Abstract:

Research opportunities exist in the area of controlled environment production of plants for food, oxygen, and clean water for life support. Studies typically focus on influences of environmental factors, including lighting, CO$_2$, mineral nutrition, and horticultural approaches. Studies are conducted in plant growth chambers using re-circulating hydroponic culture to quantify water and nutrient use. These studies typically include measurements of leaf gas exchange, stomatal conductance, leaf carbohydrate status, and tissue elemental and proximate composition.

Bioregenerative research opportunities also exist in the area of biological waste treatment/resource recovery using liquid stirred-tank reactors or solid, composting approaches. Studies center on retrieving nutrients from waste streams for recycling in closed life-support systems. Resource recovery studies have focused on inedible plant biomass, including human solid and liquid wastes (gray water and urine). Studies are commonly integrated with plant production tests to assess the potential for nutrient recycling and processing by plant/microbial systems.

Microbial communities associated with both plant production (rhizospheres) and resource recovery subsystems are assayed using a variety of techniques, including traditional enumeration methods, community function (carbon source), and molecular approaches. Emphasis has been placed on the resilience of communities to inputs from waste streams, persistence of human associated organisms, and interconversions of nitrogen forms.