



Understanding Fungi & Bacteria in Soil Profiles

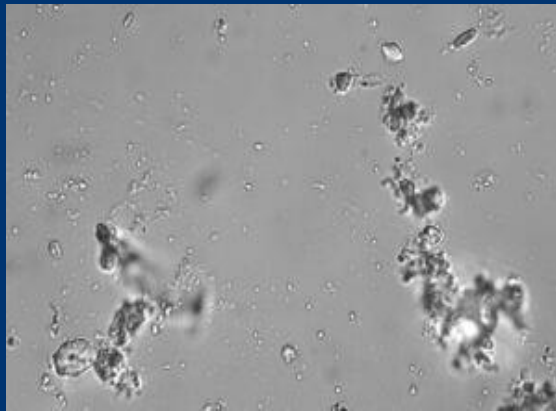
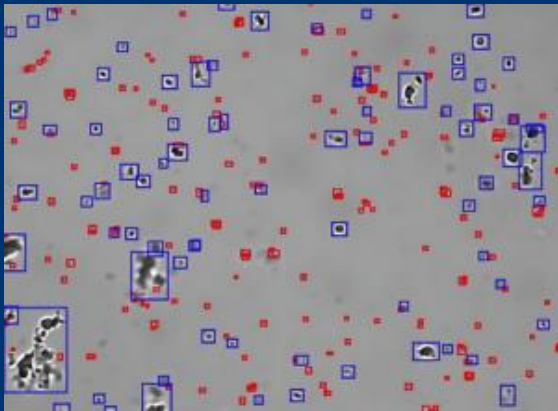
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PGW Turf Agronomist



Key Values of a Healthy & Diverse Soil Microbiome

- Microbial biomass (fungi and bacteria) is the leading indicator of soil health.
- 'Living' soil fixes nutrients, improves plant immunity, stores water more efficiently and builds soil structure.

The Microbiometer Model



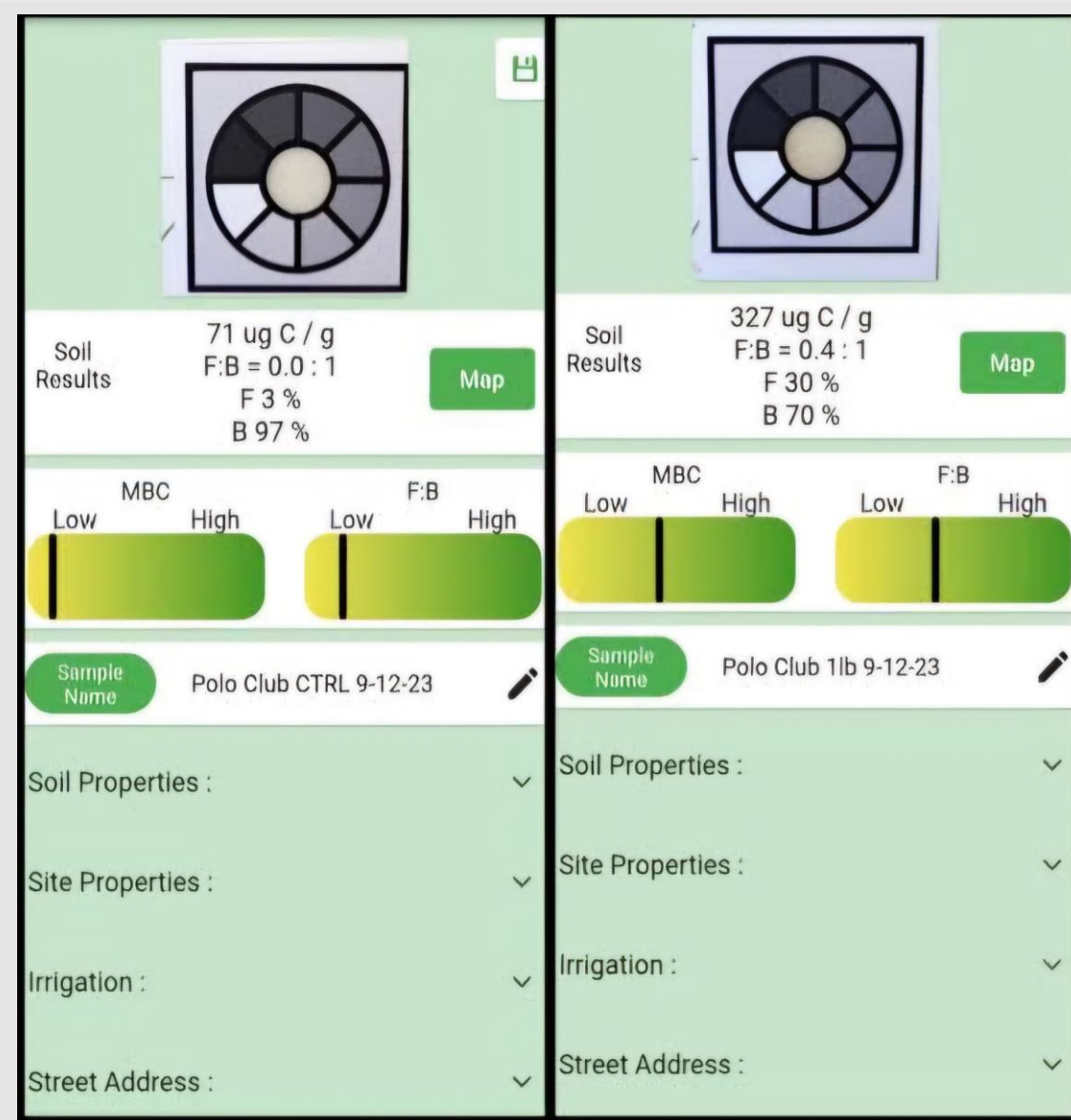
Key Facts about the Analysis Model:

