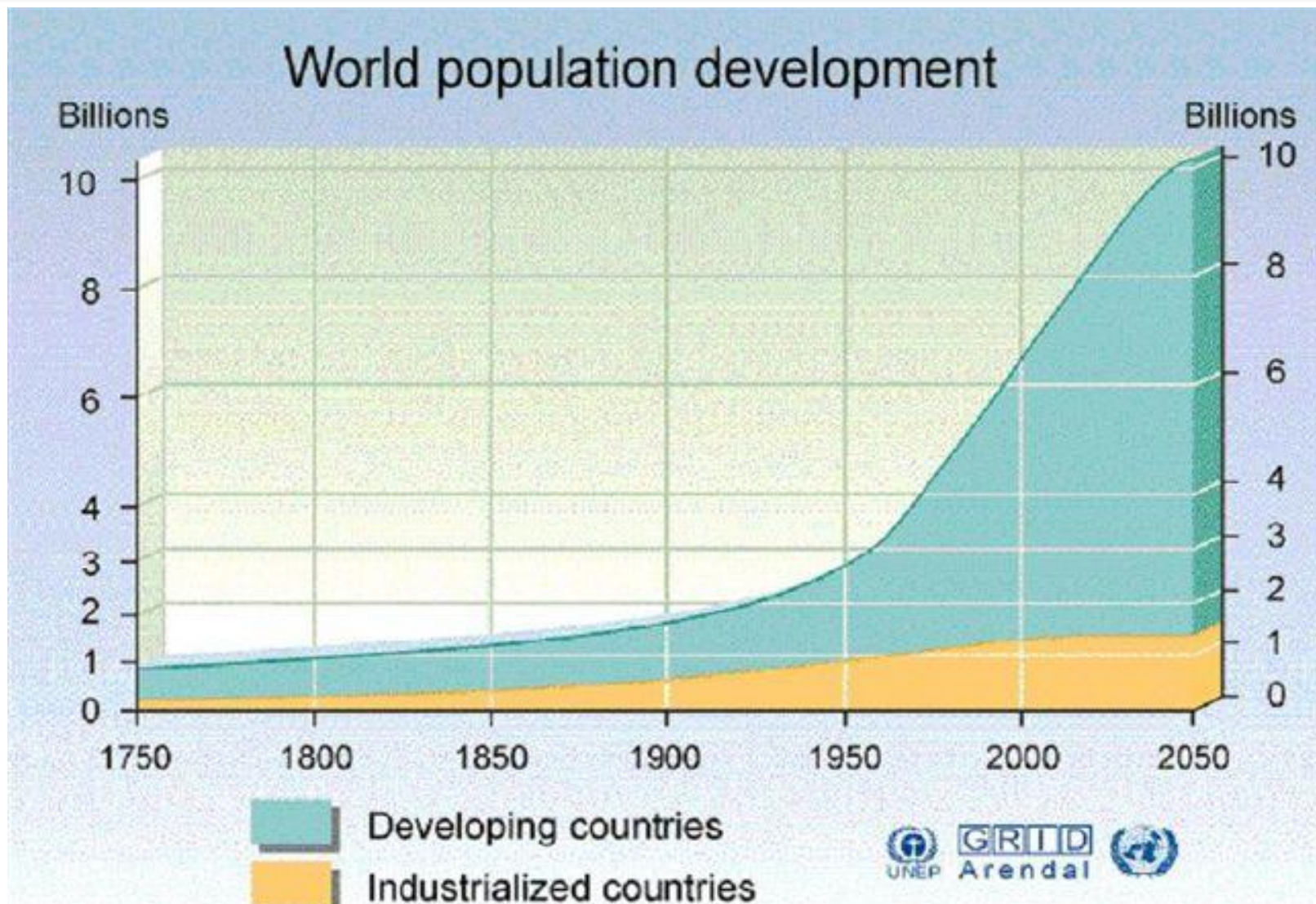




Root- associated Bacterial Communities in Flax (*Linum usitatissimum*) and Their Response to Arbuscular Mycorrhizal (AM) Inoculation

