Local, Regional and National Environmental Assessment of United States Dairy Farms

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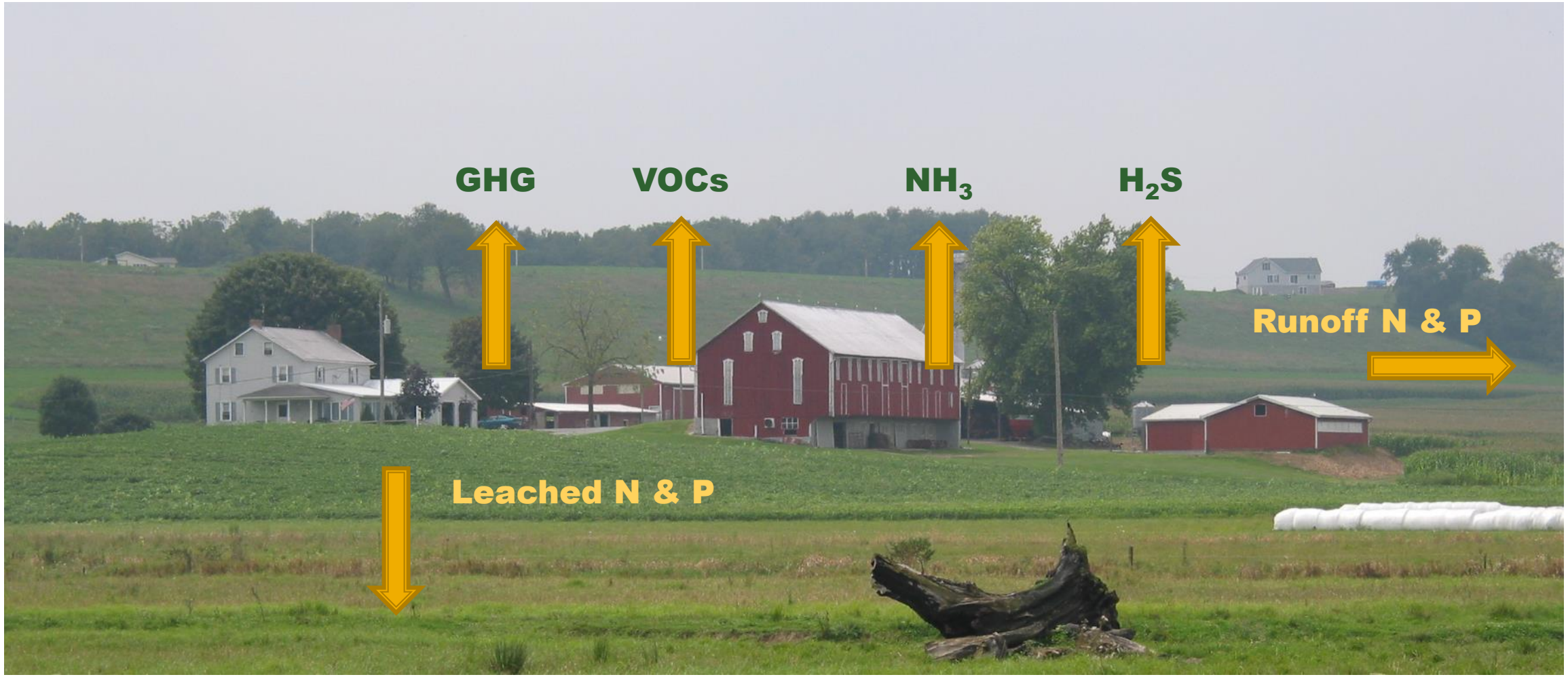
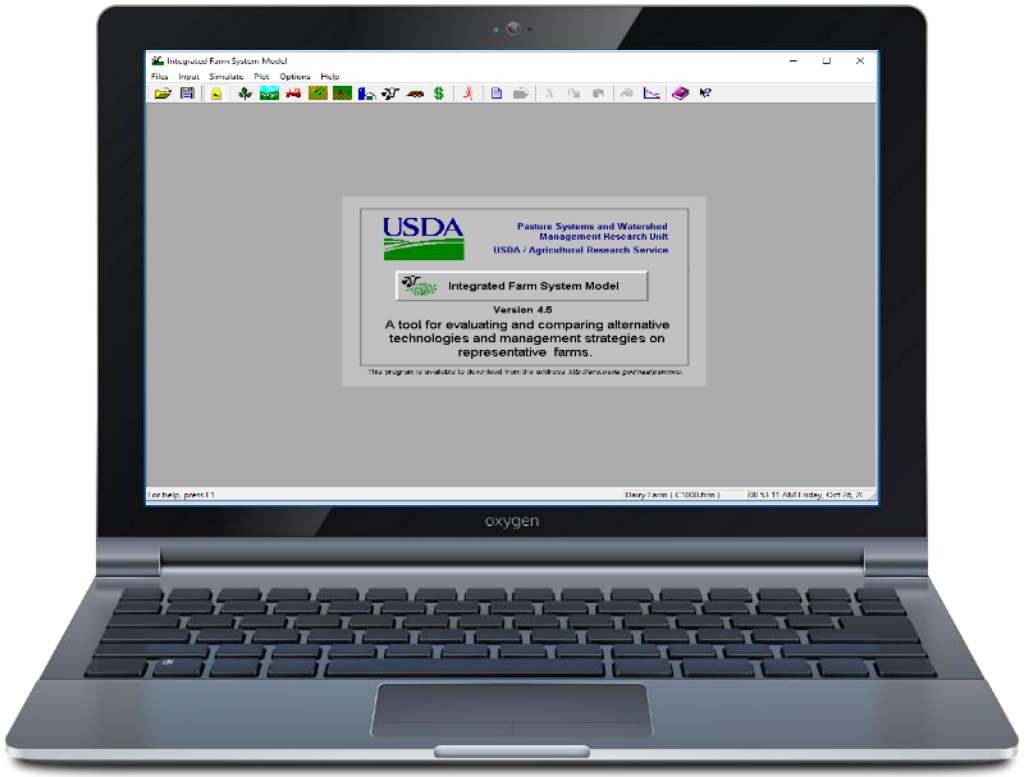
Dairy Farm Emissions

