

EXECUTIVE SUMMARY: *(State in layman's terms the application's broad, long-term objectives and specific aims, making reference to the potential public benefits of the project for California.)*

The combustion of fossil fuels, agricultural runoff, and both domestic and industrial wastewaters have led to large amounts of human-generated nitrogen entering the natural nitrogen cycle. This has had particularly disastrous consequences in aquatic systems, which are often limited for nitrogen: algal blooms choke off streams and rivers, and coastal regions become susceptible to oxygen-poor "dead zones" devoid of fish or other animals. However, recent advances in our understanding of the microorganisms that control the natural nitrogen cycle have provided new tools to reduce the amount of human-generated nitrogen discharged into the environment. Once such advance was the discovery in 2008 of microorganisms from Yellowstone National Park hot springs capable of utilizing ammonia as a source of energy. These organisms very efficiently convert ammonia to nitrite. This discovery suggests that communities of microorganisms may be able to cycle nitrogen, perhaps even converting it back to inert nitrogen gas, at temperatures much higher than previously thought. This proposal seeks to better understand the microorganisms responsible for these transformations and focuses on hot spring systems in California and Nevada. It is our hope that a better understanding of the high temperature processes may help us develop more efficient engineered systems for removing nitrogen from wastewater.