

Name _____

Nitrogen Fixation: Nature's Nitrogen Miracle

Open-Ended Response Answer Key

1. Biological nitrogen fixation reduces the need for synthetic fertilizers, improves soil fertility, and promotes crop productivity while minimizing environmental impacts such as nutrient runoff and groundwater contamination.
2. Industrial nitrogen fixation processes contribute to nitrogen pollution, including air and water pollution, greenhouse gas emissions, and biodiversity loss. Alternative strategies may include optimizing nitrogen use efficiency, promoting nitrogen-fixing crops, and implementing agroecological practices.
3. Nitrogen-fixing bacteria play a vital role in soil nutrient cycling by converting atmospheric nitrogen into forms that are accessible to plants and other organisms, thereby enhancing soil fertility and supporting ecosystem productivity.
4. Challenges of integrating nitrogen-fixing cover crops include species selection, management practices, and balancing nitrogen fixation rates with crop nutrient requirements. However, benefits include improved soil health, reduced input costs, and enhanced ecosystem resilience.

