

TITLE: ABUNDANCE OF THE THAUMARCHAOTA PHYLUM IN THE FLOODPLAIN OF THE TOCANTINS RIVER

AUTHORS: MONTEIRO, G. G. T. N.¹; BARROS, D. J.²; GABRIEL, G. V. M.³; VAZQUEZ, G. H.⁴; VELOSO, T. G. R.⁵; OLIVEIRA, L. C.³; NEU, V.¹; NAVARRETE, A. A.⁴

INSTITUTION: 1. Federal Rural University of the Amazon (Avenida Presidente Tancredo Neves, 2501, Terra Firme. Belém – PA. CEP: 66077-830); 2. Federal University of Tocantins (Quadra 109 Norte, Av. NS-15, ALCNO-14. Palmas – TO. CEP: 77001-090); 3. Federal University of São Carlos (Rodovia João Leme dos Santos, Km 110, s/n, Itinga. Sorocaba – SP. CEP: 18052-780); 4. University Brazil – Graduate Program in Environmental Sciences (Estrada projetada F1, s/n, Fazenda Santa Rita. Fernandópolis – SP. CEP: 15600000); 5. Federal University of Viçosa (Av. Peter Henry Rolfs, s/n, Campus Universitário Edifício Chotaro Shimoya. Viçosa – MG. CEP: 36570900).

ABSTRACT:

Ammonia oxidation is the first and rate-limiting step of nitrification. In acidic soils such as those found in the floodplain of the Tocantins River, ammonia-oxidation is performed mainly by ammonia-oxidizing *Archaea* (AOA). All known AOA belong to the archaeal phylum Thaumarchaeota, and in this study we analyzed the abundance of *Archaea* belonging to the Thaumarchaeota phylum inhabiting different soil layers under agroforestry and primary forest in the floodplain of the Tocantins River during the flooded and non-flooded periods. Total RNA was isolated from 24 soil samples (two soil layers x two sampling sites x two seasonal periods x three sampling points) using RNeasy PowerSoil Total RNA Kit in duplicate for each soil sample and stored at -80°C until further use. Complementary DNA (cDNA) was synthesized using a QuantiNova Reverse Transcription Kit, and amplicon libraries were prepared using the cDNA as template in the amplification reactions and specific archaeal primers for the 16S rRNA genes. Equal concentrations of libraries were loaded independently on MiSeq Reagent Kit v3 sequencing and sequenced in a MiSeq Personal Sequencing System Illumina. All 16S rRNA gene sequence reads were processed and analyzed using QIIME v.1.9.1. Statistical analyses were carried out using the R packages vegan 2.5–7 and ggplot2 3.3.5. The Thaumarchaeota phylum consisted of two AOA groups belonging to Nitrososphaeraceae and Nitrosotaleaceae families and another non-AOA from group 1.1c. While total Thaumarchaeota and AOA abundance were higher during the non-flooded season, the non-ammonia oxidizing group 1.1c increased its abundance during flood period and in the second soil layer (15-30 cm). Variance partition of the factors revealed that depth had the highest influence (15%) on community variation, followed by changes in land use (10%) and in seasonal period (7%). These results indicate the potential for aerobic and anaerobic growth regarding this phylum and showcase the effects of the seasonal variations in soil oxygen conditions caused by the flood pulse in the Amazon basin and its effects on microbial communities.

Keywords: Thaumarchaeota, Ammonia-oxidizing Archaea, Amplicon sequencing, Microbial ecology

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