- Developed by Dr Judith Fitzpatrick, Dr Brady Trexler and James Sottilo
- Uses a salt extraction method
- Determines microbial biomass and F:B by colour
- Lateral flow test
- Precipitates soil to ease analysis
- Validated using digital microscopy (Earthfort Labs, Oregon USA)

The Microbiometer Model

Analysis is performed using an App and results expressed as:

- Total microbial biomass (ug C/g)
- Ratio of Fungi to Bacteria
- % Fungi and Bacteria



The Project

To capture soil microbiological data across a range of sports and recreational turf surfaces and systems over several years:

- Golf courses
- Sports fields
- Lawns

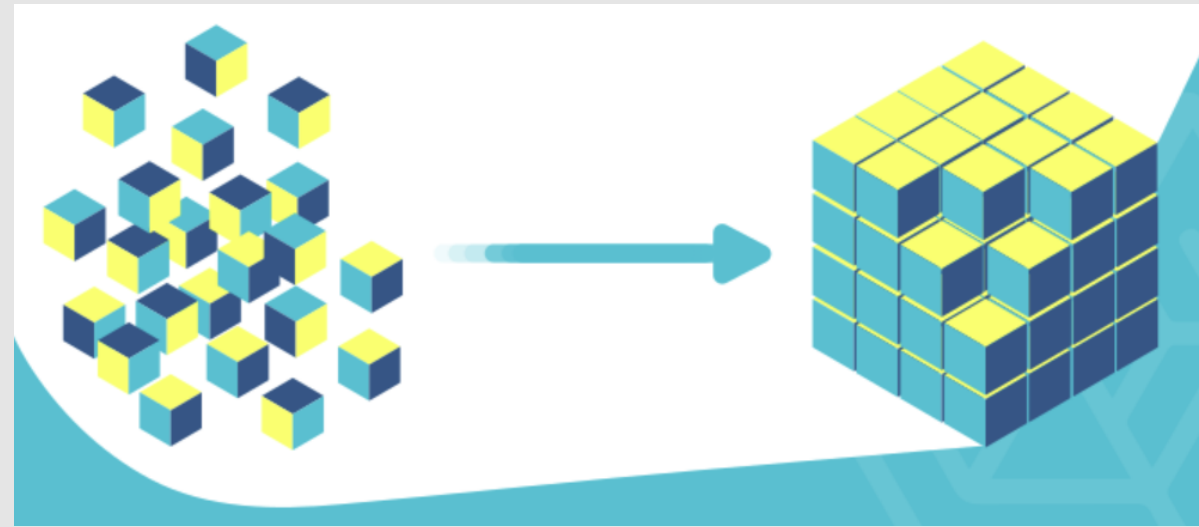
Building a database of data on the microbiological characteristics of different soil and turf types.