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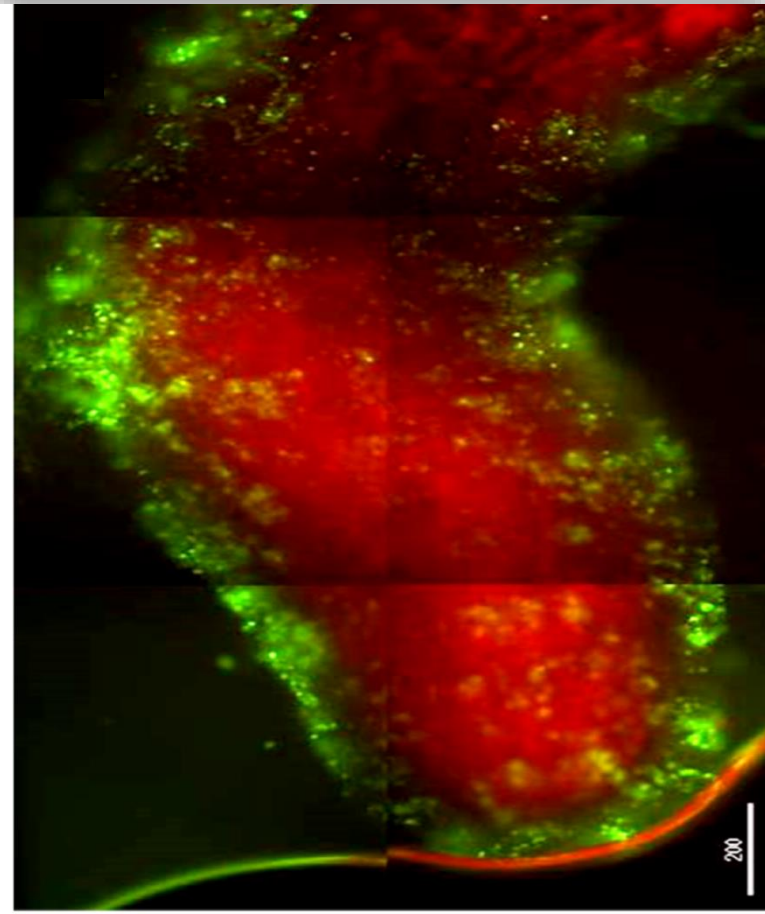
Sustainable Agriculture for Increasing World Population



(<http://www.fewresources.org>)

Plant-Associated Microbes in Sustainable Agriculture

- More attention to Endophytes
 - Superior plant growth promotion
 - Subset of rhizosphere microbes
 - Simple
 - Great potential to aid sustainable agriculture



(source: Ye et al., 2014)

Flax as a Healthy Food



- A functional food
 - Poly unsaturated fatty acids (~75%)
 - Alpha linolenic acid (ALA) (~ 57%)
 - Dietary fibre and lignans
 - Health benefits



- Lead producer
- Mainly grown in Canadian prairies
- More flax from SK



Flax plant is sensitive to chemical fertilization

Growth Chamber Experiment

Objectives

1. Endophytic and rhizo-Bacterial communities associated with flax
2. Impact of AM inoculation on bacterial communities



Brief Methodology

- **Three different soils**

- Central Butte
- Allen
- Kelvington

- **Two rates of AM inoculation**

- Control (C)
- Recommended rate (X)
- 4 times recommended rate (4X)



Brief Methodology (cont.)