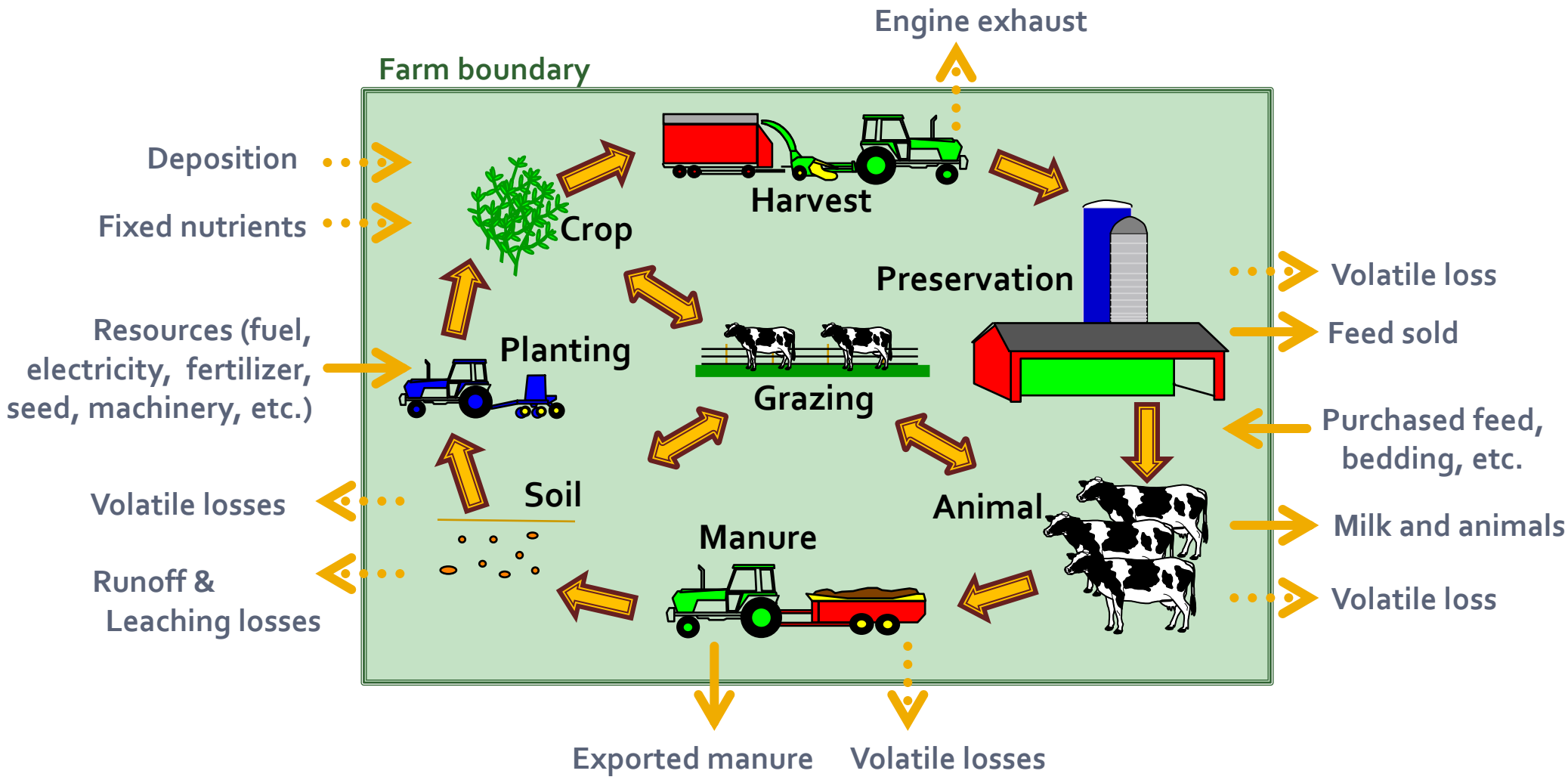


Comprehensive Assessment

Integrated Farm System Model



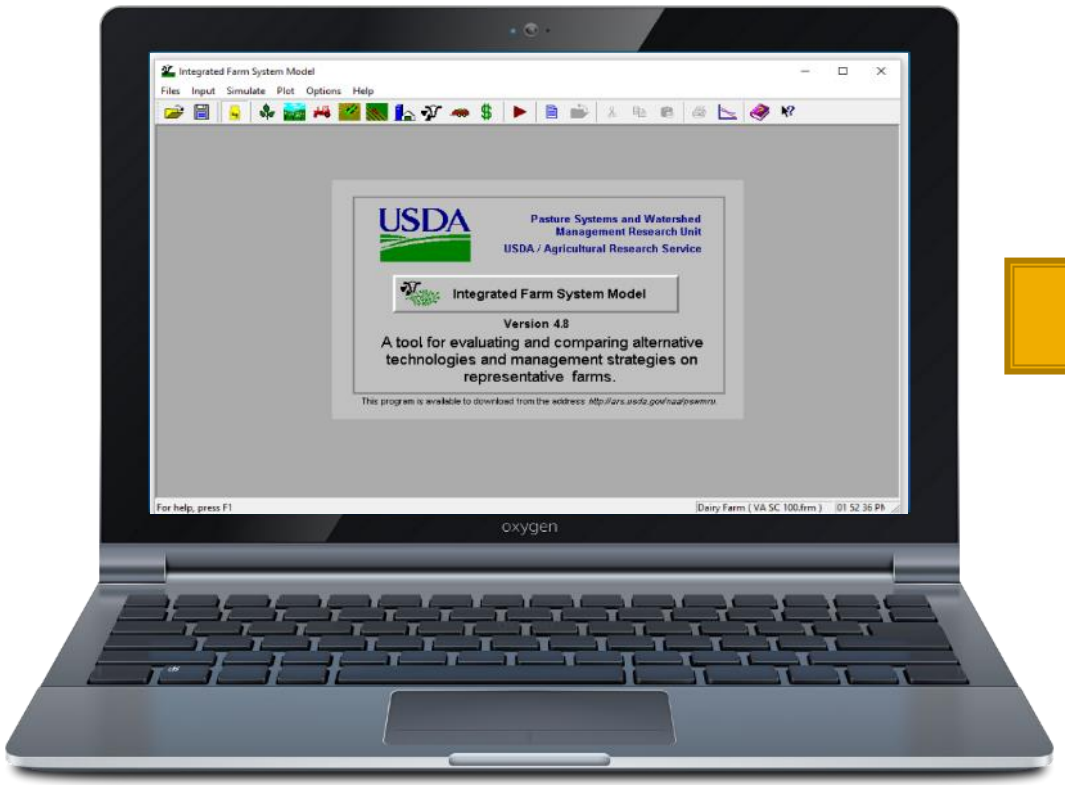
Process-Level Simulation



Environmental Impacts

- Greenhouse gas emissions
- Ammonia emission
- Hydrogen sulfide emission
- VOC emissions
- De/nitrification N losses
- Leached N and N concentration reaching groundwater
- Sediment erosion, P and N runoff losses
- N, P, K and C balance

