ECOS Center for Ecosystem Science and Society at Northern Arizona University

This presentation participates in OSPP

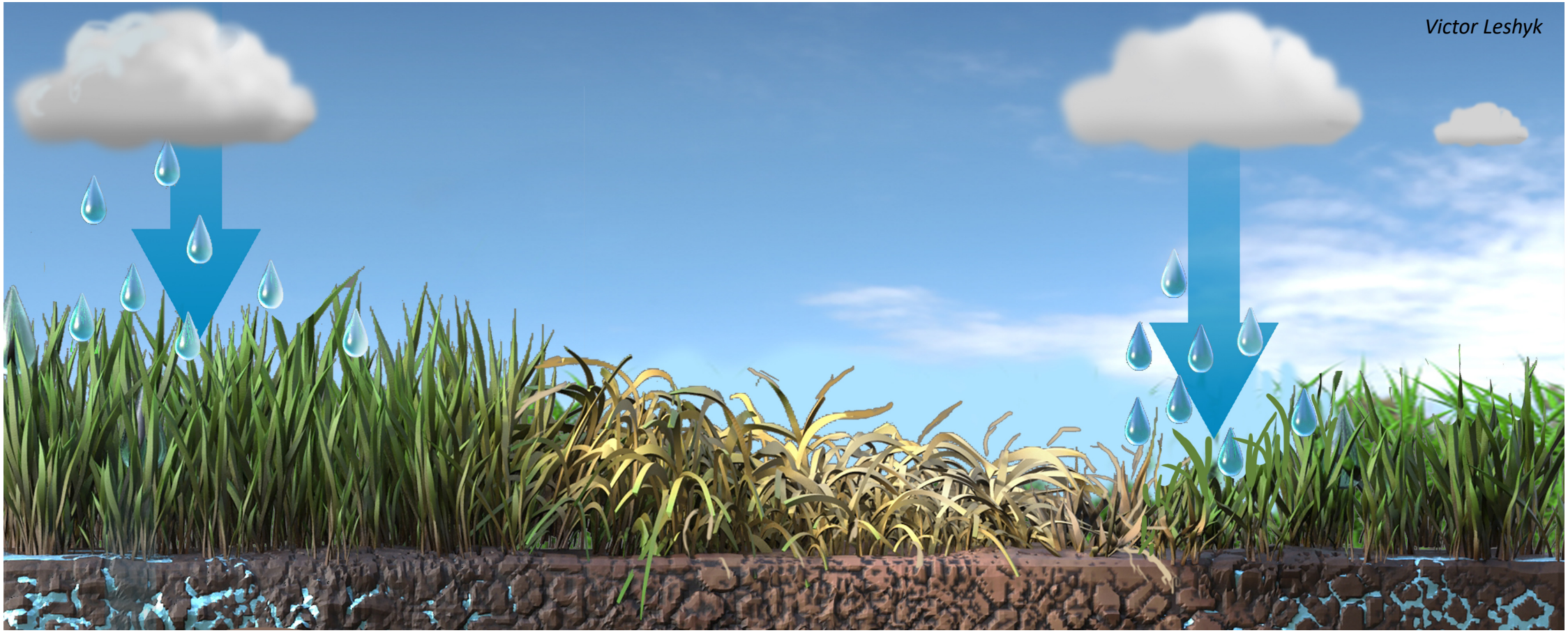
EGU

Outstanding Student & PhD candidate Presentation contest

Historical precipitation regimes structure the growth of soil microorganisms in three California annual grasslands

Megan Foley, Steven Blazewicz, Karis McFarlane, Alex Greenlon, Michaela Hayer, Jeffrey Kimbrel, Benjamin Koch, Victoria Monsaint-Queeney, Keith Morrisson, Ember Morrissey, Jennifer Pett-Ridge, and Bruce Hungate

EGU General Assembly
23 May 2022



Winter
growing season

Summer
dry season

High MAP

Low MAP

Photo: ucnrs.org

Photo: Nathan DeHart

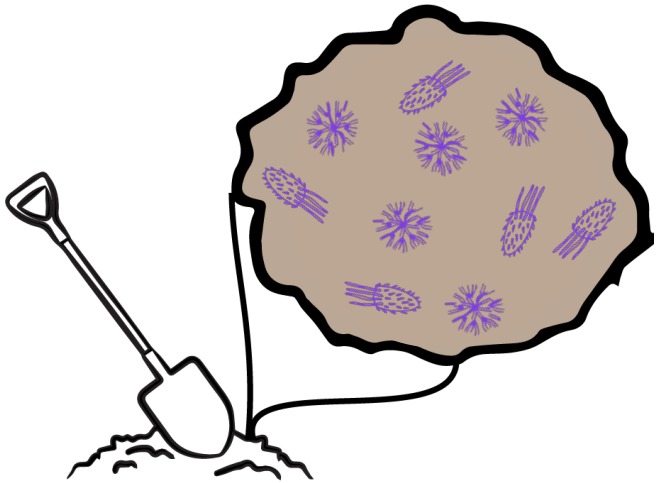
Photo: Justin Meissen

2160 mm/year

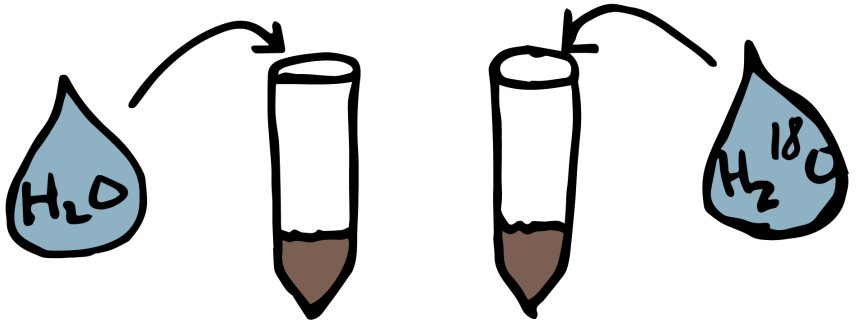
956 mm/year

383 mm/year

Sample during the wet season



Characterize growing populations with $H_2{}^{18}O$ qSIP



Images: Victoria Monsaint-Queeney

How does climate vs. recent environment shape who's growing?