Sampling of Rhizosphere Soil and Roots



Surface Sterilization of Roots



DNA Extraction



Amplicon Preparation



Illumina Sequencing



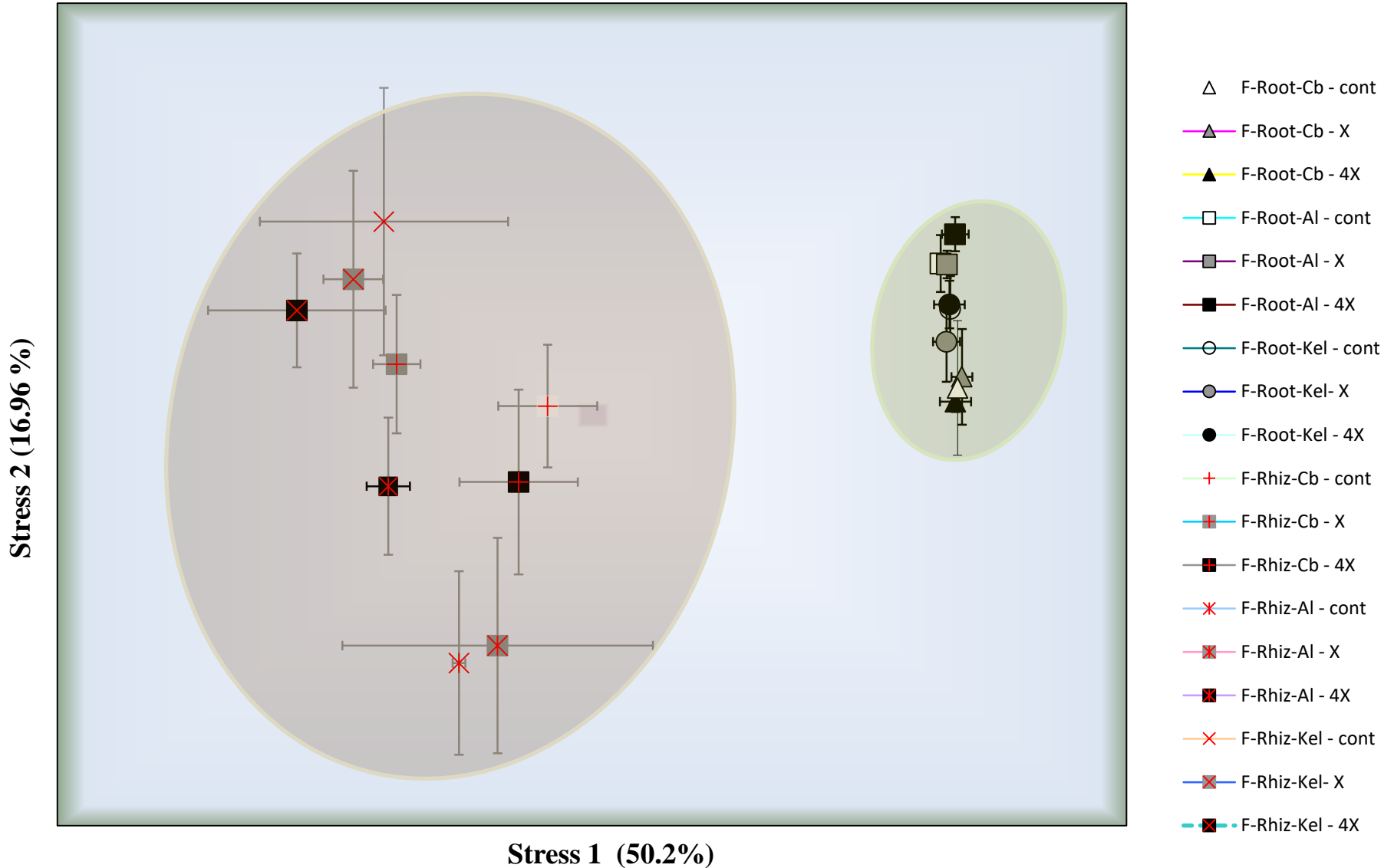
Data Analysis



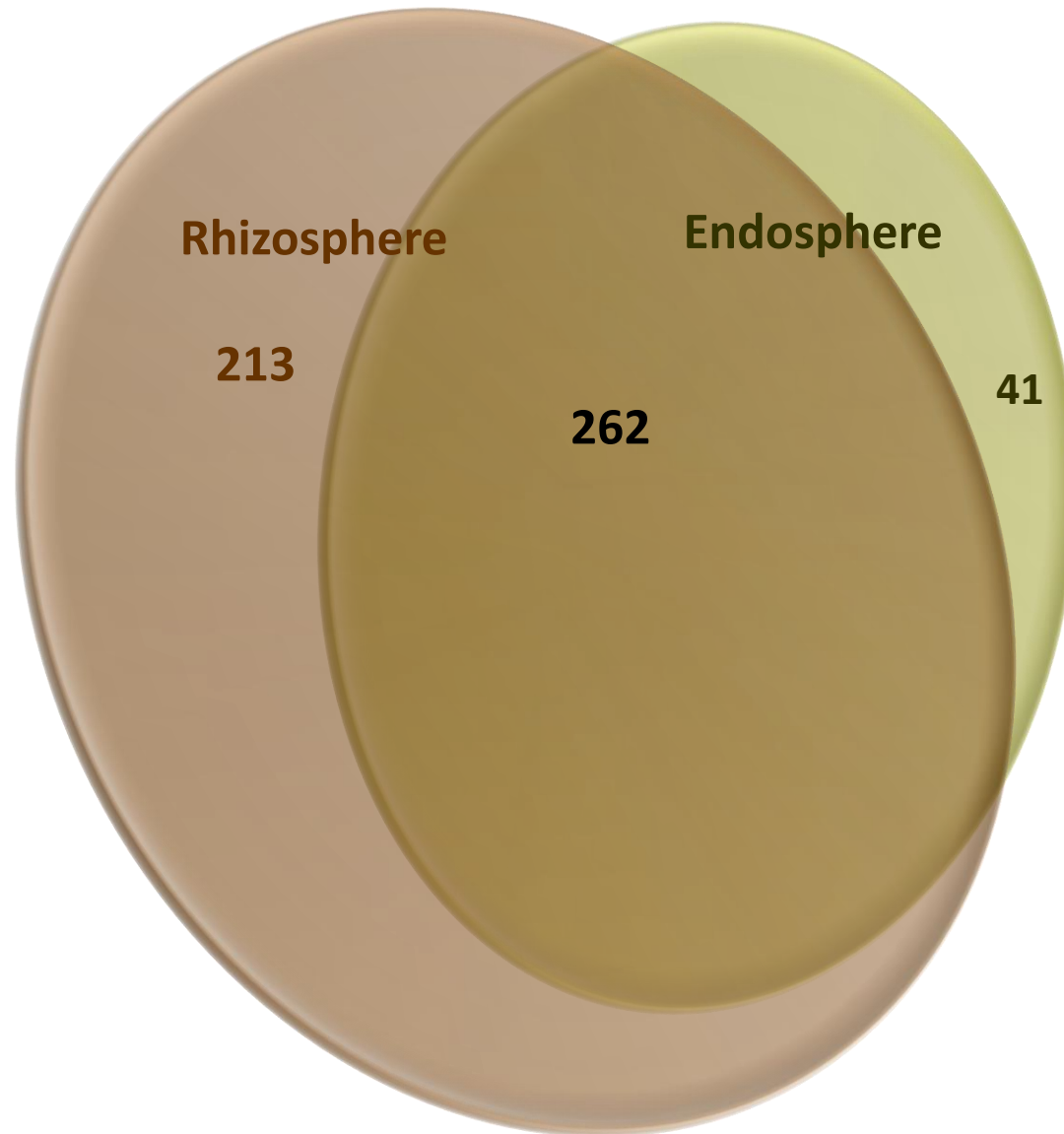
PERMANOVA Results for Bacterial Community Composition Associated with Flax

Source	d.f.	F value	P value
Habitat (Rhizosphere/ Endosphere)	1	326.43927	0.0002*
Soil	2	9.97255	0.0006*
AMF inoculation	2	0.42485	0.7556
Habitat X Soil	2	10.74913	0.0006*
Habitat X AMF inoculation	2	0.35087	0.8168
Soil X AMF inoculation	4	0.8691	0.9978