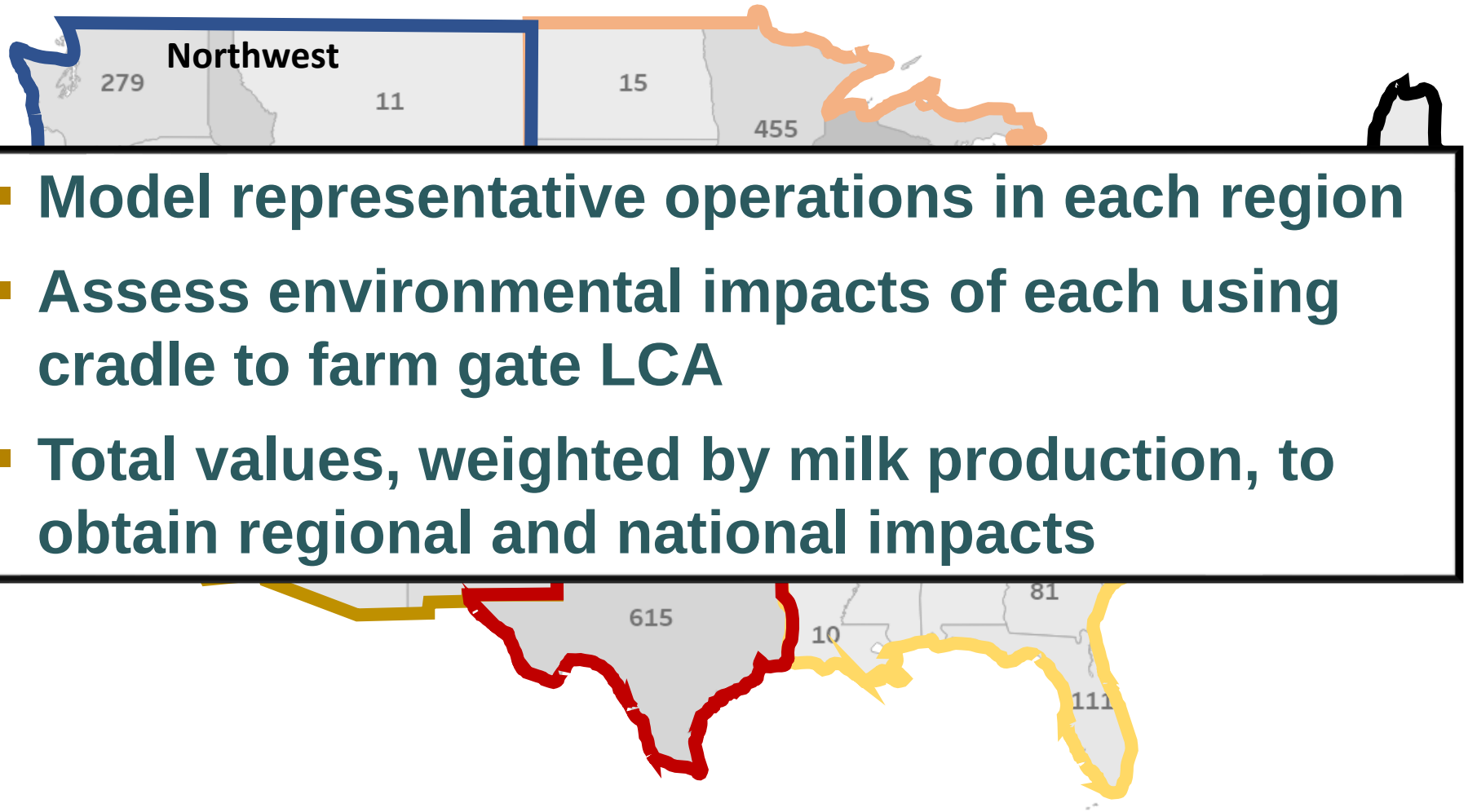
Life Cycle Assessment



Farm Assessments

- Farm productivity and environmental impact
- Comparison of production systems
- Benefits of mitigation strategies
- Effects of climate change
- Adaptation to climate change