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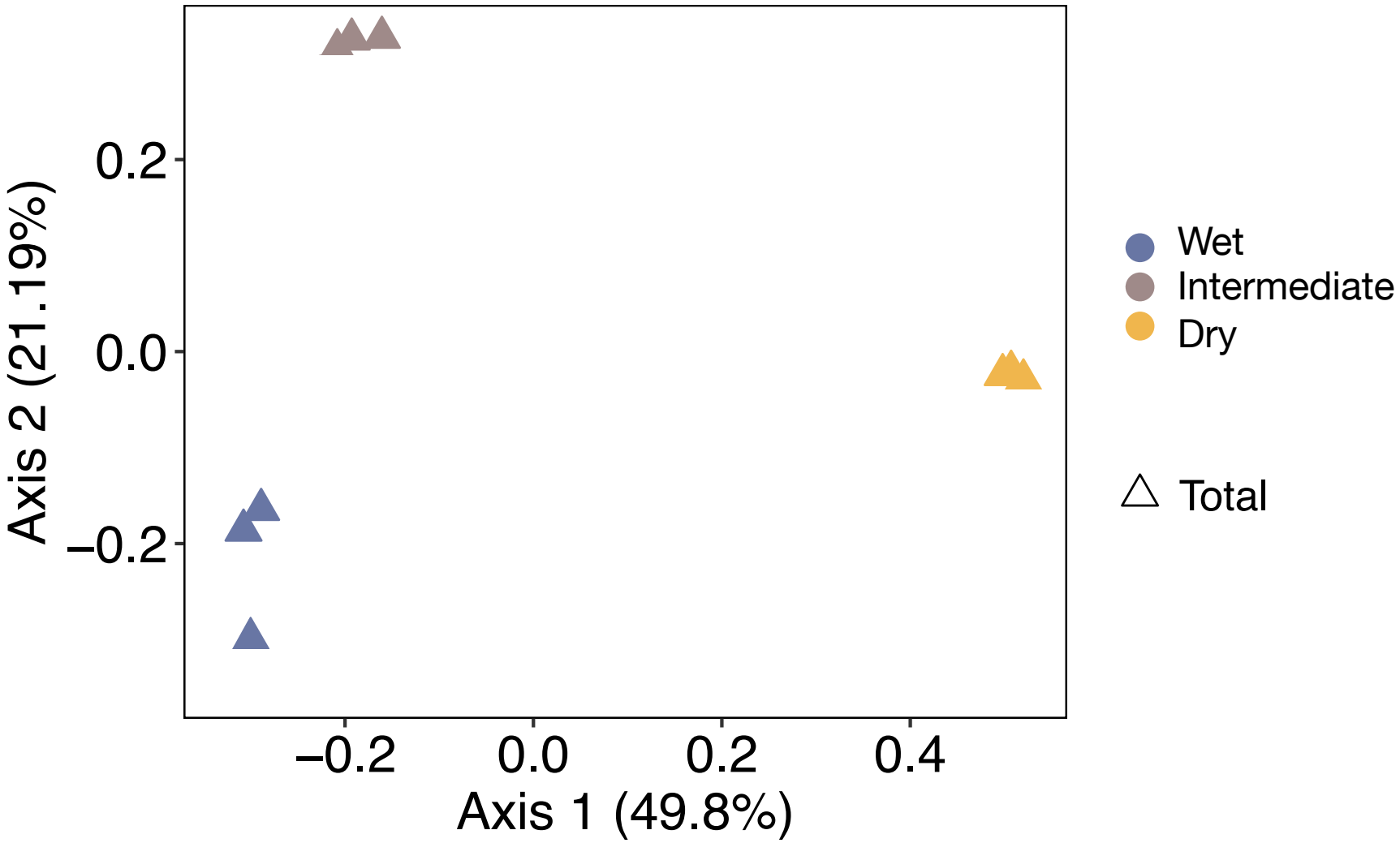
How does long term climate vs. recent environment impact taxon-specific growth rates?

Growth will be slowest at the driest site, reflecting a long-term legacy effect climate

How does long term climate vs. recent environment shape who's growing?