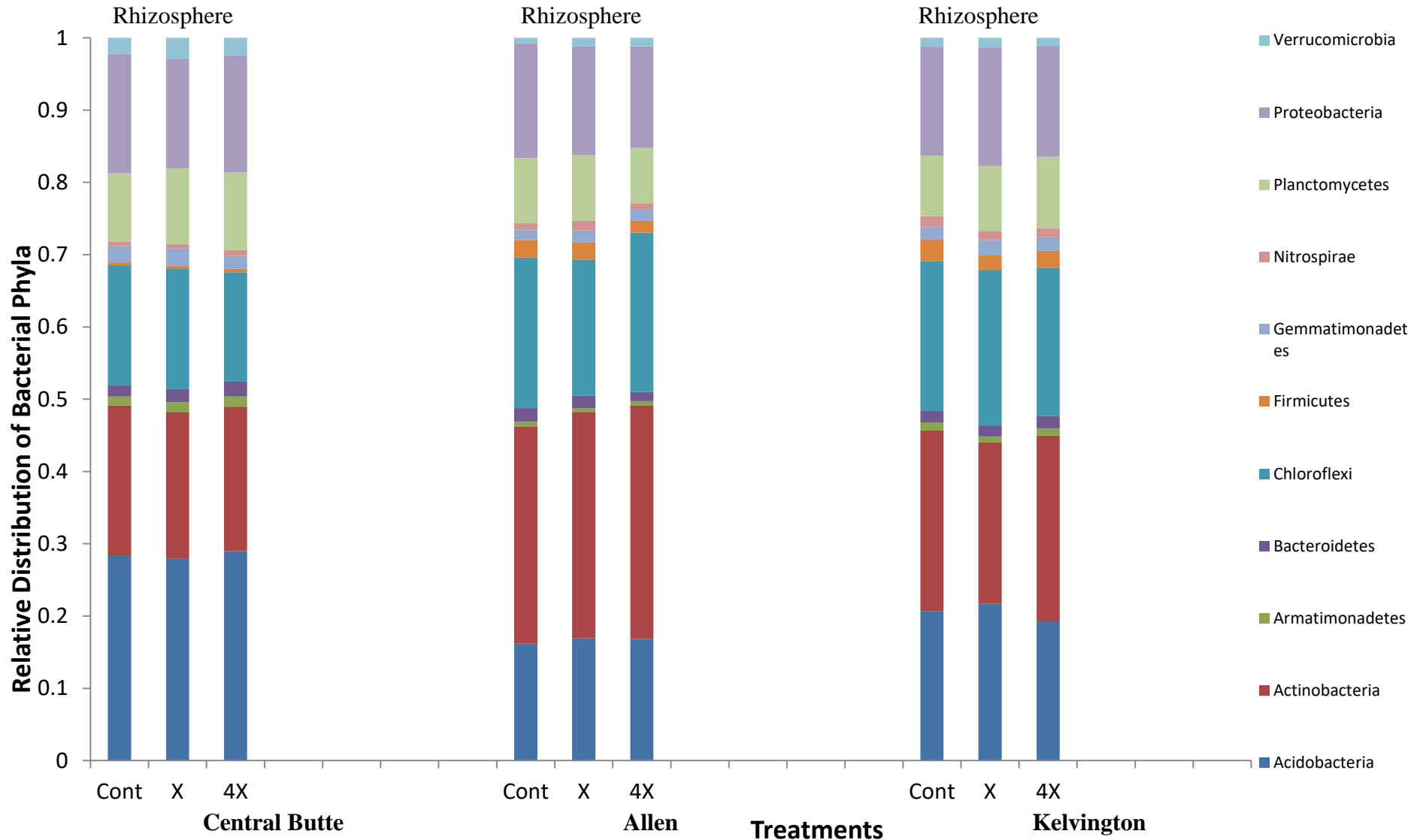
Bacterial Community Composition of Flax in Rhizosphere and Root Endosphere