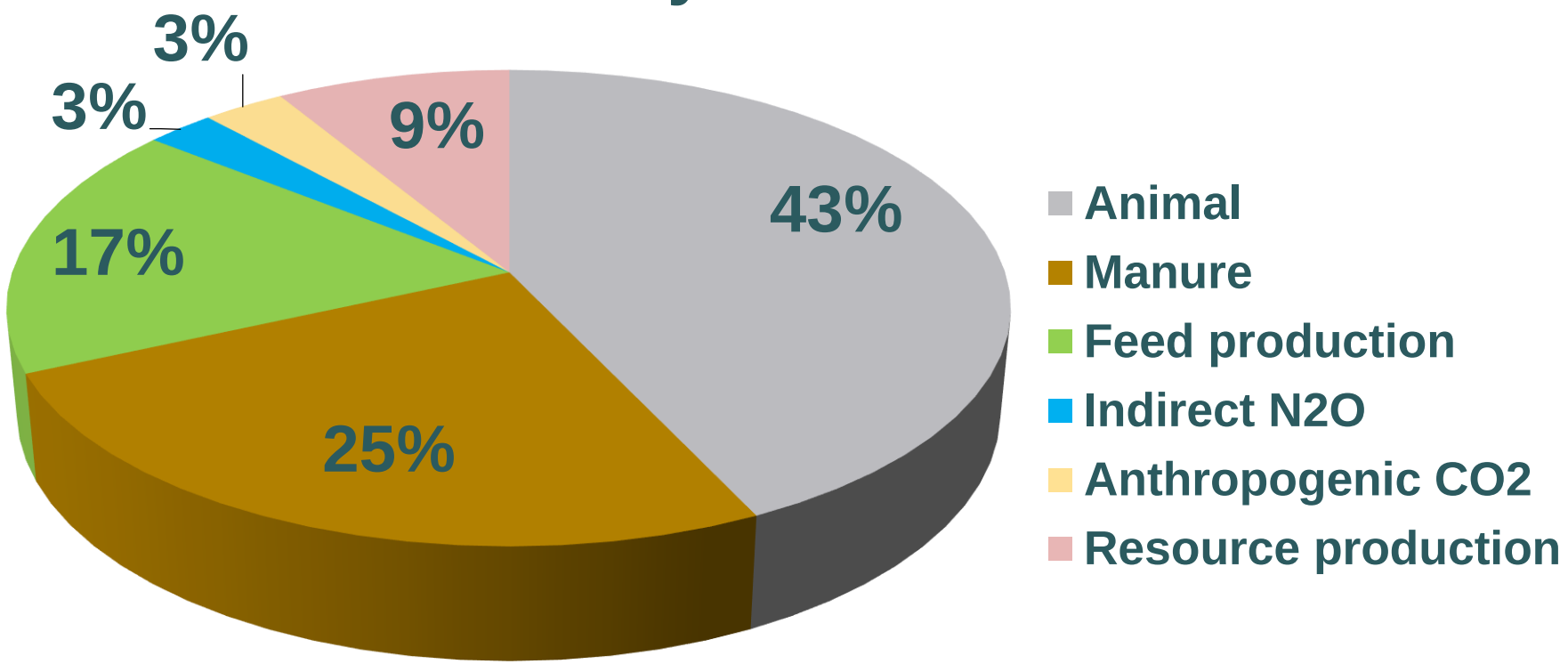
Regional & National Assessments



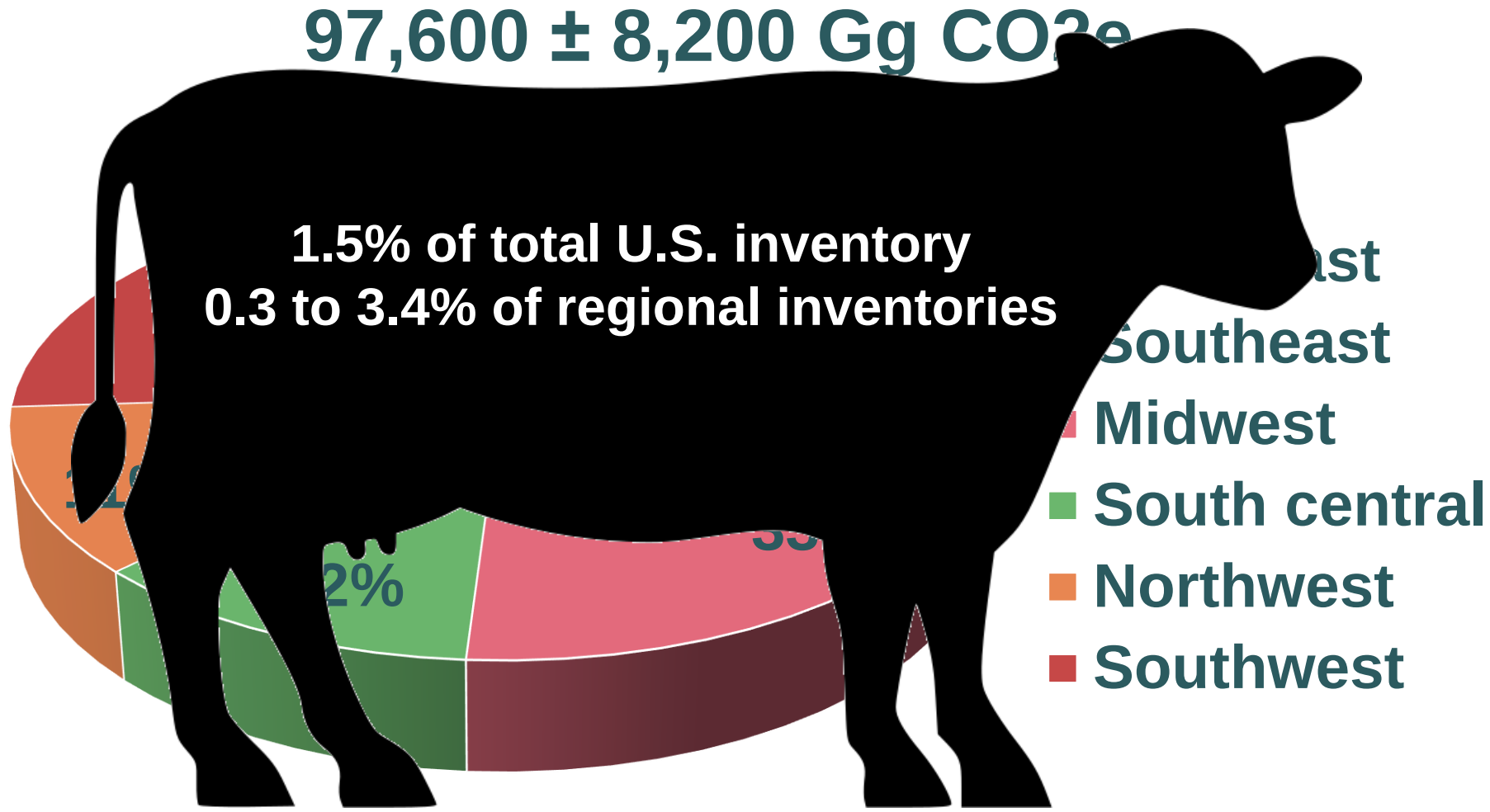
- Model representative operations in each region
- Assess environmental impacts of each using cradle to farm gate LCA
- Total values, weighted by milk production, to obtain regional and national impacts

Milk Carbon Footprint

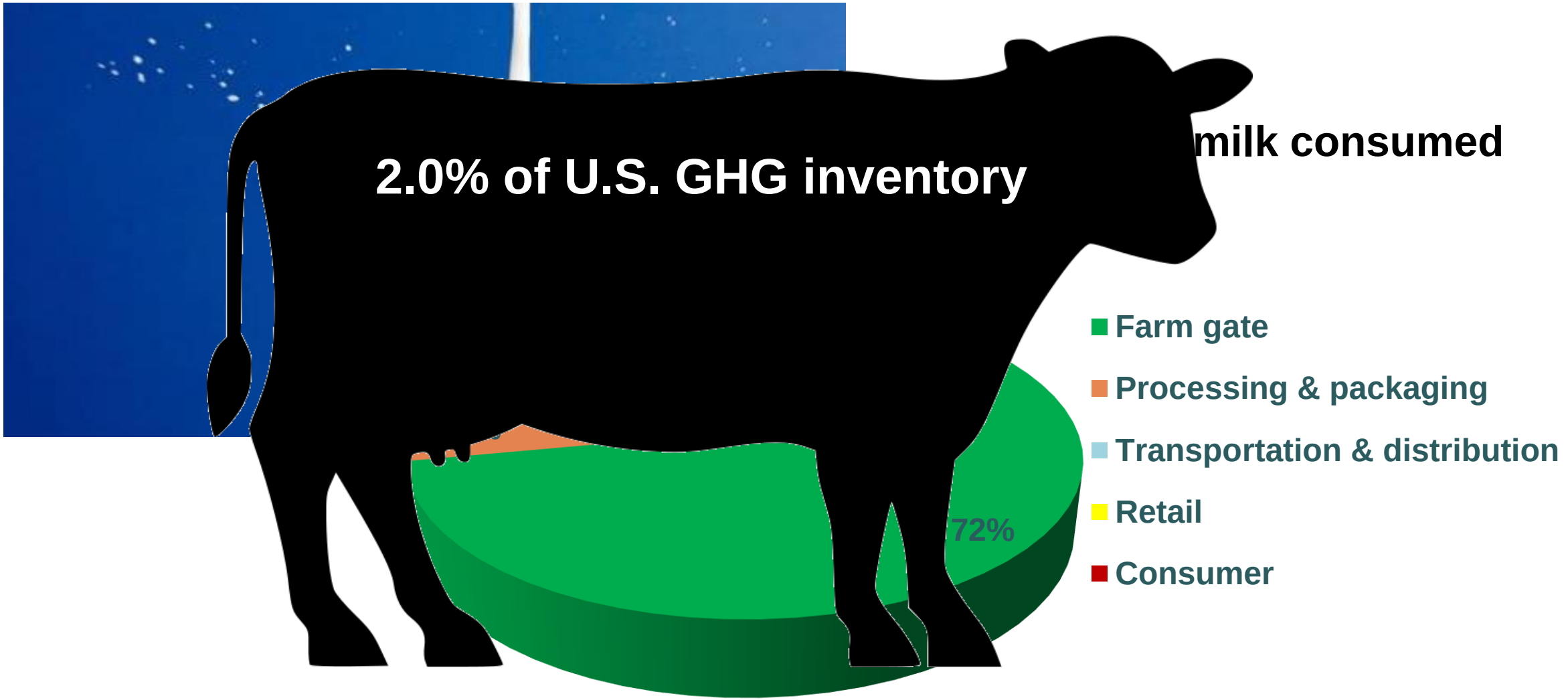
1.0 kg CO_2e / kg FPCM
Regions: 0.9 to 1.2
Production systems: 0.7 to 1.5