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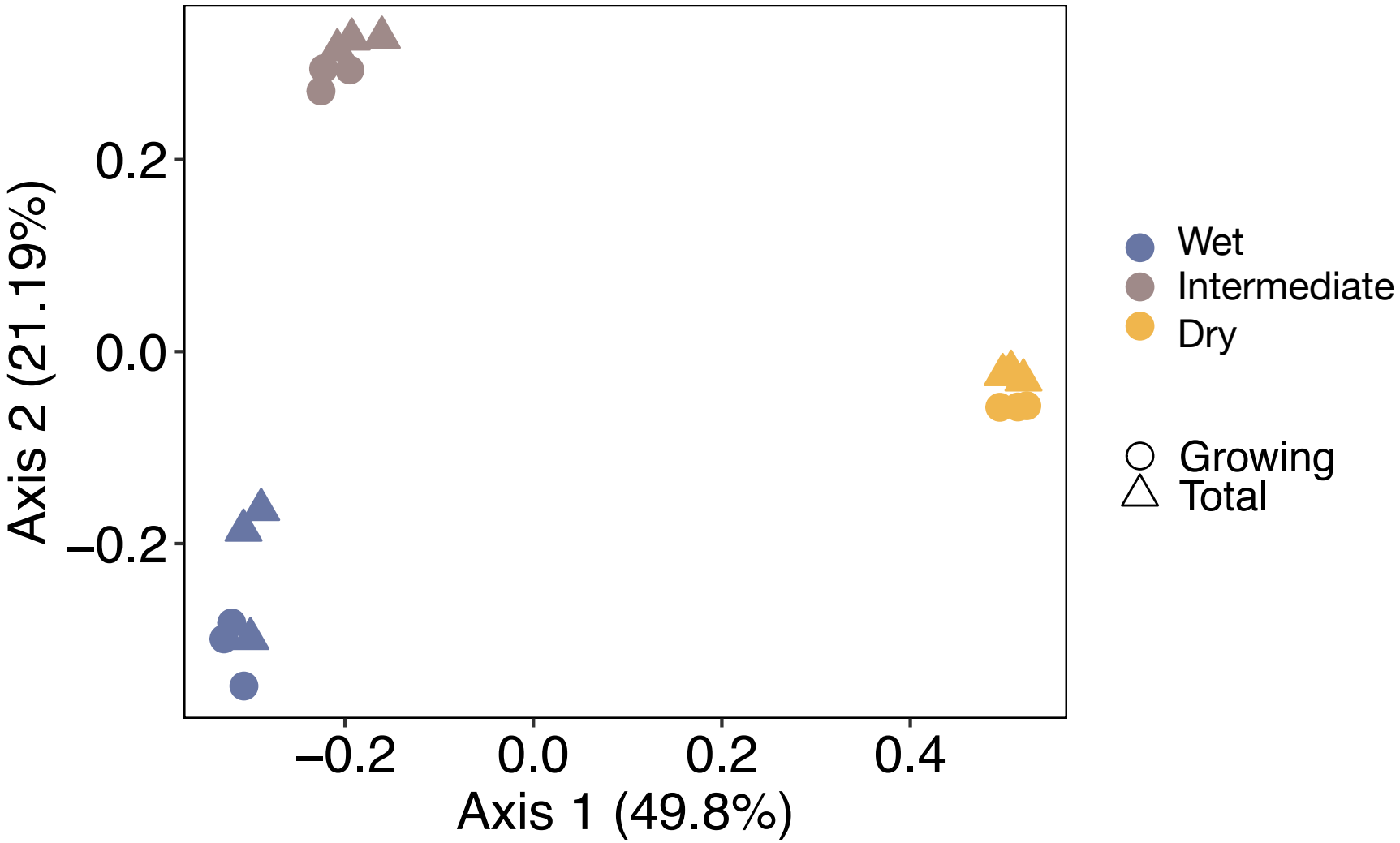

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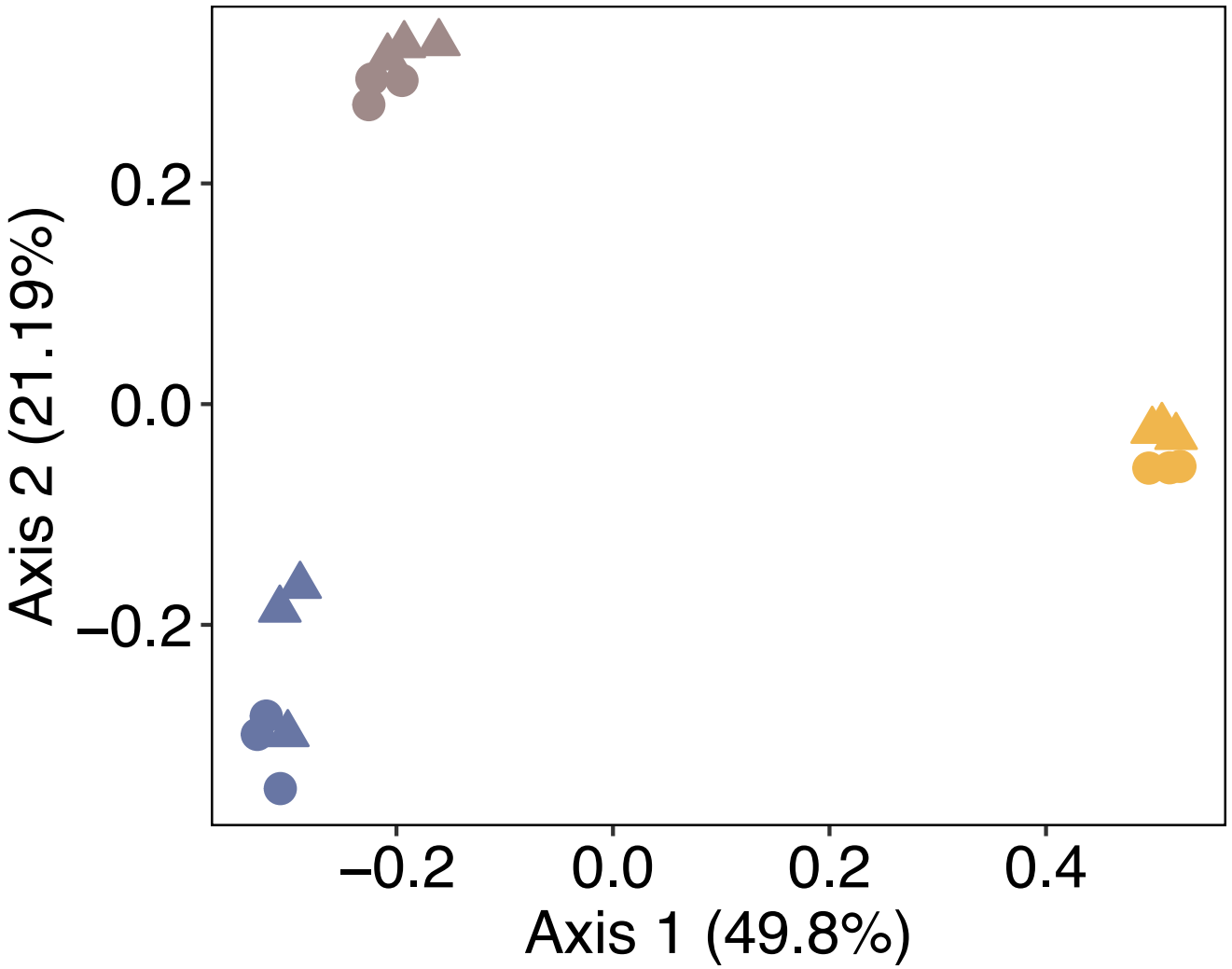

