STUDY GUIDE – QUIZ 3
ELEMENTAL ECOLOGY (FALL 2025)

This study guide is designed to highlight the main themes and concepts you should focus on while preparing for the quiz. It is **not a complete list** of everything we've covered in class, and you are responsible for the full scope of material from lectures, readings, and discussions. Use this as a roadmap to guide your studying but make sure to review your notes and practice applying the concepts in different ways.

Bring a calculator to Quiz 3!

Primary Producer Nitrogen. Focus on the major microbial transformations of nitrogen between organic and inorganic forms. Be sure you can:

- Name and describe at least three transformations (e.g., processes that convert between ammonium, nitrate, atmospheric N_2).
- Understand the basic chemistry: know general reactant-to-product equations.
- Identify isotopic discrimination patterns associated with each process (e.g., large >10‰ vs. small <5‰).
- Connect process to environment and identify where each transformation generally happens (e.g., soils, oxic vs. anoxic zones).
- Interpret how these processes shape $\delta^{15}N$ values in primary producers.

Consumer Nitrogen

- Review what determines $\Delta^{15}N$ (trophic discrimination) between diet and consumer.
- Understand how and why nitrogen excretion mode, protein quantity, and protein quality influence $\Delta^{15}N$ and how this may vary among taxa.

Isotopic Turnover

- Know which tissues are metabolically active (rapid isotopic response to diet change) versus metabolically inert (no turnover once formed).
- Understand what turnover time means and how to calculate complete turnover from half-life.
- Consider how turnover rates constrain the temporal resolution of dietary information—what time window a tissue's isotopic ratio represents.
- Apply these principles to real examples such as selecting tissues for ecological studies based on the research question (e.g., short-term diet vs. lifetime diet).

Isotopic Mixing Models

- Understand how mixing models estimate the proportional contributions of sources to a consumer's diet.
- Review the core assumptions of linear mixing models and why each matters.
- Review concentration-dependent mixing models and know why/when to use them.
- Interpret simple mixing space diagrams: where consumers plot relative to their sources, and what happens when a source lies outside the mixing polygon.
- Think critically about how isotopic variation and source overlap can influence uncertainty in model results.
- Be comfortable doing a basic two-source mixing model.