Greenhouse Gas Emission

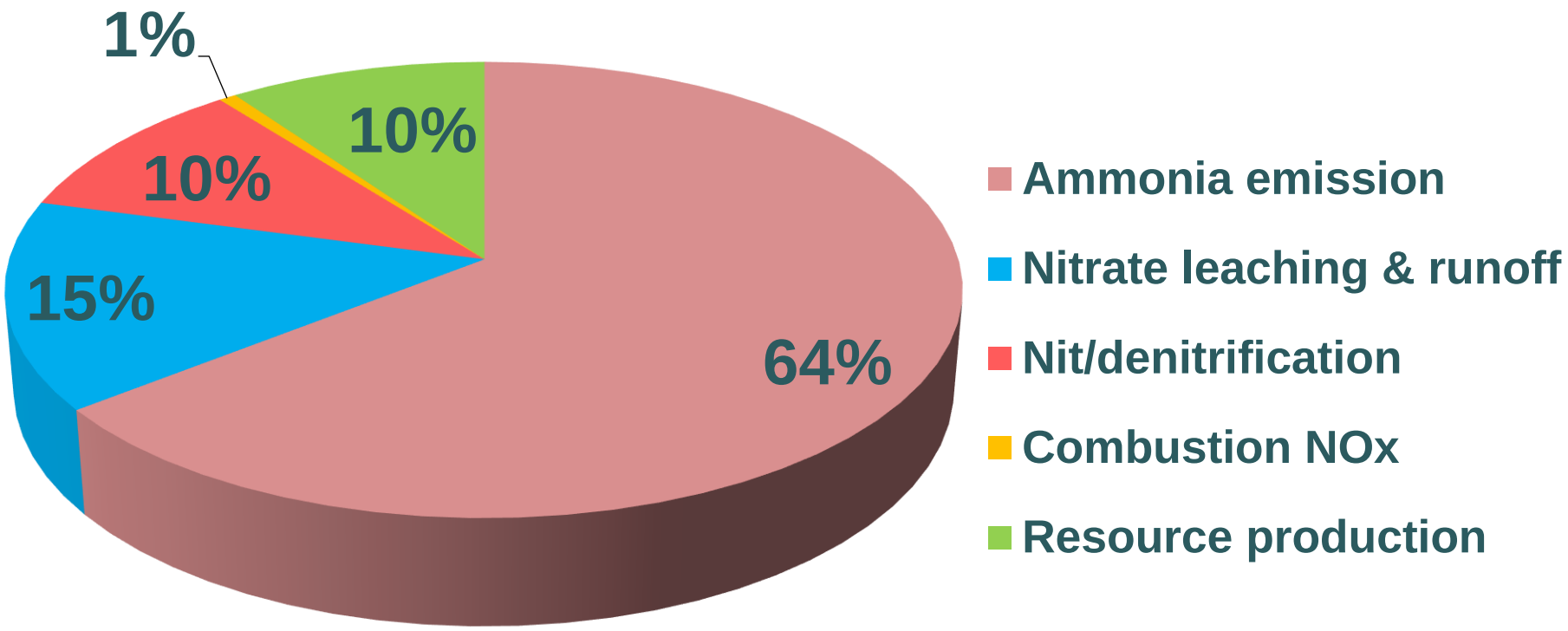


Full Life Cycle Emission

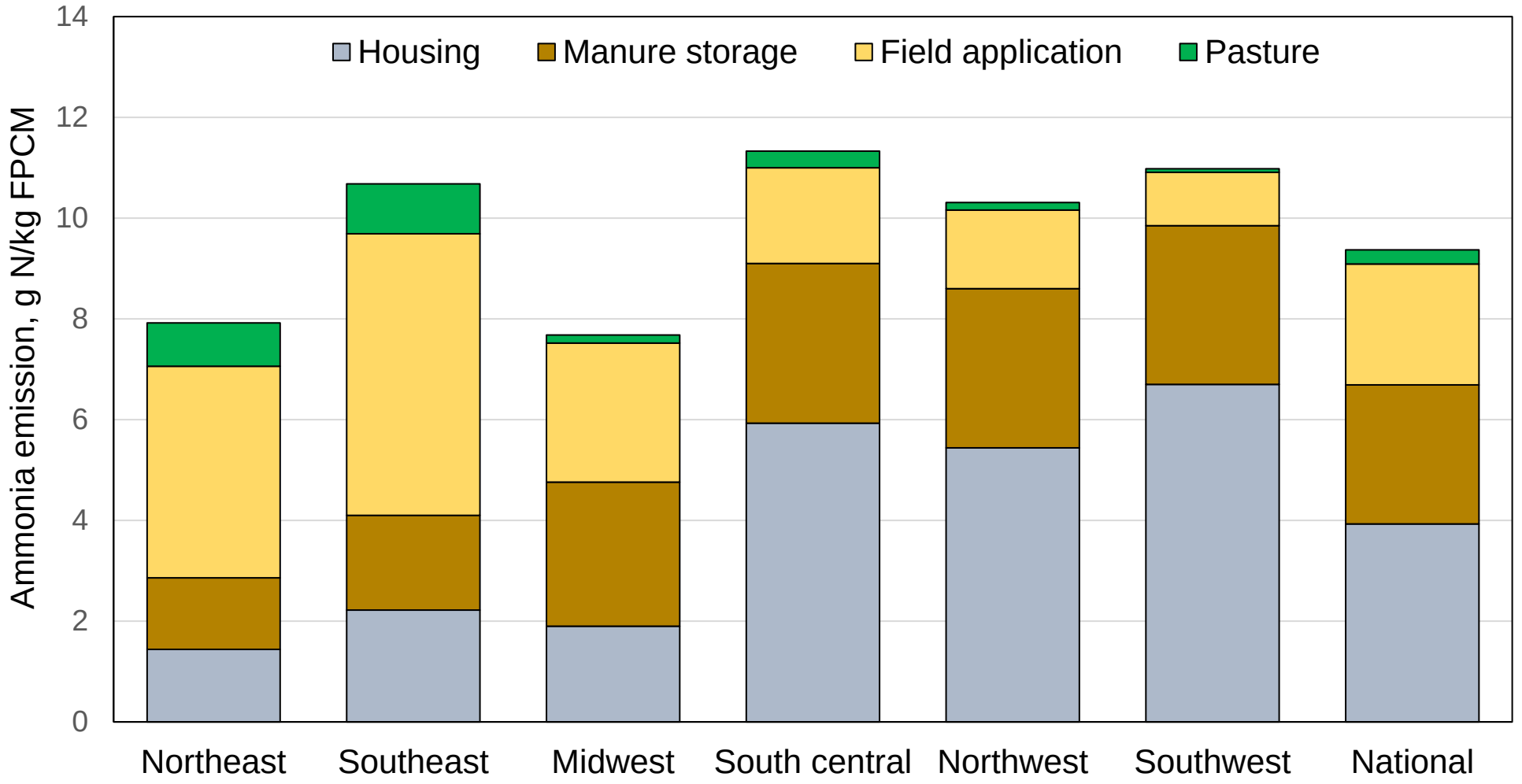


Reactive N Footprint

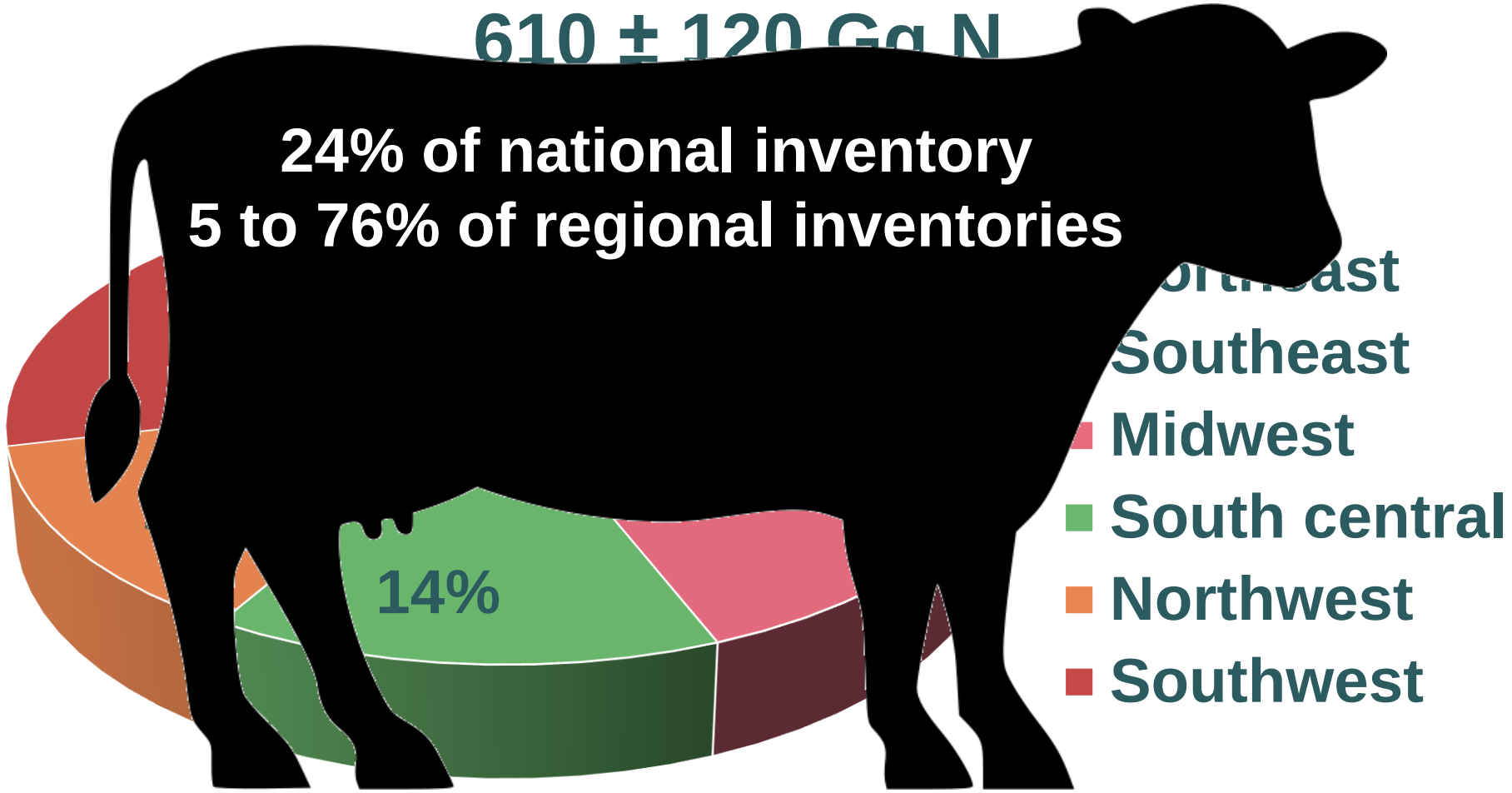
9.9 ± 1.4 g N / kg FPCM



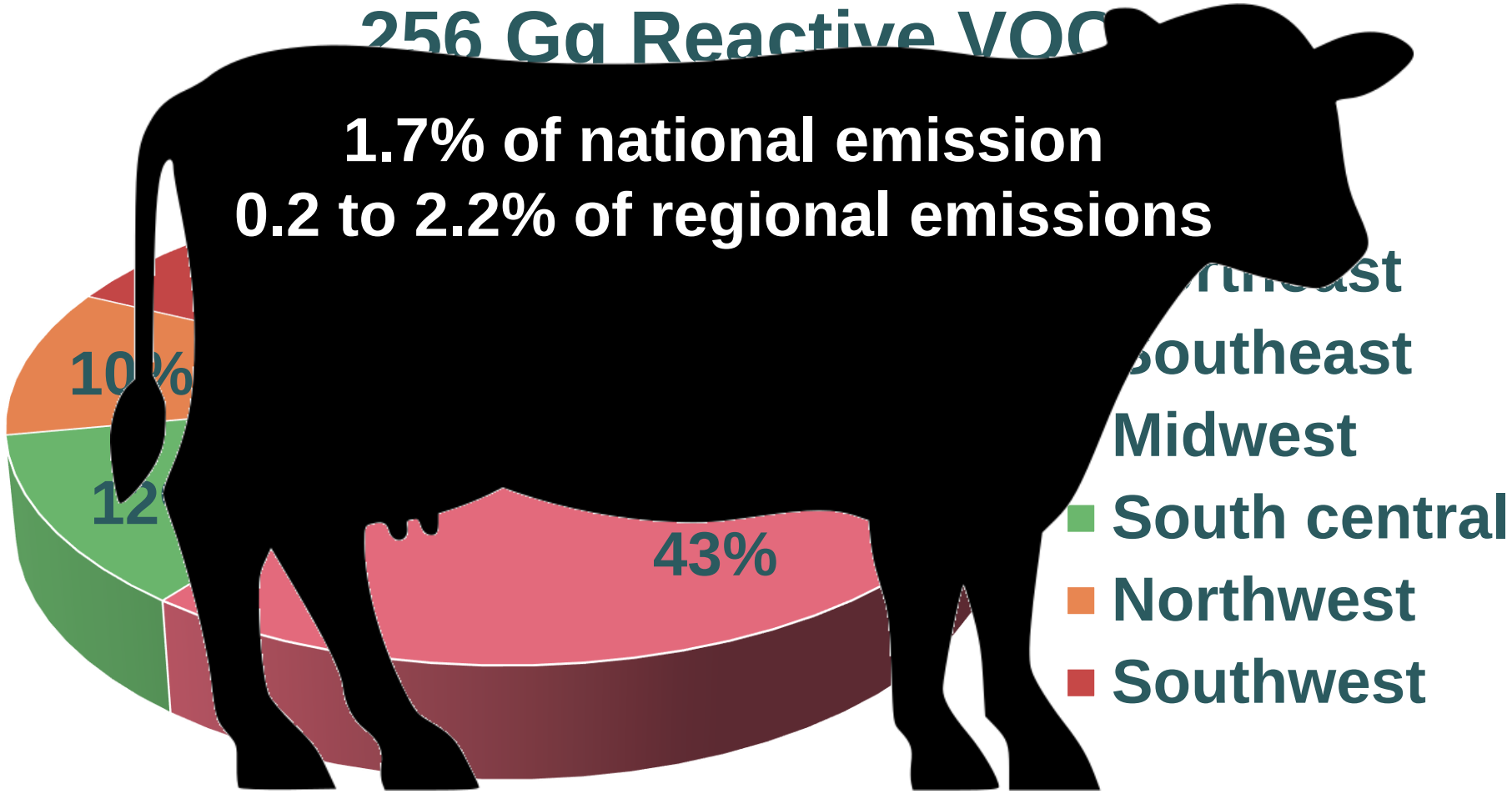
Ammonia Emissions



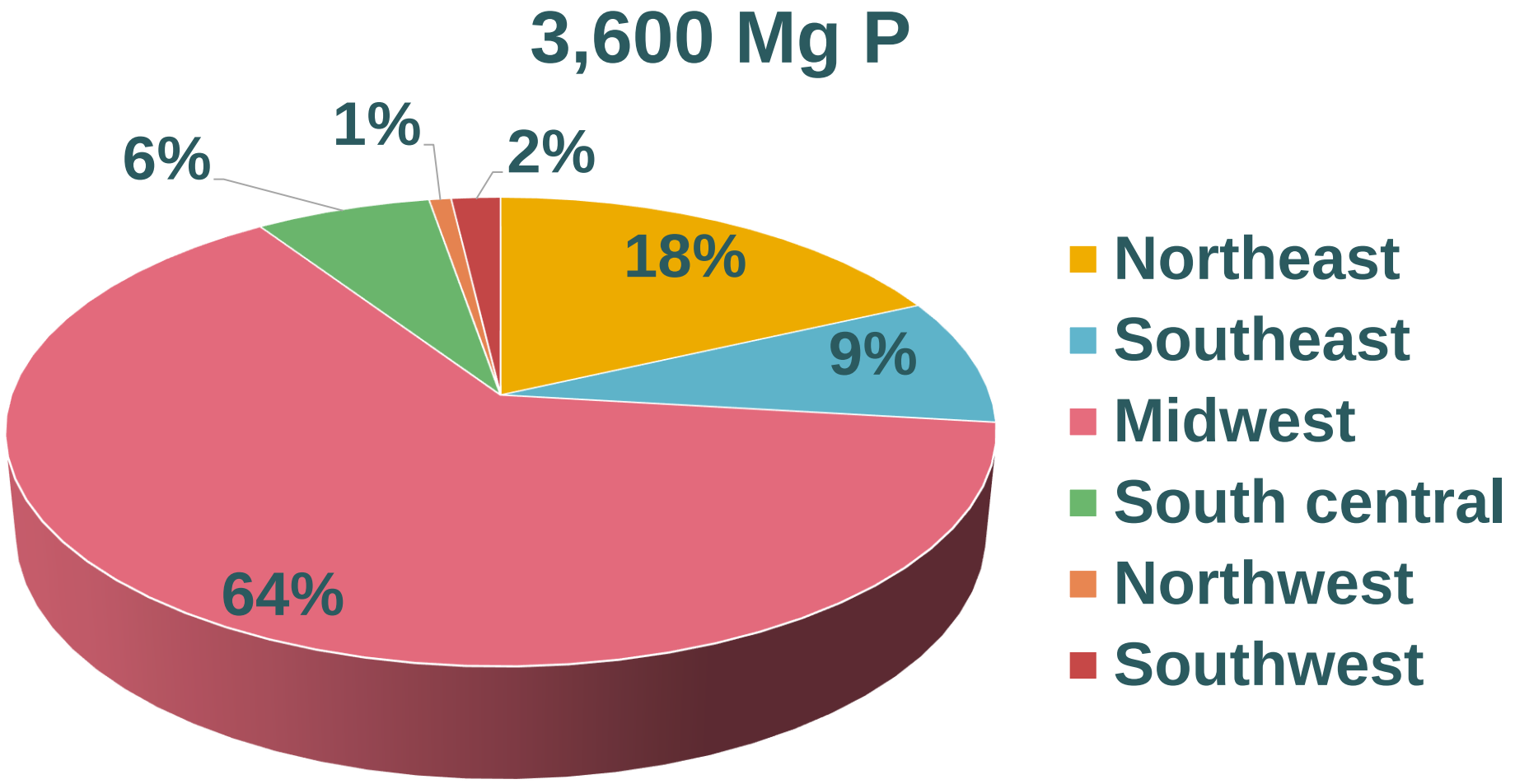
Ammonia Emission



VOC Emission



Phosphorus Loss



Take Home

- GHG emissions have become the focus of environmental assessments of dairy (all livestock) production systems
- Reactive nitrogen (primarily ammonia) losses may be a more important consideration in long term sustainability of dairy farms
- Nitrate and phosphorus runoff losses can also be important contributors to eutrophication of surface waters

Take Home

- VOC emissions can be important in some locations or under some conditions
- Hydrogen sulfide can be an important safety issue on dairy farms, but not an environmental concern
- Tradeoffs do occur which requires a comprehensive life cycle assessment to fully evaluate the environmental impacts of dairy farms