Wet site: 28%
Intermediate site: 48%
Dry site: 58%

Wet
Intermediate
Dry

Growing
Total

Growth will be slowest at the driest site, reflecting a long-term legacy effect of climate

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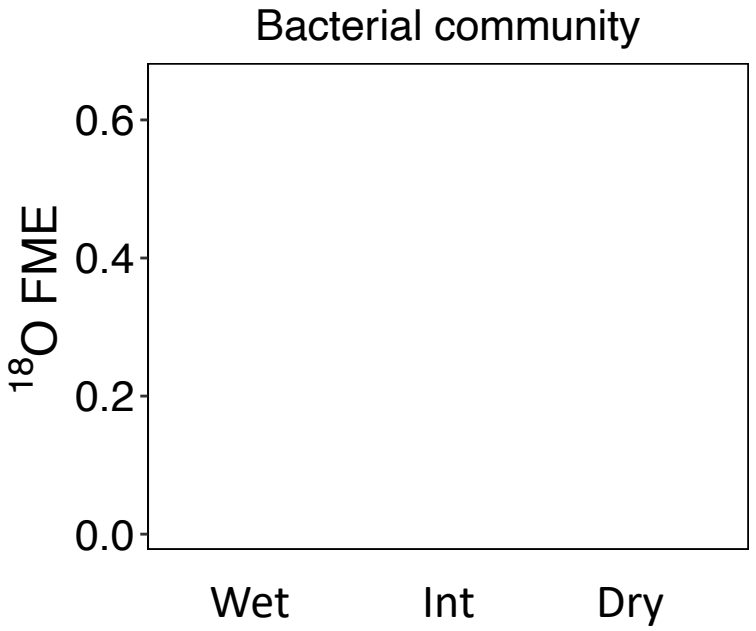

FME = **F**raction of **m**aximum potential **e**nrichment

$$\text{FME} = \frac{^{18}\text{O EAF DNA}}{^{18}\text{O EAF soil water}}$$

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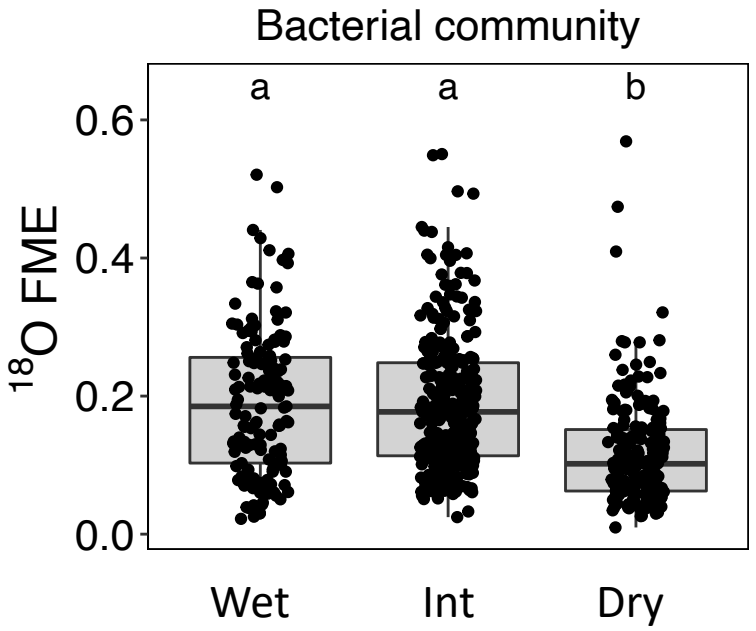