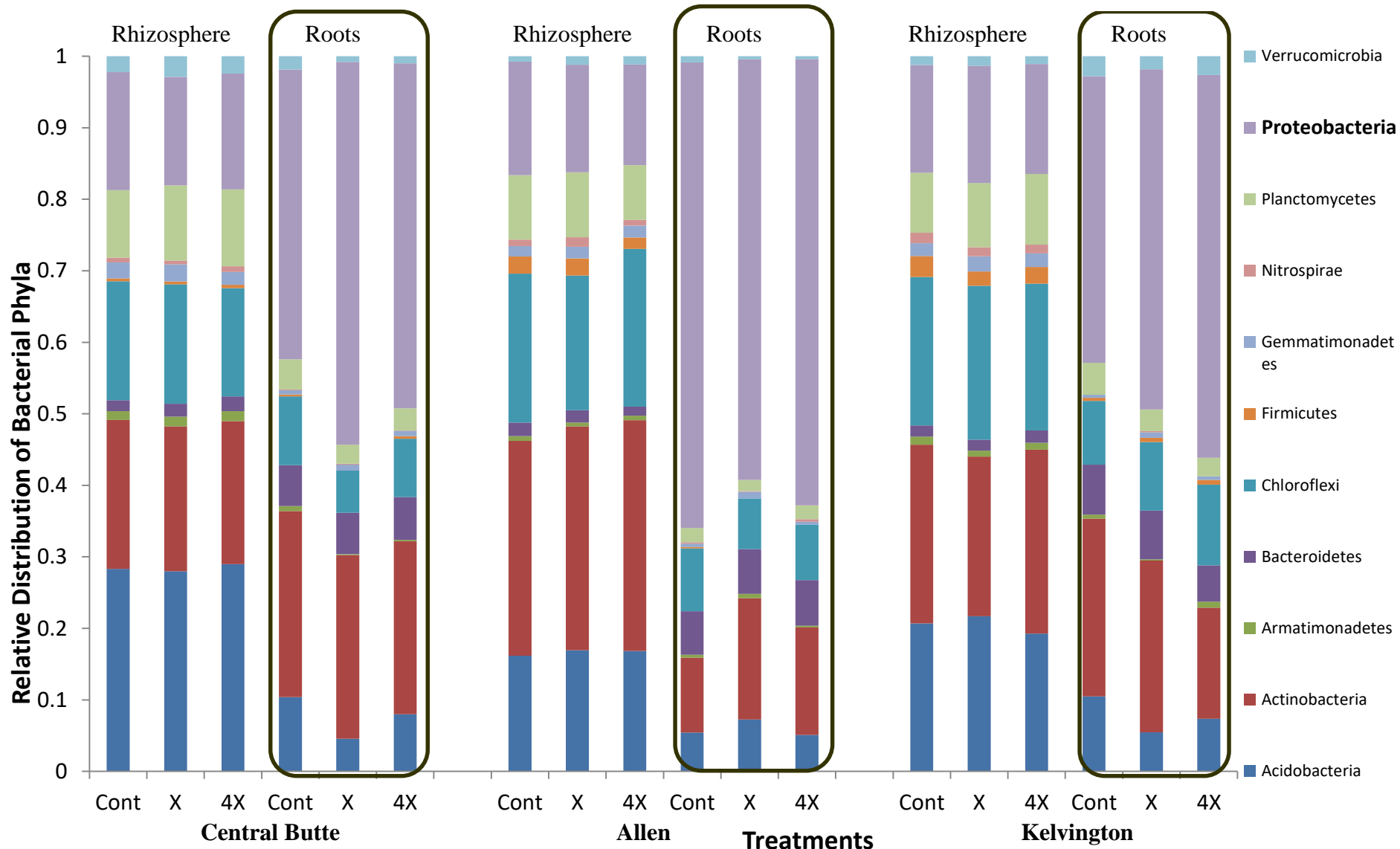
Distribution of Bacterial Genera among Rhizosphere and Root Endosphere in Flax