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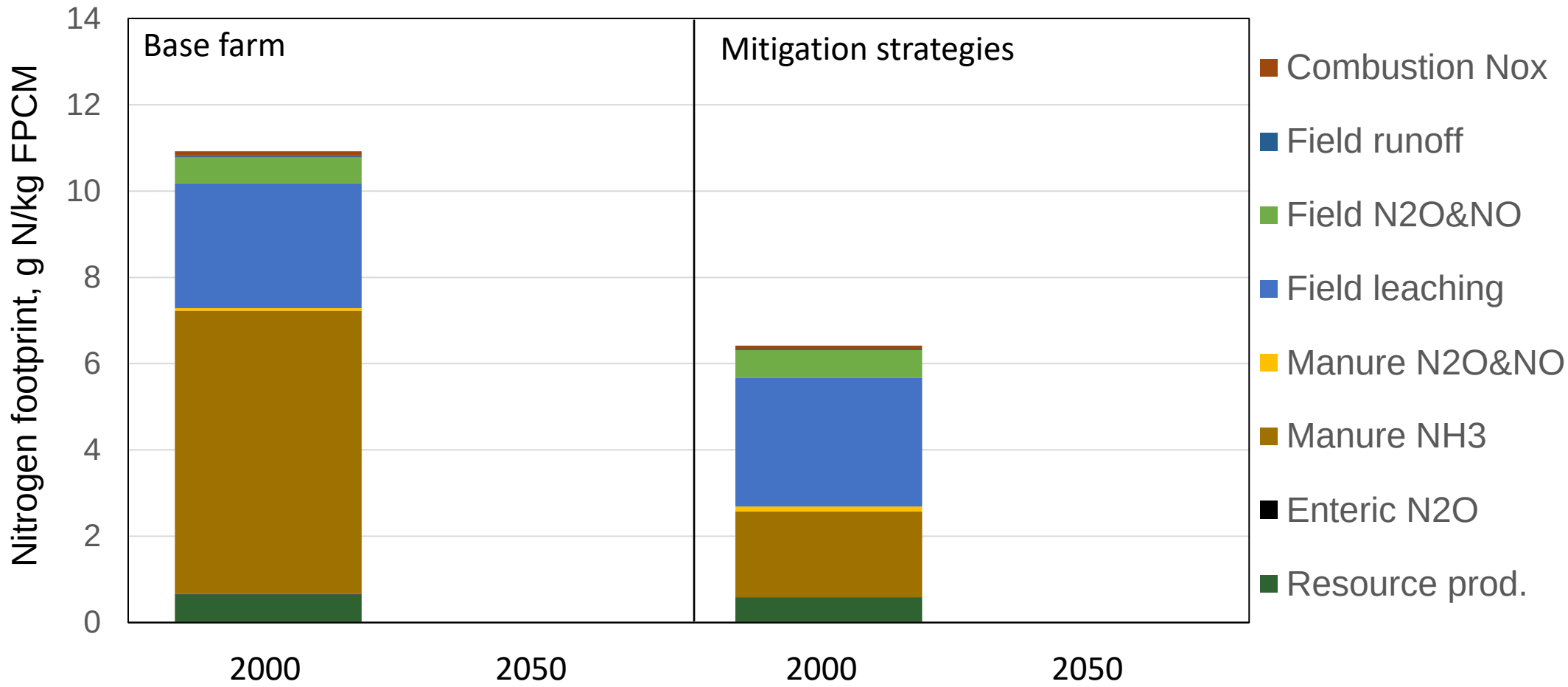
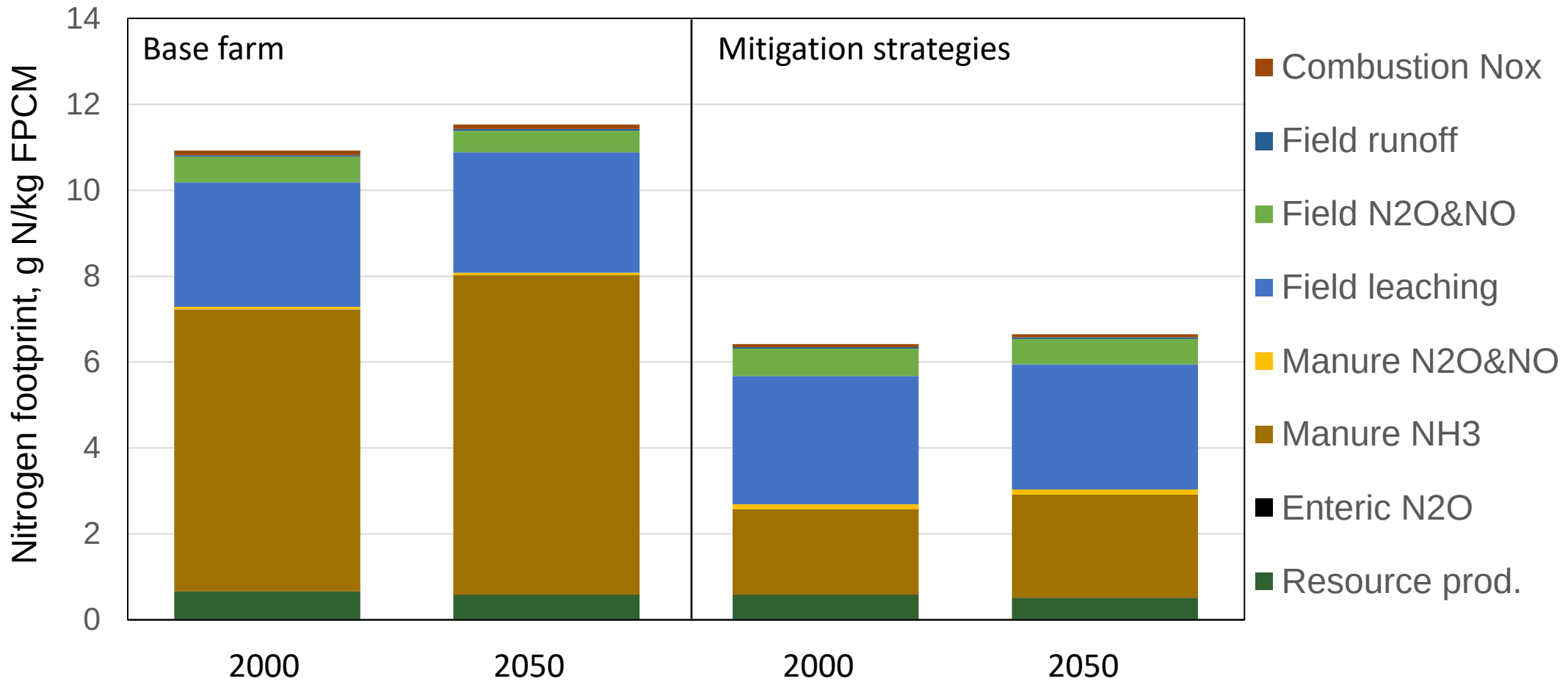
Farm Assessments

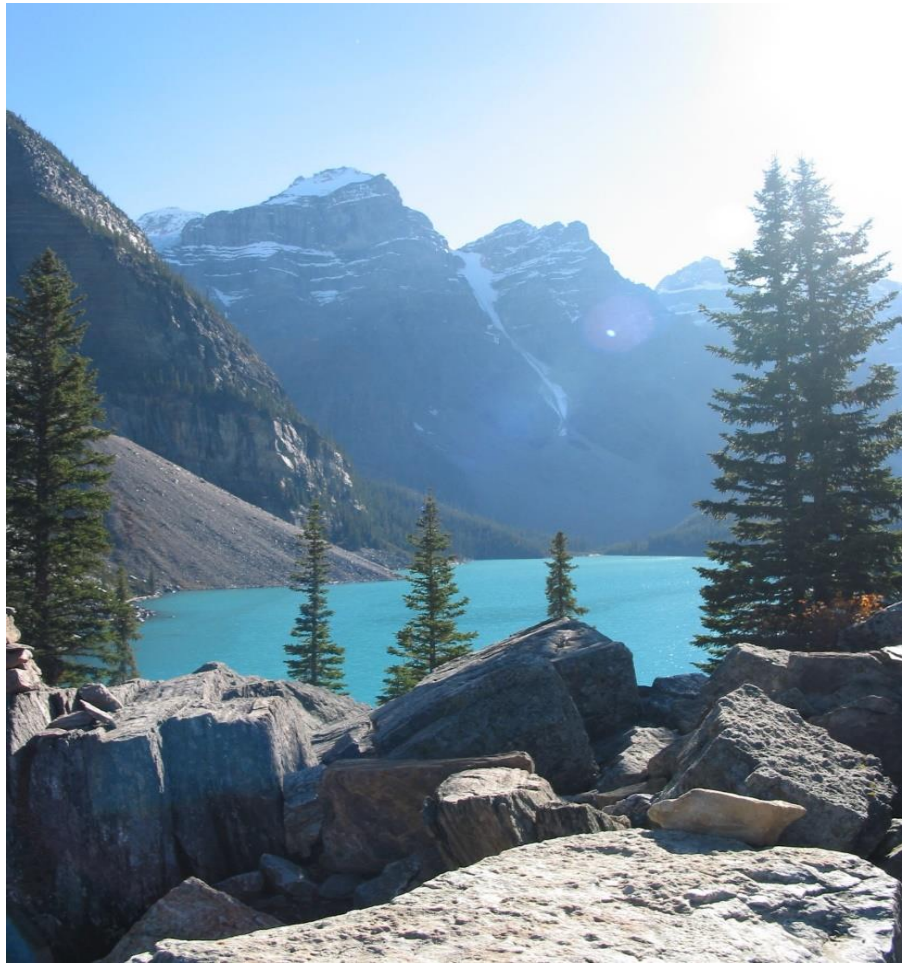


Effects of Climate Change



LCA Environmental Metrics

- Global warming potential
- Energy consumption
- Water consumption
- Resource depletion
- Acidification potential
- Eutrophication potential
- Water emissions
- Solid waste
- Land use
- Photochemical ozone creation
- Ozone depletion potential



Life Cycle Assessment

(Cradle-to-farm gate)