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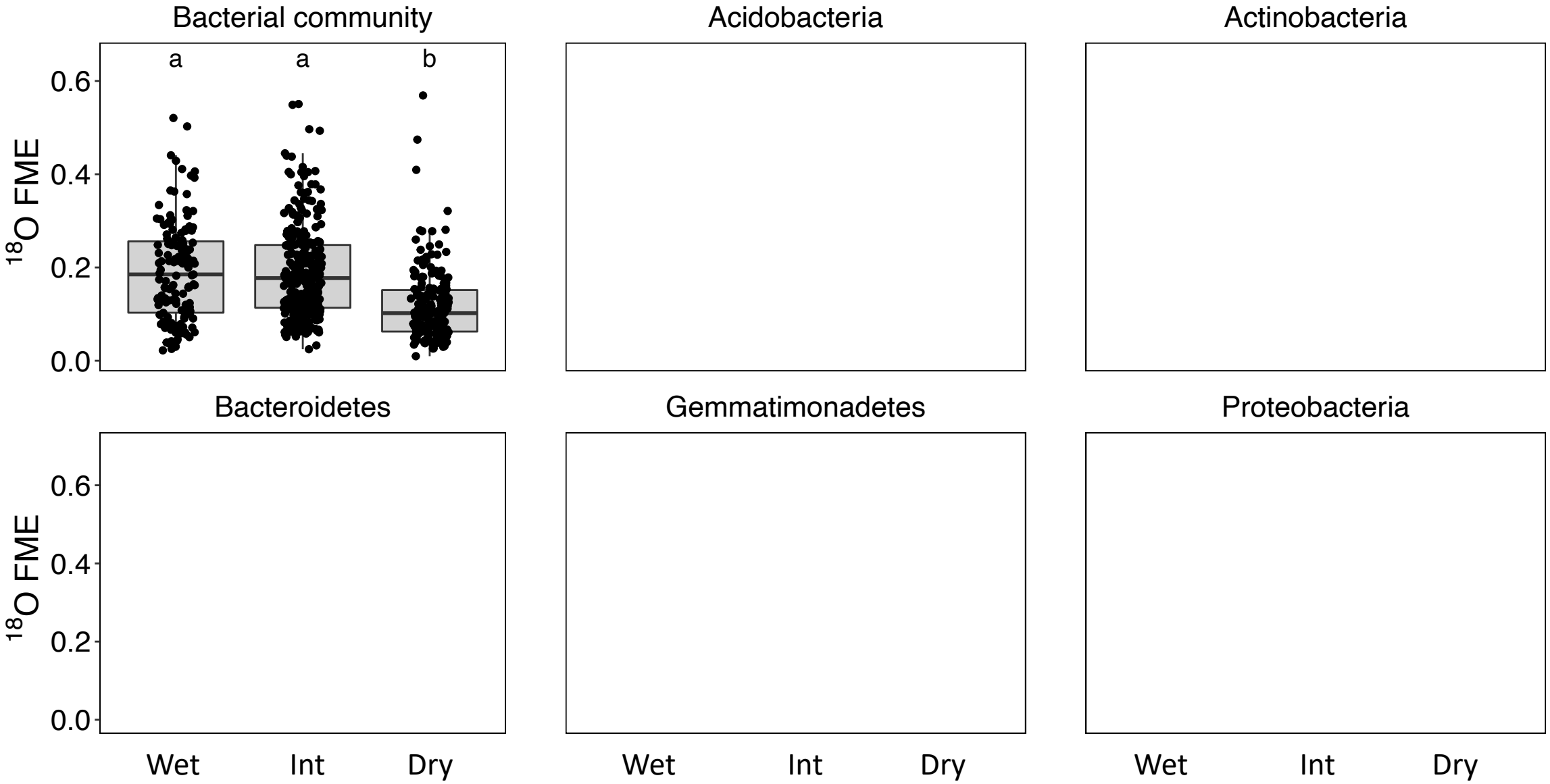
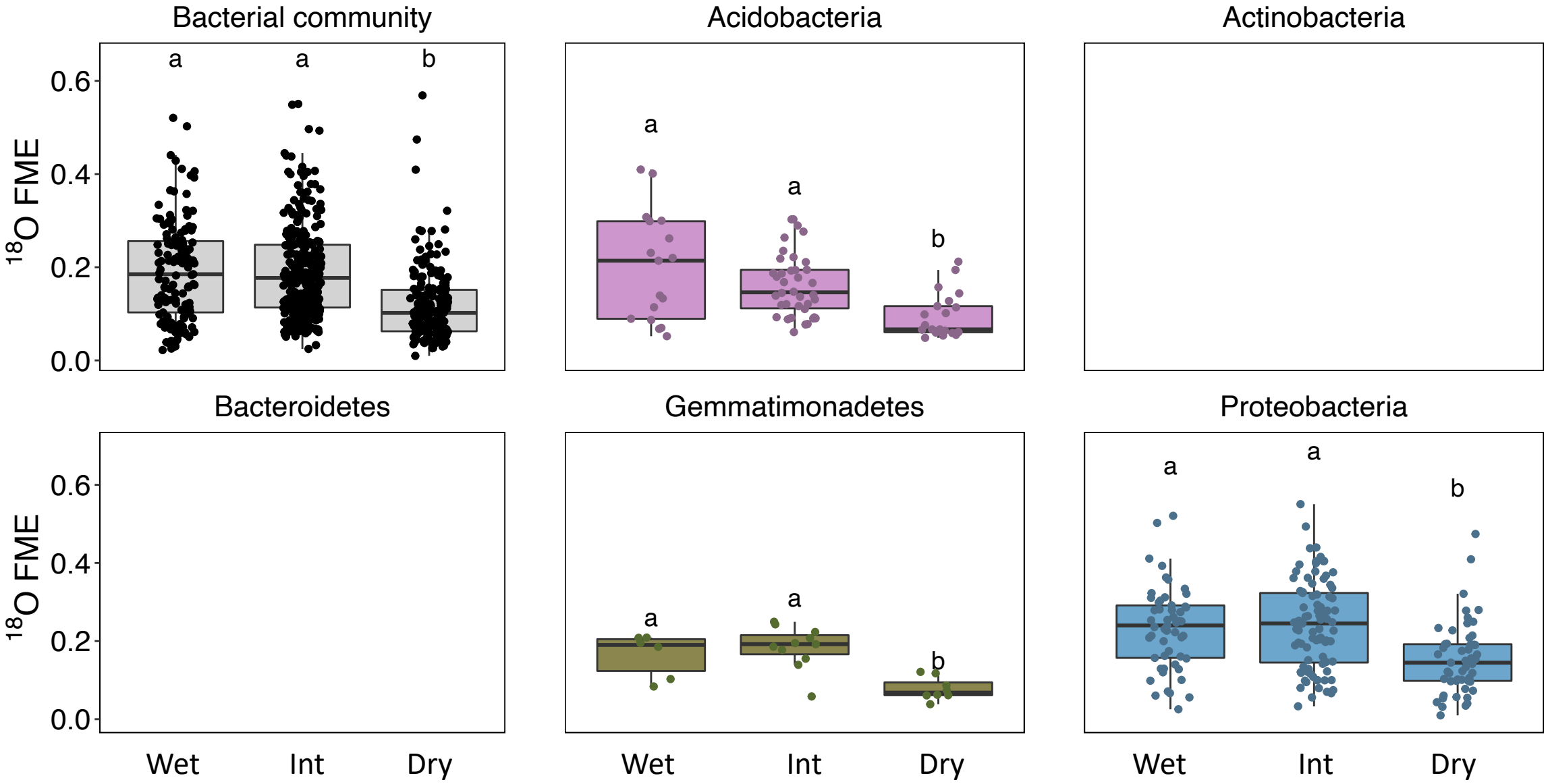

