



USE OF ECOSYSTEM SERVICES IN EPA DECISION MAKING FOR CRITERIA AIR POLLUTANTS

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Outline

- **National Ambient Air Quality Standards**
- **Secondary Standards and Ecosystem Services**
- **Overview of 2008 Review**
- **Conceptual Model & Approach for current review**





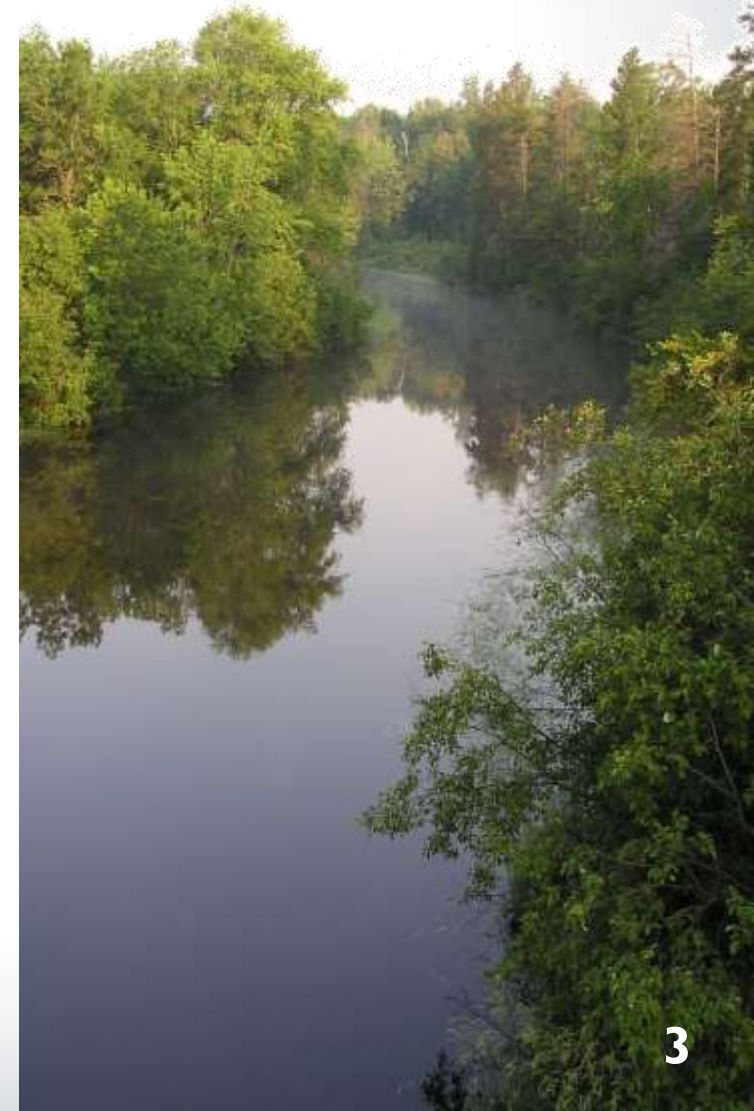
Statutory Requirements for NAAQS CAA § 109

Current Criteria Pollutants:

NO_x, SO_x, O₃, PM, Pb, CO

Primary (health-based) standards ... in the “judgment of the Administrator” are “requisite” to protect public health within an “adequate margin of safety”

Secondary (welfare-based) standards ... in the “judgment of the Administrator” are “requisite to protect the public welfare from any known or anticipated adverse effects”