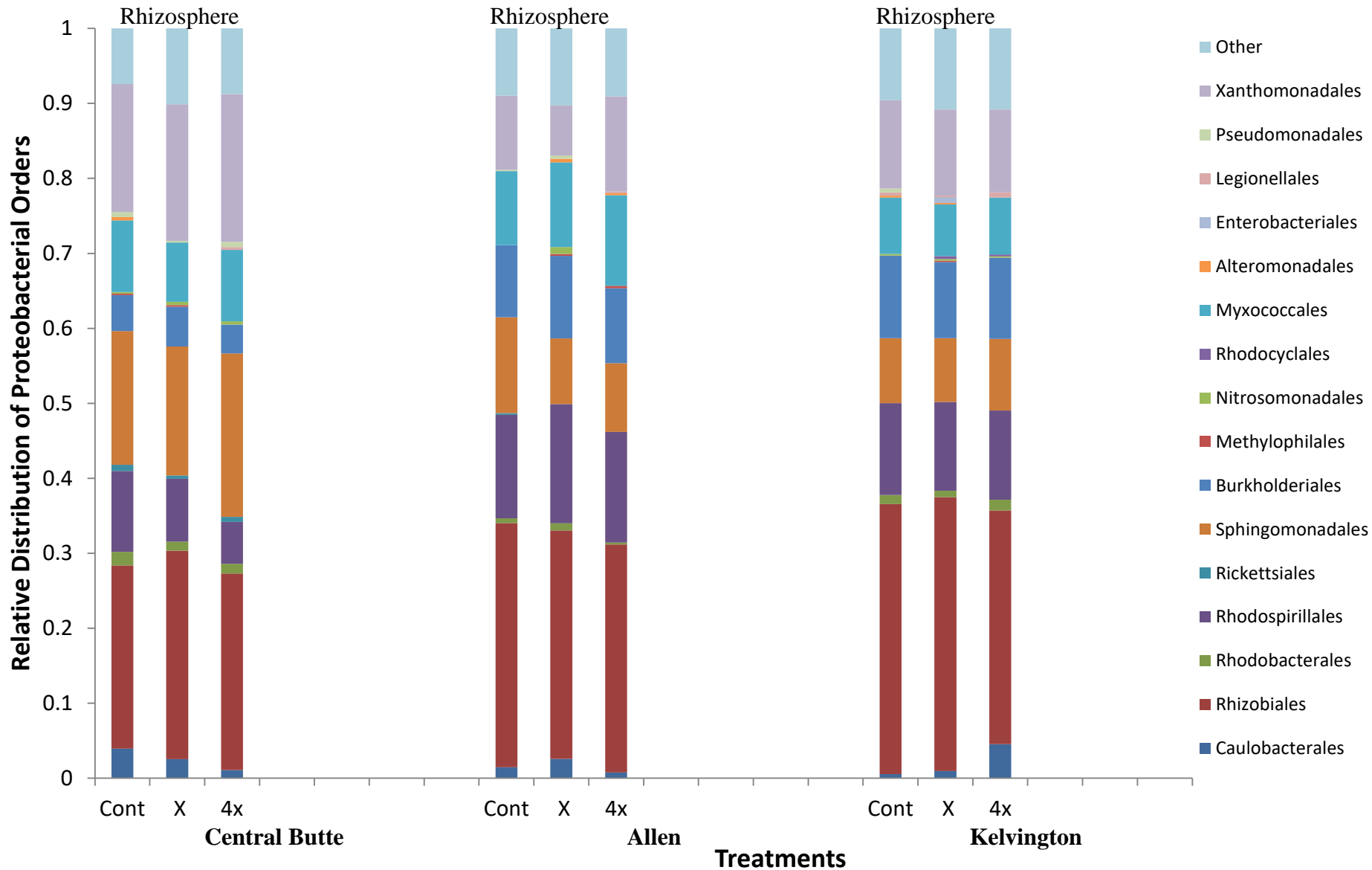
Relative Distribution of Dominant Bacterial Phyla associated with Flax Rhizosphere



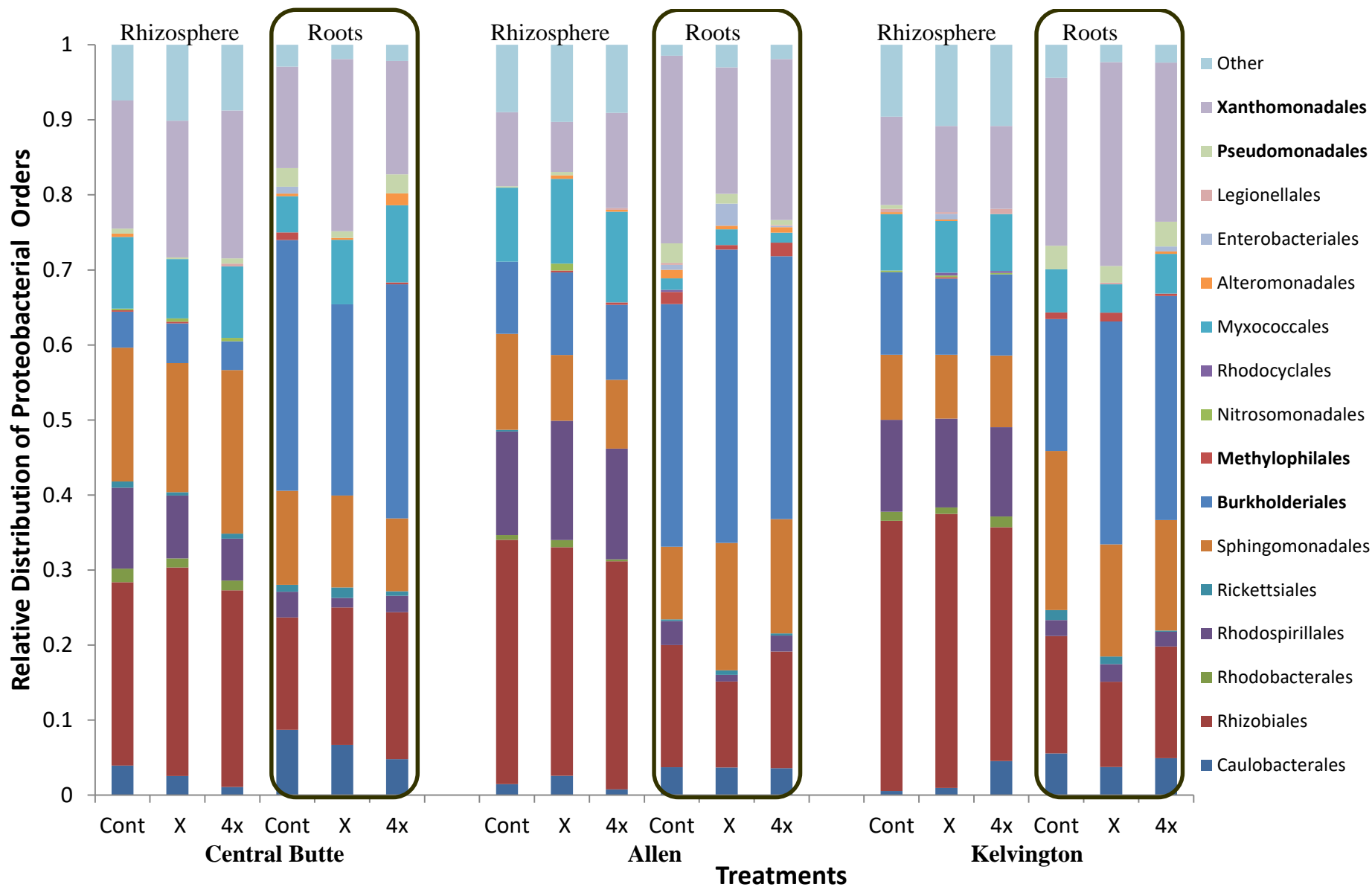
Relative Distribution of Dominant Bacterial Phyla associated with Flax Rhizosphere and Endosphere