Bacterial community
Acidobacteria
Actinobacteria
Bacteroidetes
Gemmatimonadetes
Proteobacteria
a
a
b
0.6
0.4
0.2
0.0
18O FME
Wet
Int
Dry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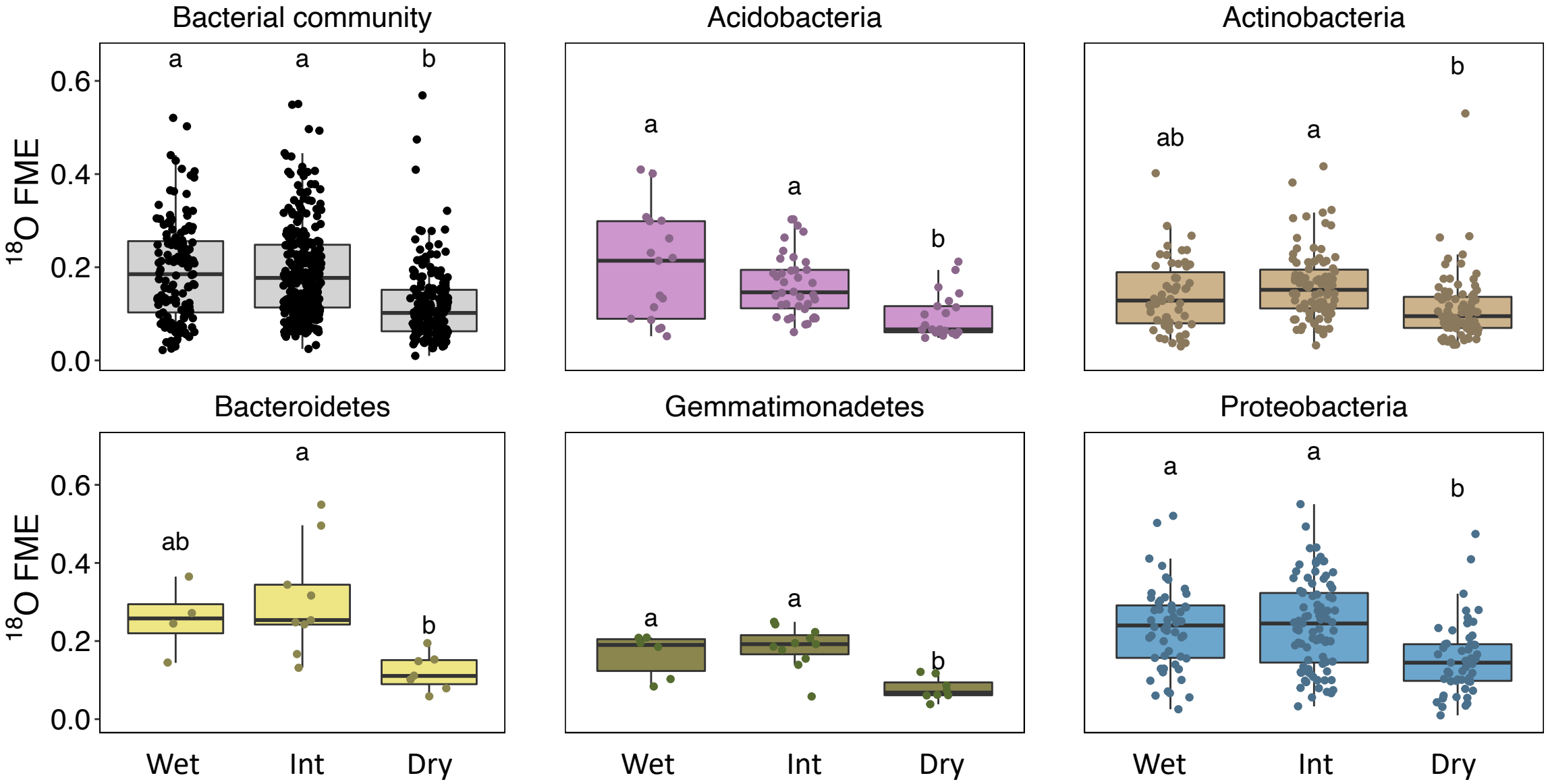
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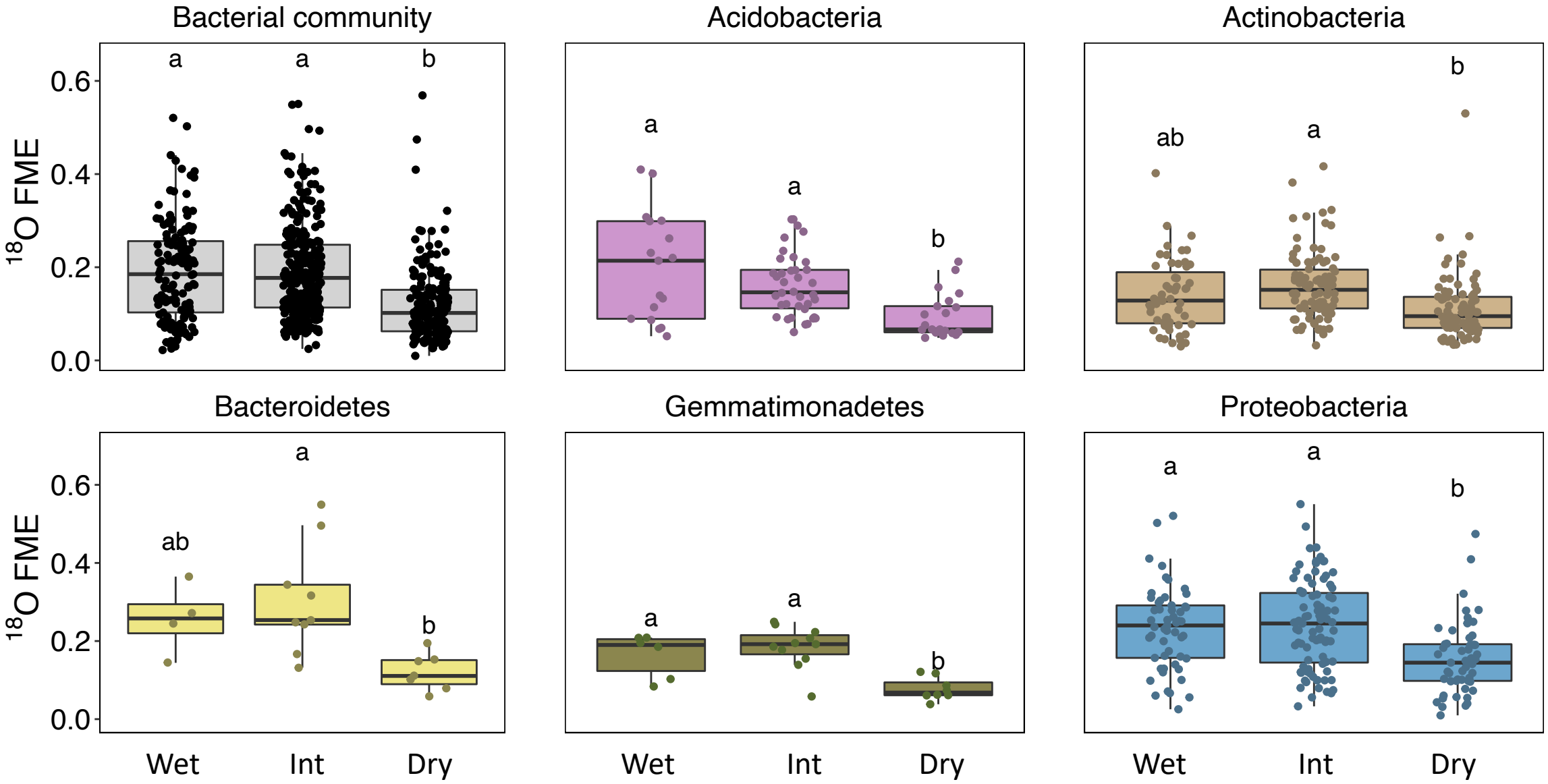
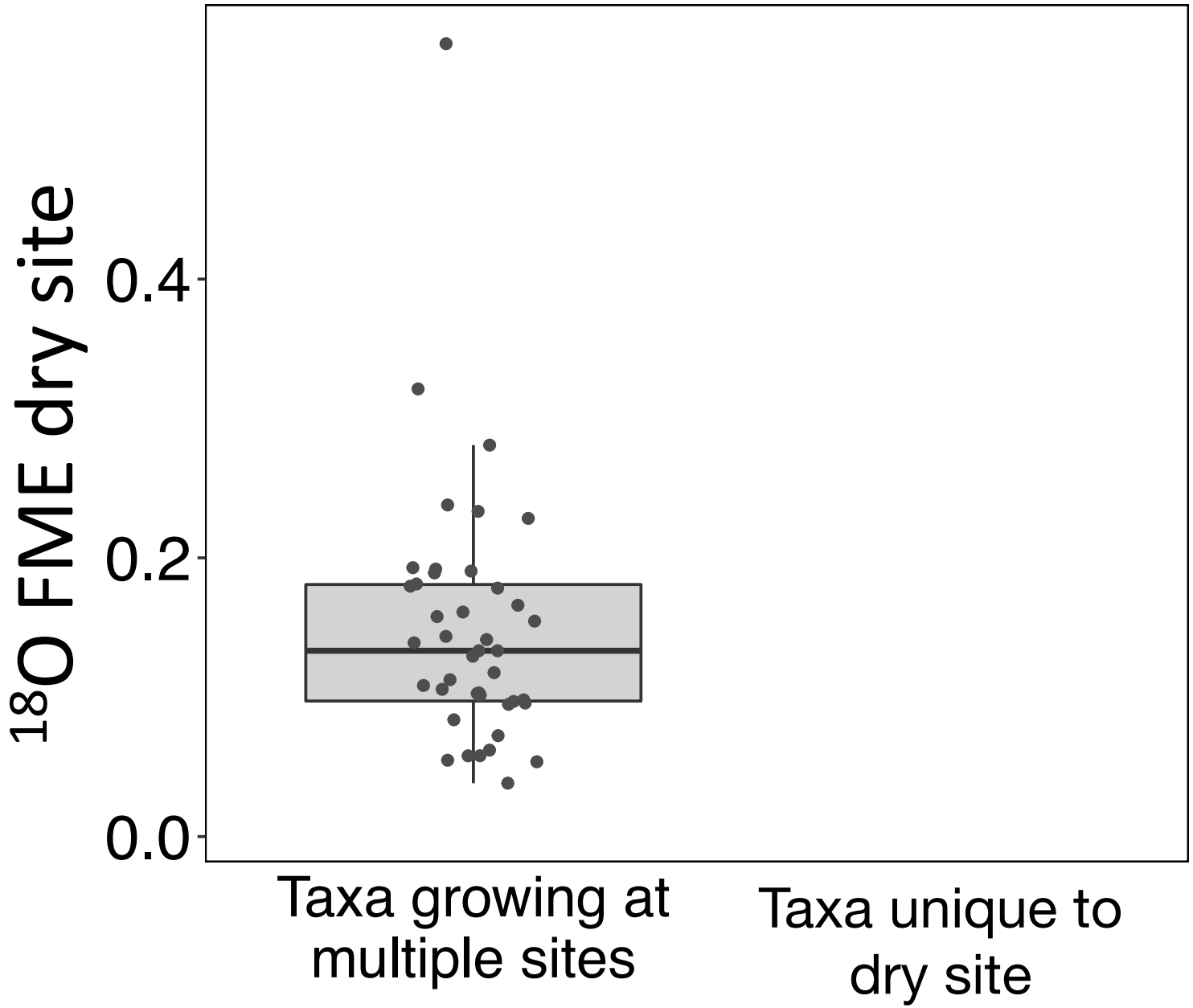
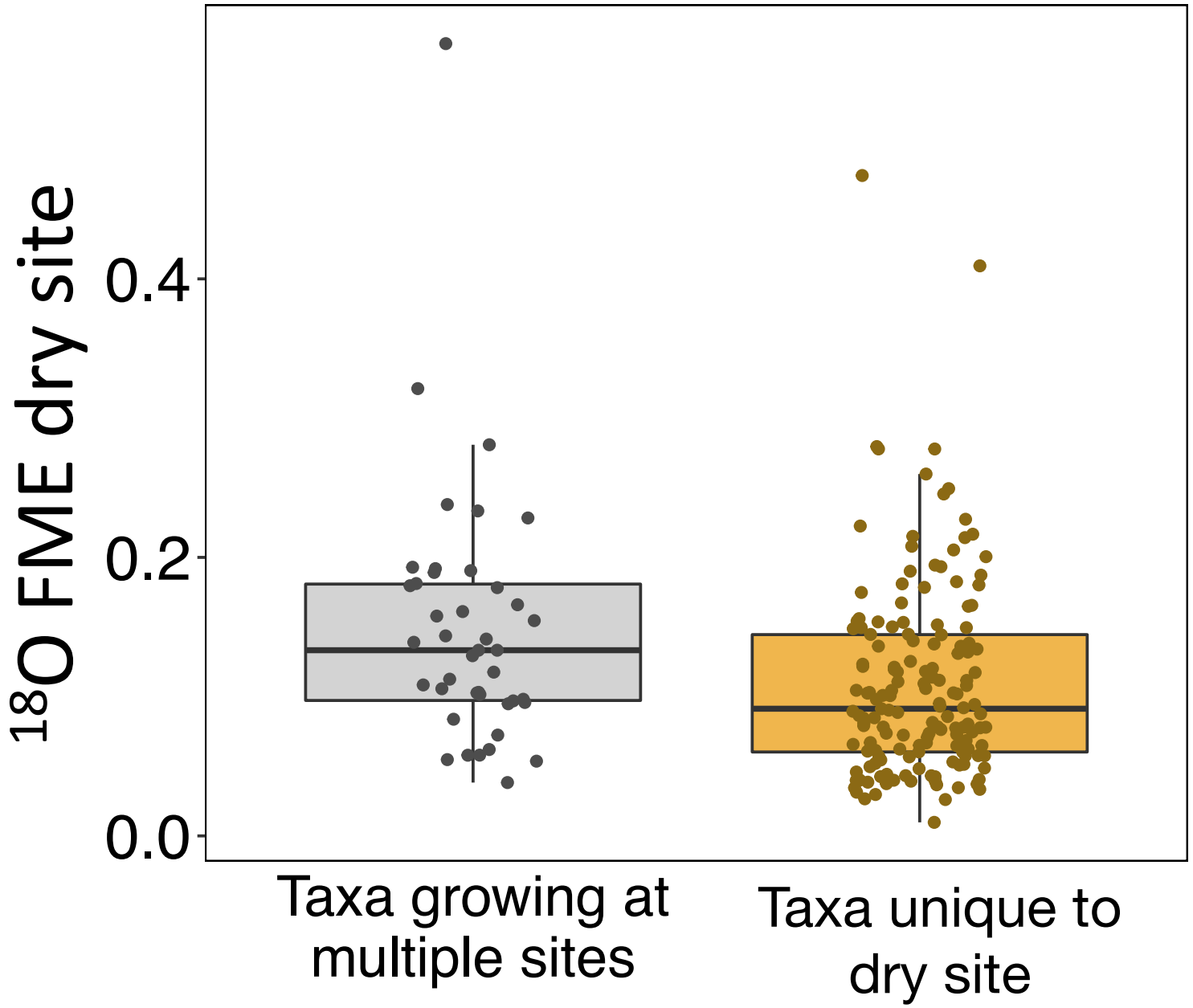
Growth is slowest at the driest site, even when water is not limiting




^{18}O FME dry site
0.4
0.2
0.0
Taxa growing at multiple sites
Taxa unique to dry site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Conclusions

Growing community structure

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→

Climate history frames microbial growth

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Climate history frames microbial growth

→ Growth was slowest at the driest site, even when water was not limiting

→ Growth capacity is reduced by repeated exposure to low soil moisture through environmental filtering for slow growing taxa

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Aaron Chew
John Bailey
Alison Smith
Hopland Research & Extension Center
Angelo Coast Range Reserve
Sedgwick Reserve

Funding sources
U.S. Department of Energy, Office of Biological and Environmental Research
Genomic Science Program 'Microbes Persist' Scientific Focus Area (#SCW1632)

National Science Foundation Graduate Research Fellowship Program