Sample No. ID	Soil type	Turf type	Age of profile	Total microbial biomass (ug C/g) (*)	Ratio F:B	% Total F	% Total B
Sportsfield	Sand	Couchgrass	>5	75	0.1:1	6%	94%
Golf green	Sand	Fine fescue	2	50	0.0:1	3%	97%
Golf green	Biochar & Sand	Fine fescue	2	543	1.0:1.0	51%	49%
Golf green	Sand	CB	>5	209	0.2:1.0	17%	83%
General lawn	General soil	Couchgrass/rye	>10	1204	2.6:1.0	73%	27%
Golf green	Soil	Poa annua	>10	1868	4.4:1.0	81%	19%
Golf green	Sand	CB	<5	233	0.4:1.0	30%	70%
Golf green	Sand	CB	<5	366	0.7:1.0	40%	60%
Sportsfield	Soil	Ryegrass	>10	304	0.6:1.0	37%	63%
Sportsfield	Soil	Fine fescue	>10	174	0.2:1.0	15%	85%
Sportsfield	Sand	Ryegrass	>5	433	0.8:1.0	45%	55%
Sportsfield	Sand	Ryegrass	>5	174	0.2:1.0	15%	85%
Sportsfield	Sand	Couchgrass/rye	1	305	0.5:1.0	33%	67%
Golf green	Sand	CB	1	63	0.0:1.0	4%	96%
Golf green	Sandy soil	BT	10	183	0.2:1.0	14%	86%
Golf green	Sandy soil	BT	10	90	0.1:1.0	7%	93%
Golf green	Sand	BT	>5	306	0.6:1.0	36%	64%
Golf green	Sandy soil	BT	10	481	0.8:1.0	45%	55%
Golf green	Sand	BT	10	404	0.7:1.0	41%	59%
Sportsfield	Sand	Ryegrass	5	258	0.5:1.0	33%	67%
Sportsfield	Sand	Ryegrass	5	147	0.1:1.0	12%	88%
Golf green	Sand	Poa annua	5	165	0.2:1.0	13%	87%
Golf green	Sandy soil	Poa annua	10	308	0.6:1.0	36%	64%
Sportsfield	Sand	Ryegrass	5	80	0.1:1.0	6%	94%
Golf green	Sand	CB	<5	103	0.1:1.0	8%	92%
Golf green	Sand	CB	<5	231	0.4:1.0	30%	70%
Sportsfield	Sandy soil	Ryegrass	5	251	0.5:1.0	32%	68%
Sportsfield	Sandy soil	Ryegrass	5	334	0.6:1.0	39%	61%

Year 1 Stage Review

Establishing relationships between the following key factors:

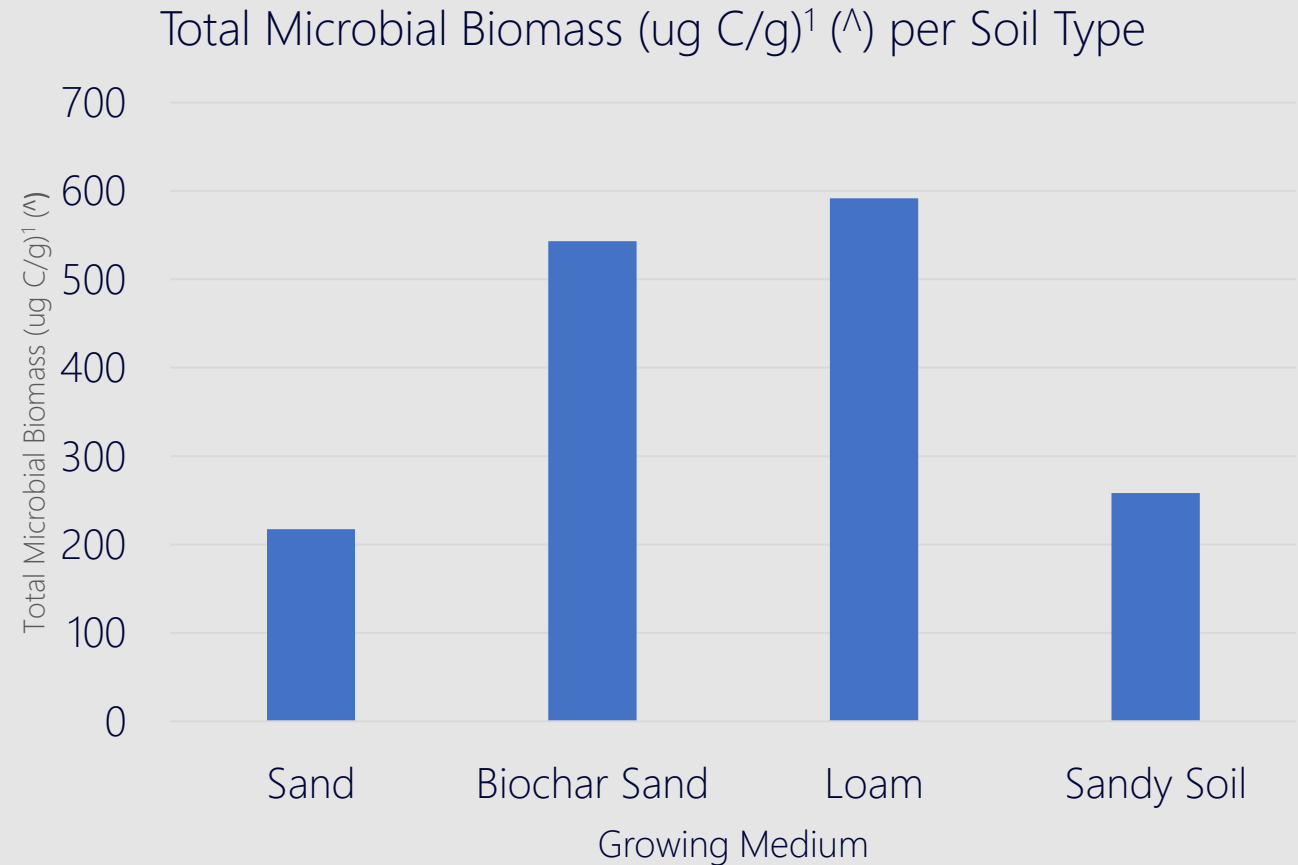
1. Type of growing medium
2. Type and age of sports turf system
3. Turfgrass species
4. Region