Welfare Effects & Ecosystem Services

• Welfare Effects

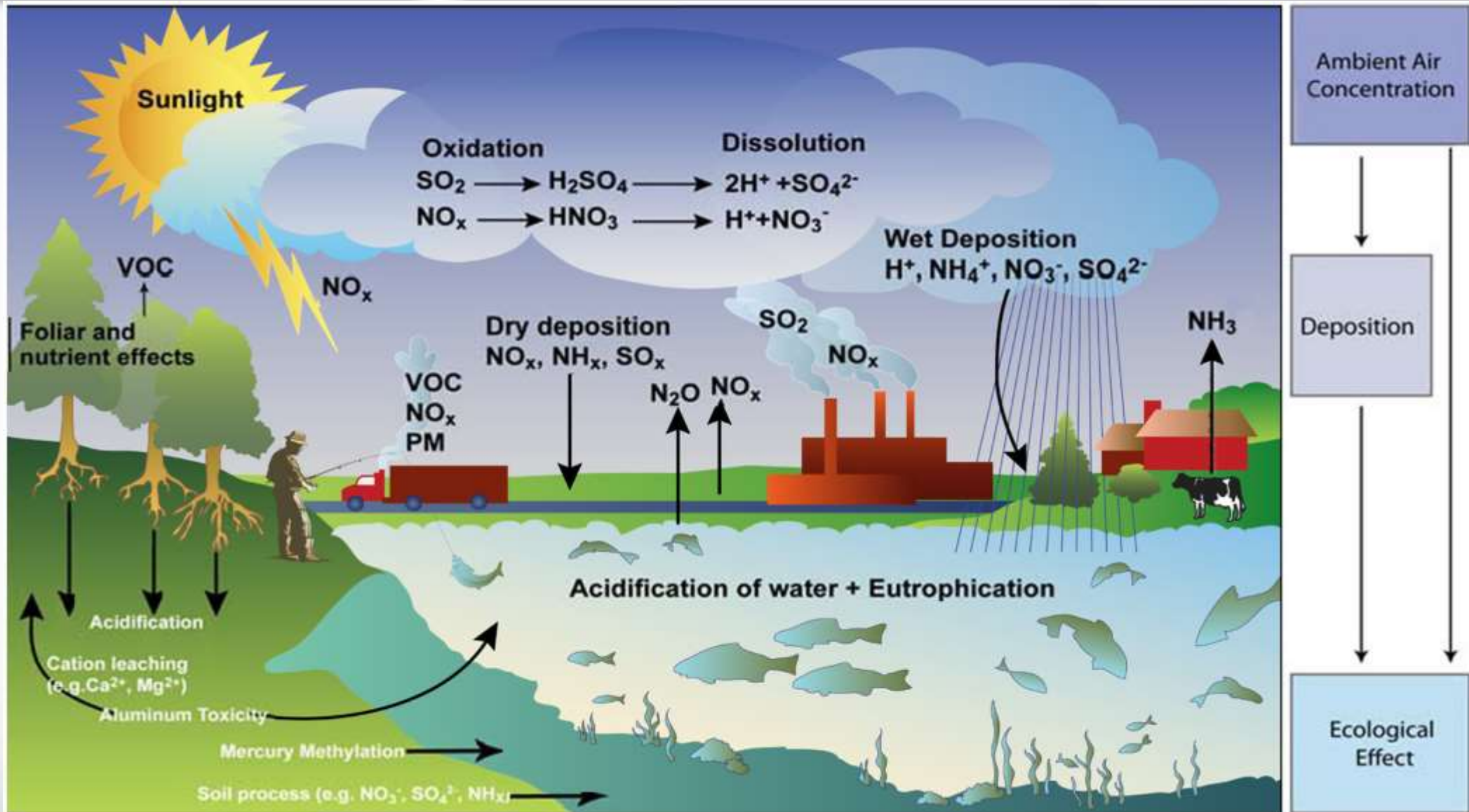
- “Effects on **soils**, **water**, **crops**, **vegetation**, man-made materials, animals, wildlife, weather, visibility, and **climate**; as well as damage to and deterioration of property, hazards to transportation, and the effects on economic values and on **personal comfort and well-being**, whether caused by transformation, conversion, or combination with other air pollutants.” (CAA 302[h])

• Ecosystem Services

- “Outputs of ecological functions or processes that directly or indirectly contribute to social welfare or have the potential to do so in the future.” (EPA 2005)
- Classified as provisioning (**food and water**), regulating (control of **climate** and disease), cultural (**spiritual, recreational**), supporting (**nutrient cycling**) (MEA 2005)