Relative Distribution of Dominant Proteobacterial Orders associated with Flax Rhizosphere



Relative distribution of Dominant Proteobacterial Orders associated with Flax Rhizosphere and Endosphere



Diversity and Richness of Rhizo- and Root Endophytic- Bacteria

Treatments		Shannon Diversity		Chao richness		SOBs	
Soil	AM Inoculation	Rhizo *	Endo *	Rhizo *	Endo *	Rhizo *	Endo *
C. Butte	Control	8.3 AB	4.9 C	1240.8 ABC	575.3 D	499.3 A	152.3 EFGH
	1X	8.4 AB	3.8 DE	1156.7 ABC	366.7 DEFG	509.3 AB	211.7 DEF
	4X	8.3 AB	4.75 CD	1119.7 BC	571.2 D	490.6 A	235 CDE
Allen	Control	8.35 AB	4.5 CDE	1182.1 ABC	370.8 DEF	496 AB	189.3 DEFG
	1X	8.34 AB	4.8 CD	1212.5 ABC	427.4 D	493.3 ABC	143.7 EFGH
	4X	8.3 AB	3.8 DE	1224.1 ABC	394.5 DE	496 ABC	172 DEFGH
Kelvington	Control	8.5 A	3.8 DE	1436.2 A	402.3 DE	541 AB	138.7 EFGH
	1X	8.5 AB	3.7 E	1309.4 AB	349 DEFGH	524.7 BCD	142 EFGH
	4X	8.6 A	3.5 E	1319.3 AB	457 D	544.3 A	162.7 DEFGH

Take Home Message



- **Flax accommodate 475 and 303 bacterial genera in their rhizosphere and root endosphere, respectively**
- **Root endophytic-bacterial community of flax is a simple and non-random subset of rhizo-bacterial community**
- **Proteobacteria are more dominant among bacterial root endophytes in flax**
- **Commercial AM inoculation dose not affect community composition and diversity of bacteria associated with flax**
- **Endospheric bacteria will be isolated and evaluated for potential benefits**

Acknowledgement

- Technical support from Flath Ben and Amanda Bruce



Government
— of —
Saskatchewan
Ministry of Agriculture

A photograph of a blue flower in a field. The flower is in the foreground, slightly out of focus. The background is a vast green field under a blue sky with white clouds. The text "THANK YOU!" is overlaid in the center of the image.

THANK YOU !