1. Type of Growing Medium

Soil Type	Total Microbial Biomass (ug C/g)
Sand	217.4
Biochar Sand	543
Loam	591.6
Sandy Soil	258.1

Level	Interpretation
< 200	Low
200-400	Fair
400-600	Good
> 600	Excellent

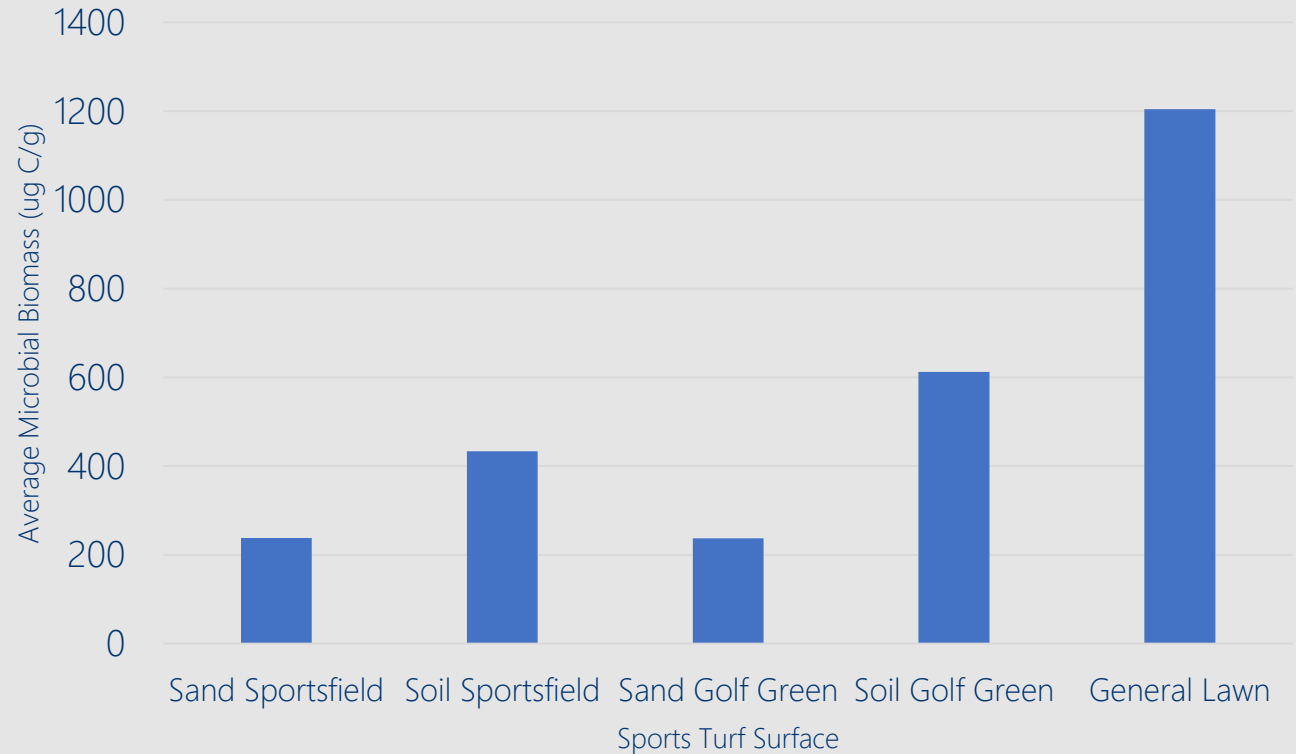


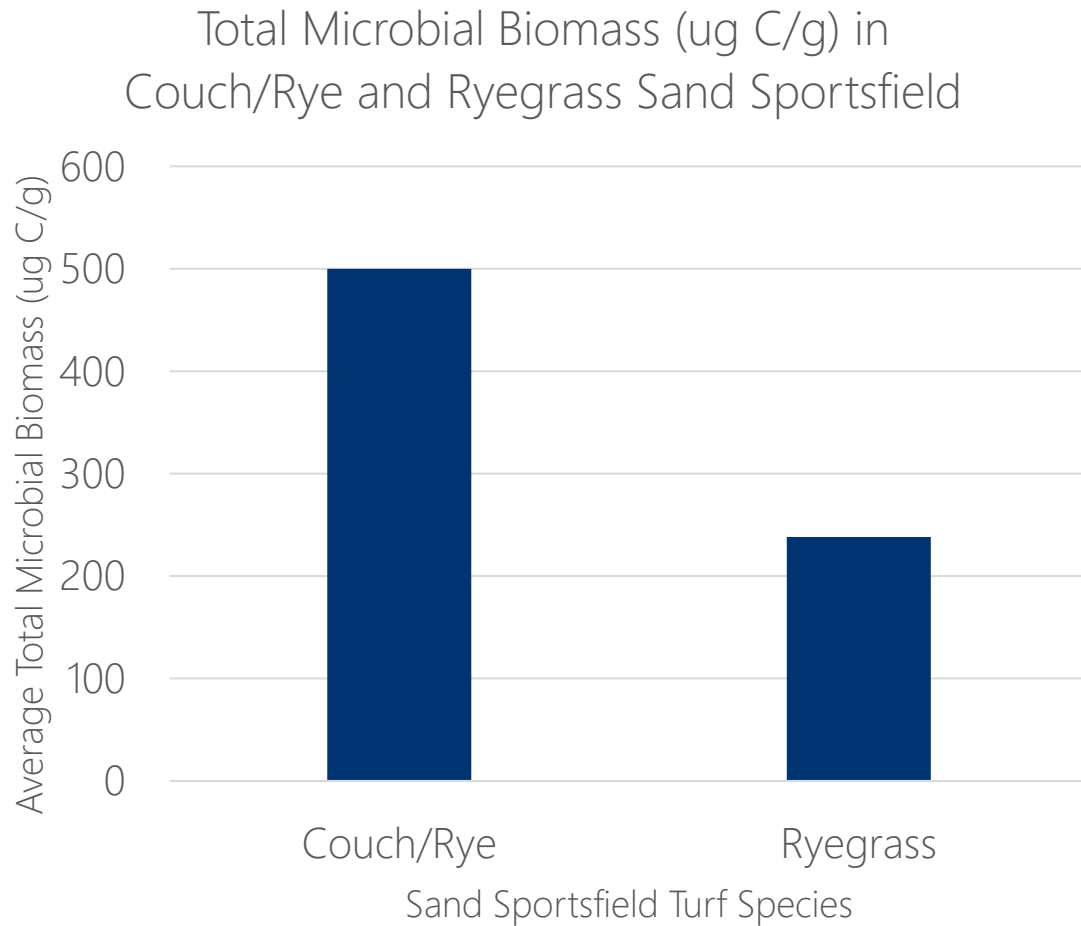
1. Type of Sports Turf Surface

Surface Type	Total Microbial Biomass (ug C/g)
Sand Sportsfield	238
Soil Sportsfield	433.6
Sand Golf Green	237.3
Soil Golf Green	612.2
General Lawn	1204

Surface Type	% Fungi or Bacterial Dominated Fungi
Sand Sportsfield	Bacterial
Soil Sportsfield	Bacterial
Sand Golf Green	Heavily Bacterial
Soil Golf Green	Slightly Bacterial
General Lawn	Fungal

