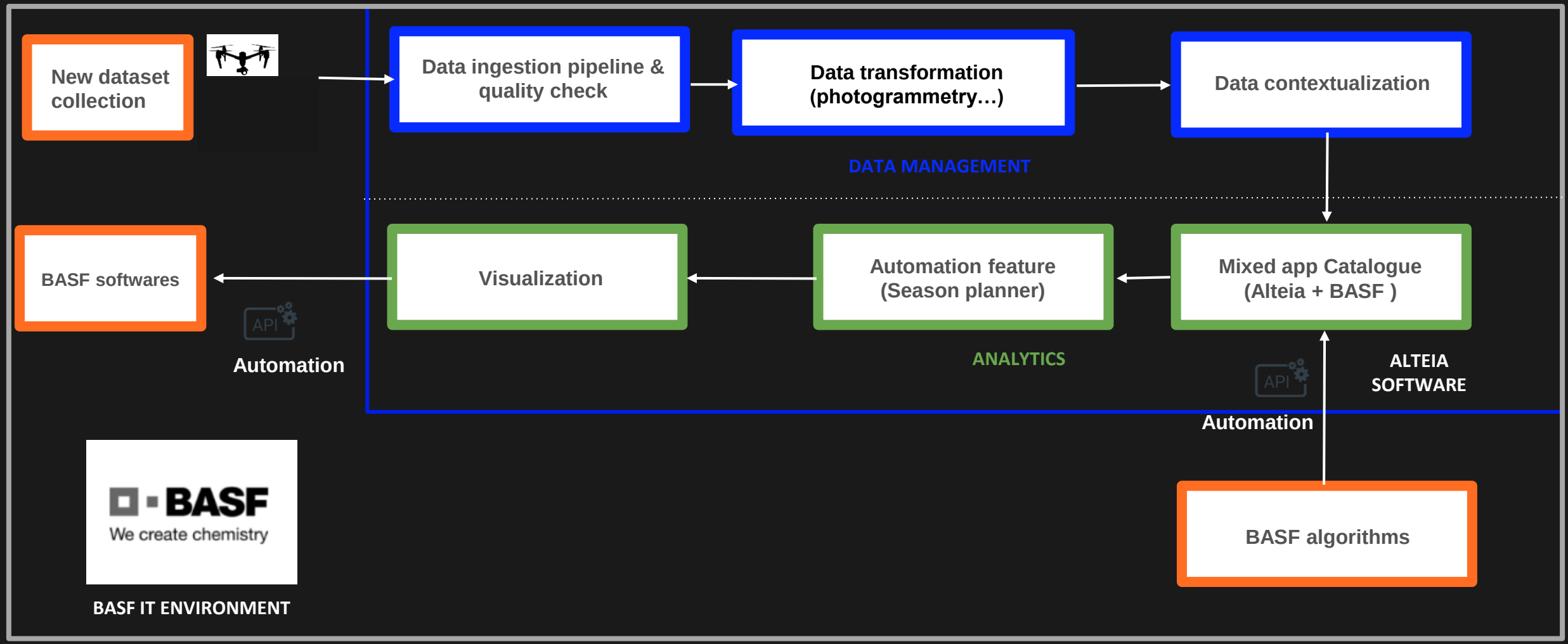
- **Why use one single platform ?**
  - Operation coordination: Alteia provides a common pipeline & method, shared by all the stations for drone phenotyping
  - Tool mutualization among the different sites
  - Process standardization

- **Why using Alteia as mutual solution for the global deployment ?**
  - Infrastructure ready for deployment
    - End to end software for high throughput phenotyping (Pix4D, metashape are integrated)
    - Large range of compatible sensors
    - Pre Built apps ready for main traits extraction
  - Contextualization
    - Alteia infrastructure aligned with BASF : Station / Field / Trial / Plot…
    - Integration with existing BASF digital ecosystem: including BASF models
  - Customization : BASF focus on its core expertise

Plug & play your own analytics. App is only 5% of the code lines on a AI project

- Focus on your core expertise
- Gain of versatility
- Save time & money for your deployment




New dataset collection
Data ingestion pipeline & quality check
Data transformation (photogrammetry…)
Data contextualization
DATA MANAGEMENT
BASF softwares
Visualization
Automation feature (Season planner)
Mixed app Catalogue (Alteia + BASF)
API
Automation
ANALYTICS
ALTEIA SOFTWARE
API
Automation
BASF algorithms
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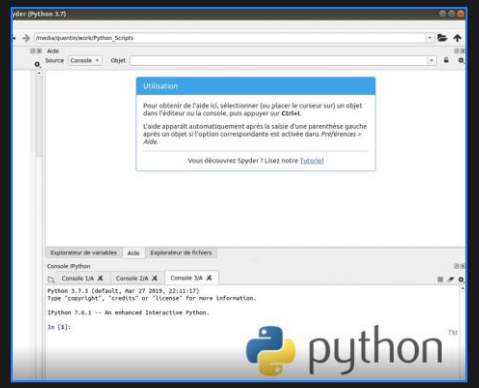
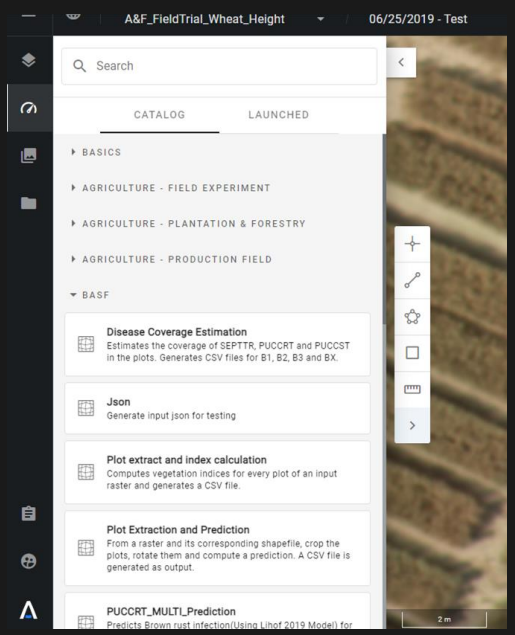
BASF IT ENVIRONMENT

Integration of BASF inhouse apps for a customized experience

- Enjoy of the Alteia environment, feature & processing power
- BASF development roadmap and priorities
  - Integration of non-generic models, connected with BASF specifications (agro conditions, methodology …)
  - Gain in agility
  - Control of the model production & deployment agenda
- IP is BASF's property

Code your App → **Package in the docker** → **Push to Alteia** → **Run your APP in Alteia**





- **BASF**

  - Continuous improvement
  - Possible PoC for new trait, new sensor integration

- **Alteia**

  - Integration of external (third party) apps
    - Creation of a marketplace to ease new apps integration
    - For Universities, technical institutes, Private companies

Alteia.com

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Our clients

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setec
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