Total Microbial Biomass (ug C/g)¹ by Surface Type



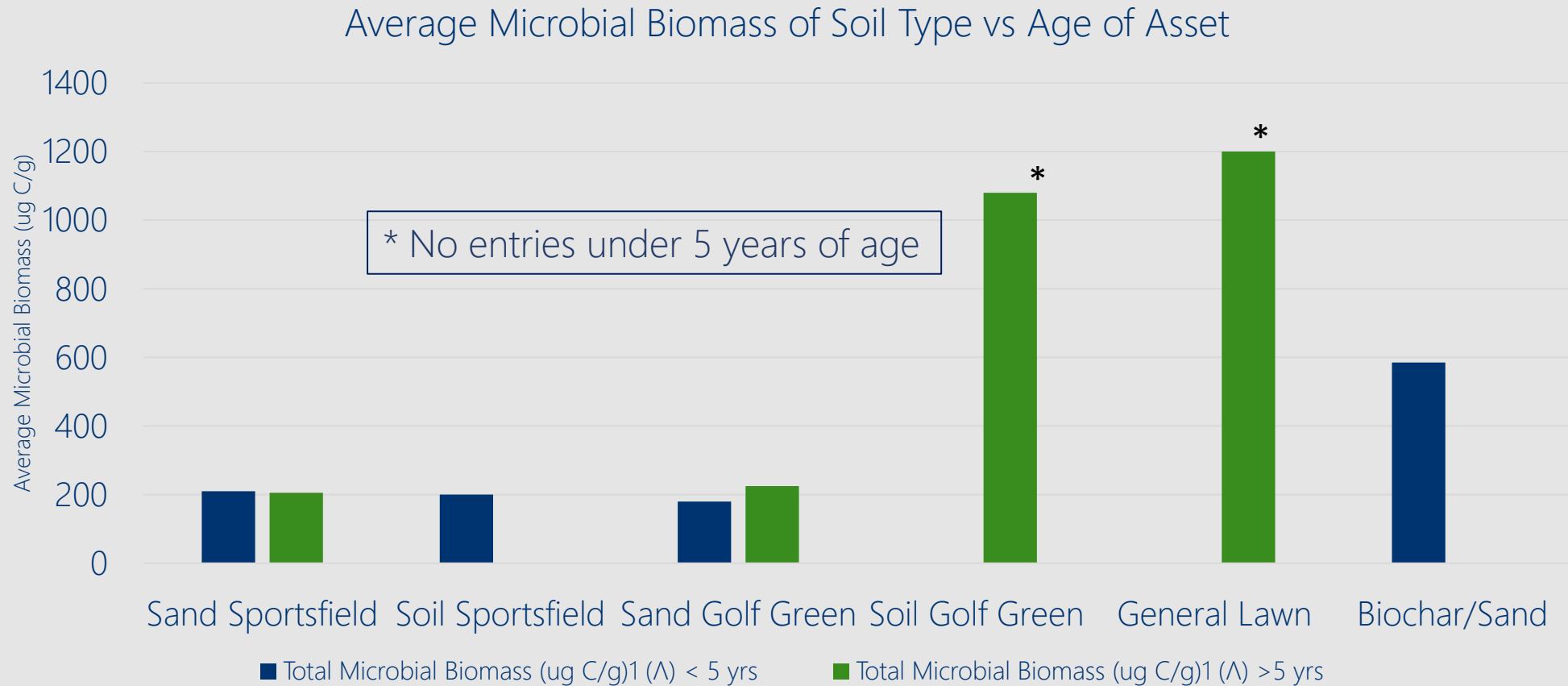


2. *Type of Sports Turf System*

Transitioned couchgrass sand profiles had **77%** greater average microbial biomass compared to straight perennial ryegrass.

No indication of allelopathic effects of endophytic Pr through transitioning.

2. Type of Sports Turf System & Age



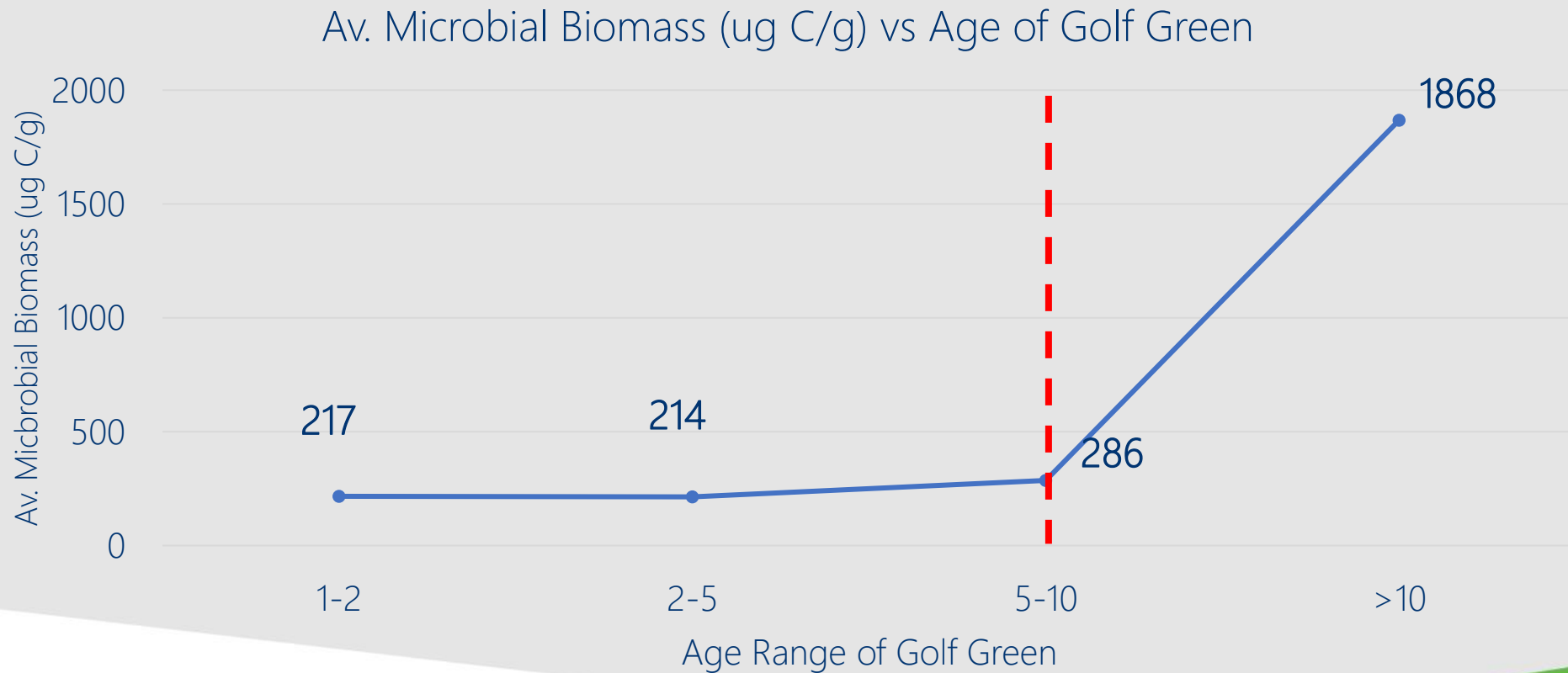
2. Type of Sports Turf System

Fungal/Bacterial ratio associated with Sports Systems

Asset Type	Ratio (F:B)
Sand Sportsfield	0.3 : 1.0
Soil Sportsfield	0.5 : 1.0
Sand Golf Green	0.3 : 1.0
Soil Golf Green ¹	1.1 : 1.0 ¹
Biochar/Sand Amended	1.0 : 1.0
	¹ Slightly Fungal

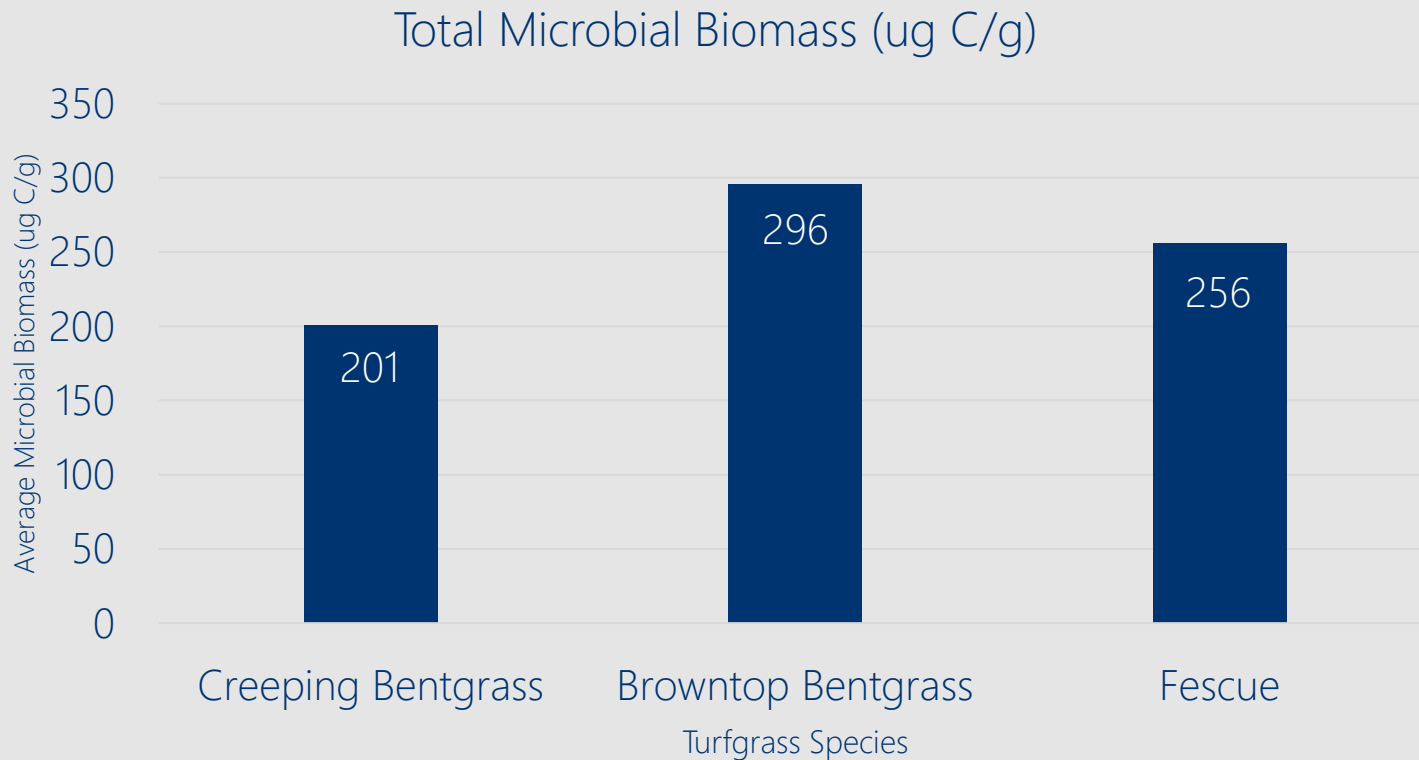
2. Type of Sports Turf System

Golf Green Microbial Biomass associated with age



3. Turfgrass Species

Relationship between Turfgrass species on golf greens and microbial biomass

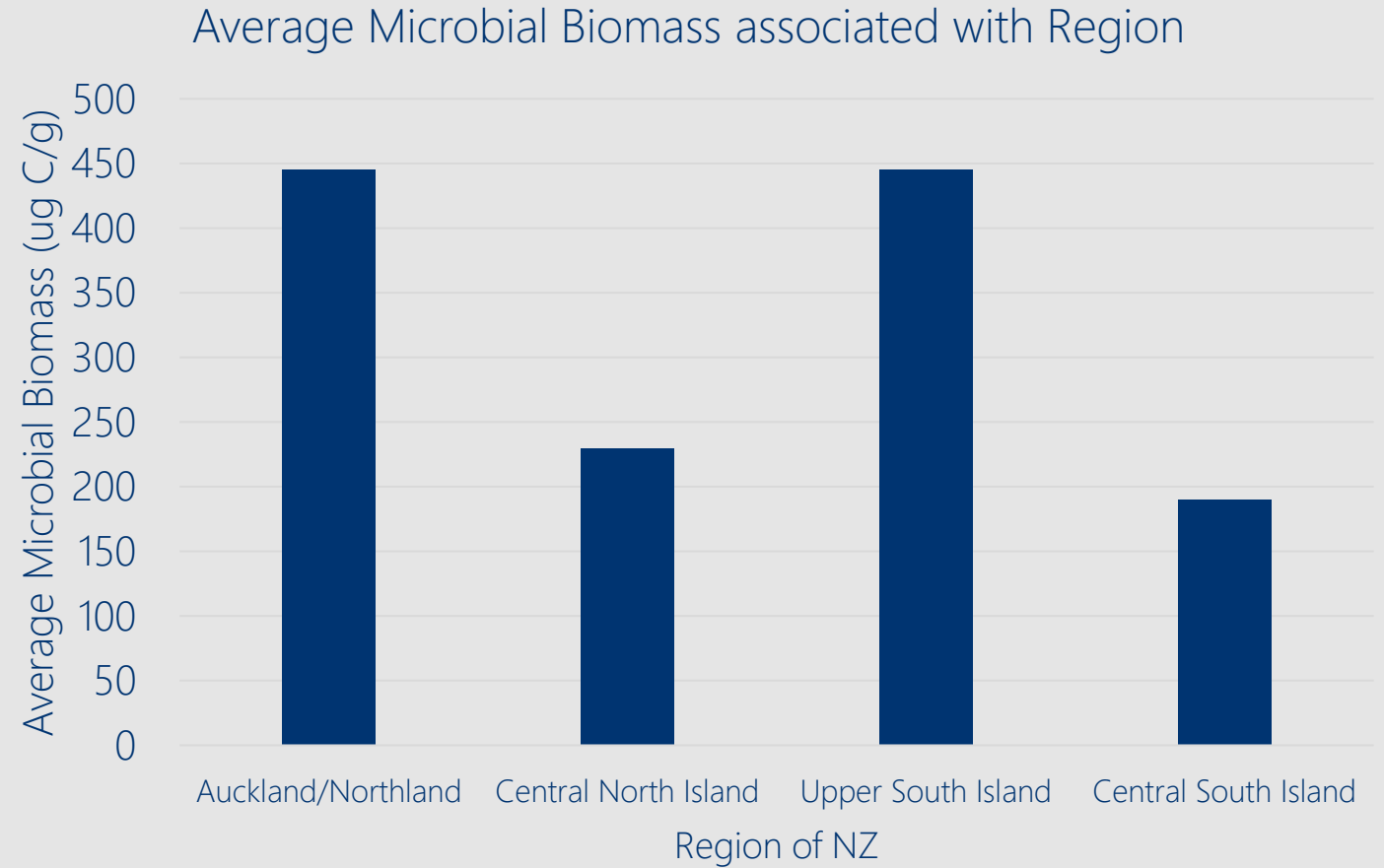


4. Regional Influence

Hypothesis:

Auckland/Northland > no. of couchgrass surfaces

Upper South Island > no. of 'aged' systems



Outcomes after 1 Year

1. Loam soils had the greatest microbial biomass
2. Soil golf greens (> 5 years of age) had the greatest biomass of compared sports surfaces
3. Transitioned systems had significantly > microbial biomass than straight c3 systems.
4. Soil and sand/biochar greens had the most balanced ratio of Fungi : Bacteria
5. The microbial biomass of a golf green increased exponentially after 10 years
6. Sports turf systems over 5 years of age are 'naturally regenerative' IE managed with low disturbance.
7. Regions with a mix of transitioned turf assets and systems > 5 years of age had the highest microbial biomass

***Thank You &
Questions?***