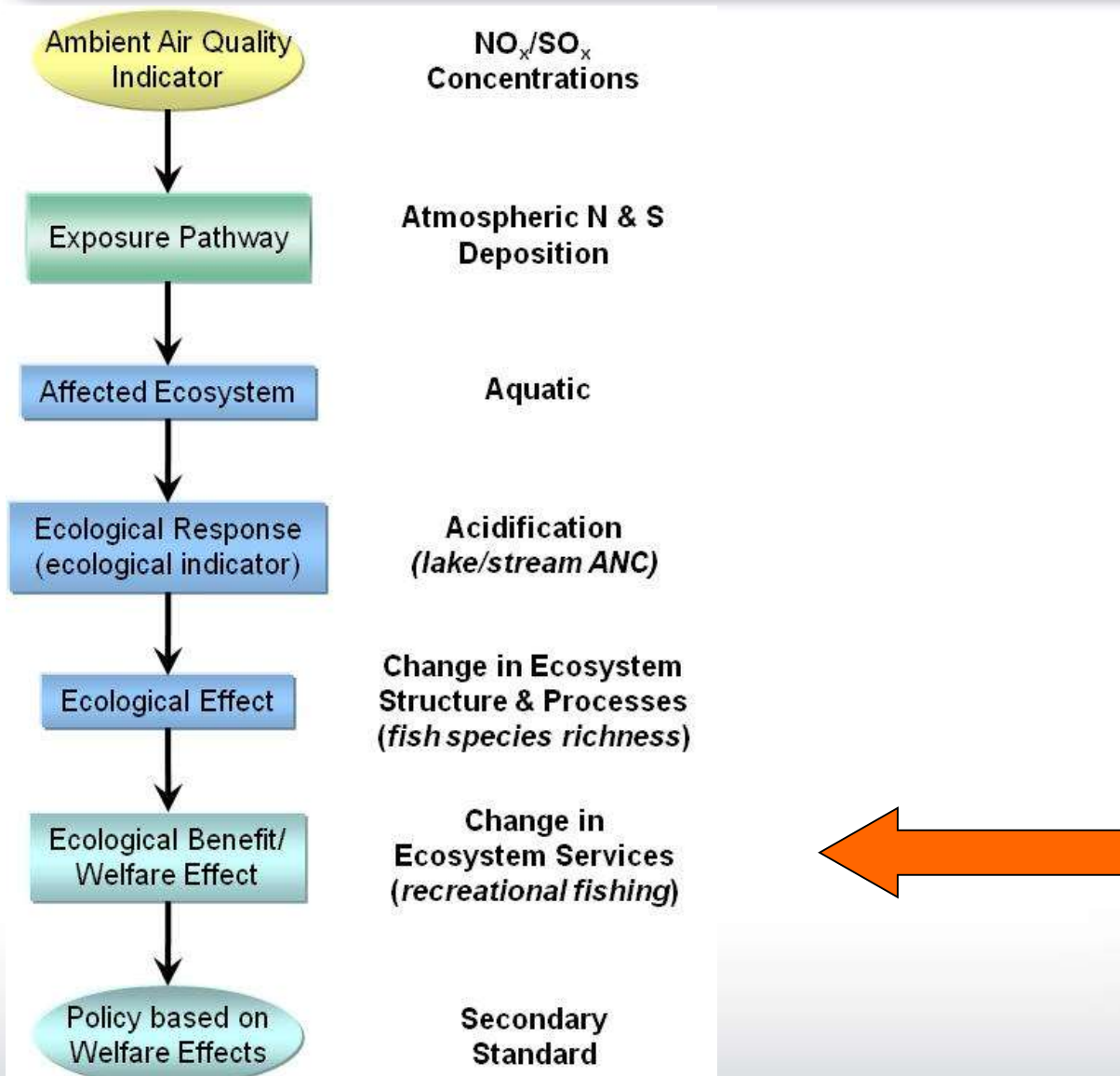


The Problem & Where It's Occurring





Integrating Ecosystem Services



Using Ecosystem Services To Inform Decisions on U.S. Air Quality Standards

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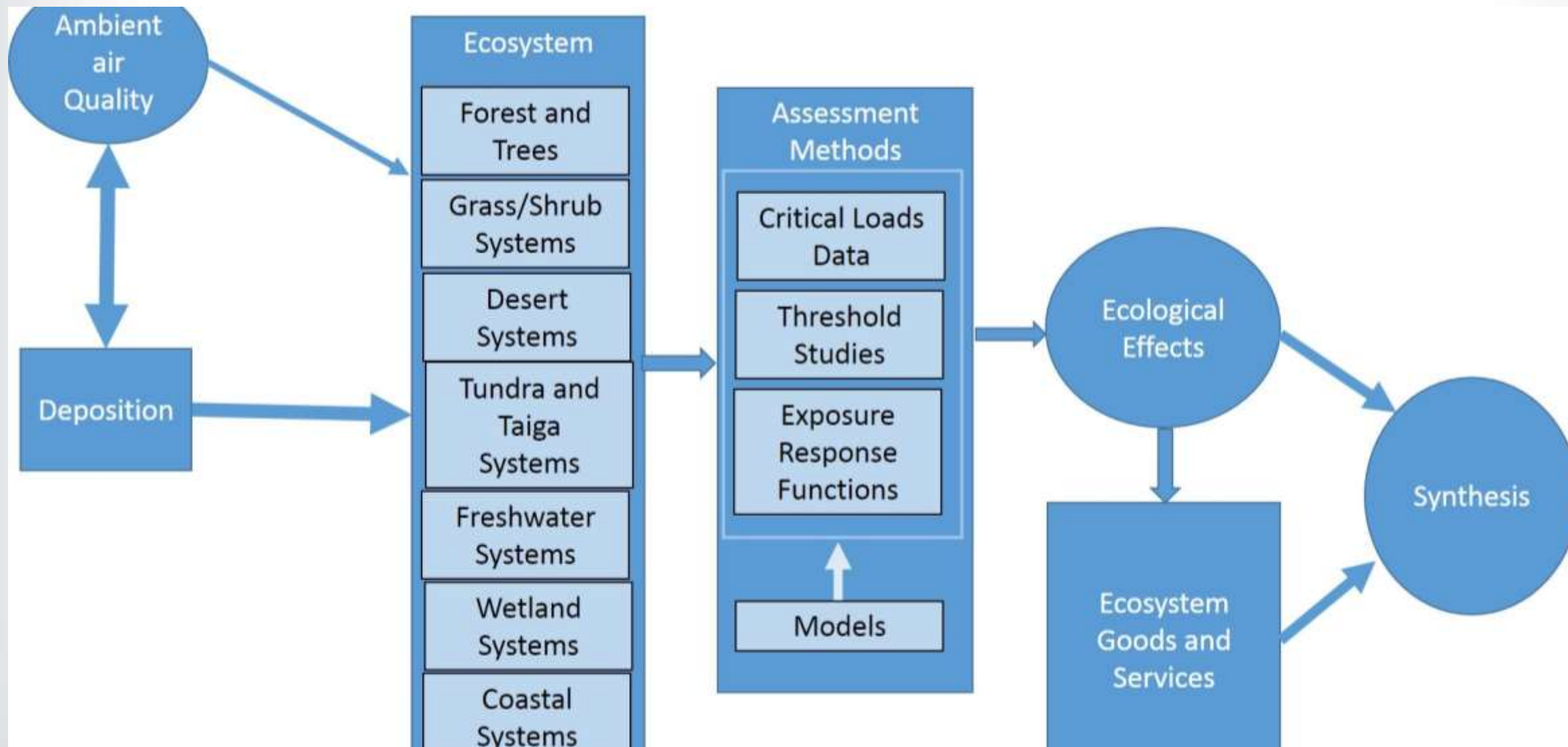
ABSTRACT: The ecosystem services (ES) framework provides a link between changes in a natural system's structure and function and public welfare. This systematic integration of ecology and economics allows for more consistency and transparency in environmental decision making by enabling valuation of nature's goods and services in a manner that is understood by the public. This policy analysis (1) assesses the utility of the ES conceptual framework in the context of setting a secondary National Ambient Air Quality Standard (NAAQS), (2) describes how economic valuation was used to summarize changes in ES affected by NO_x and SO_x in the review, and (3) uses the secondary NO_x/SO_x NAAQS review as a case study to highlight the advantages and challenges of quantifying air pollutant effects on ES in a decision making context. Using an ES framework can benefit the decision making process by accounting for environmental, ecological, and social elements in a holistic manner. As formal quantitative linkages are developed between ecosystem structure and function and ES, this framework will increasingly allow for a clearer, more transparent link between changes in air quality and public welfare.



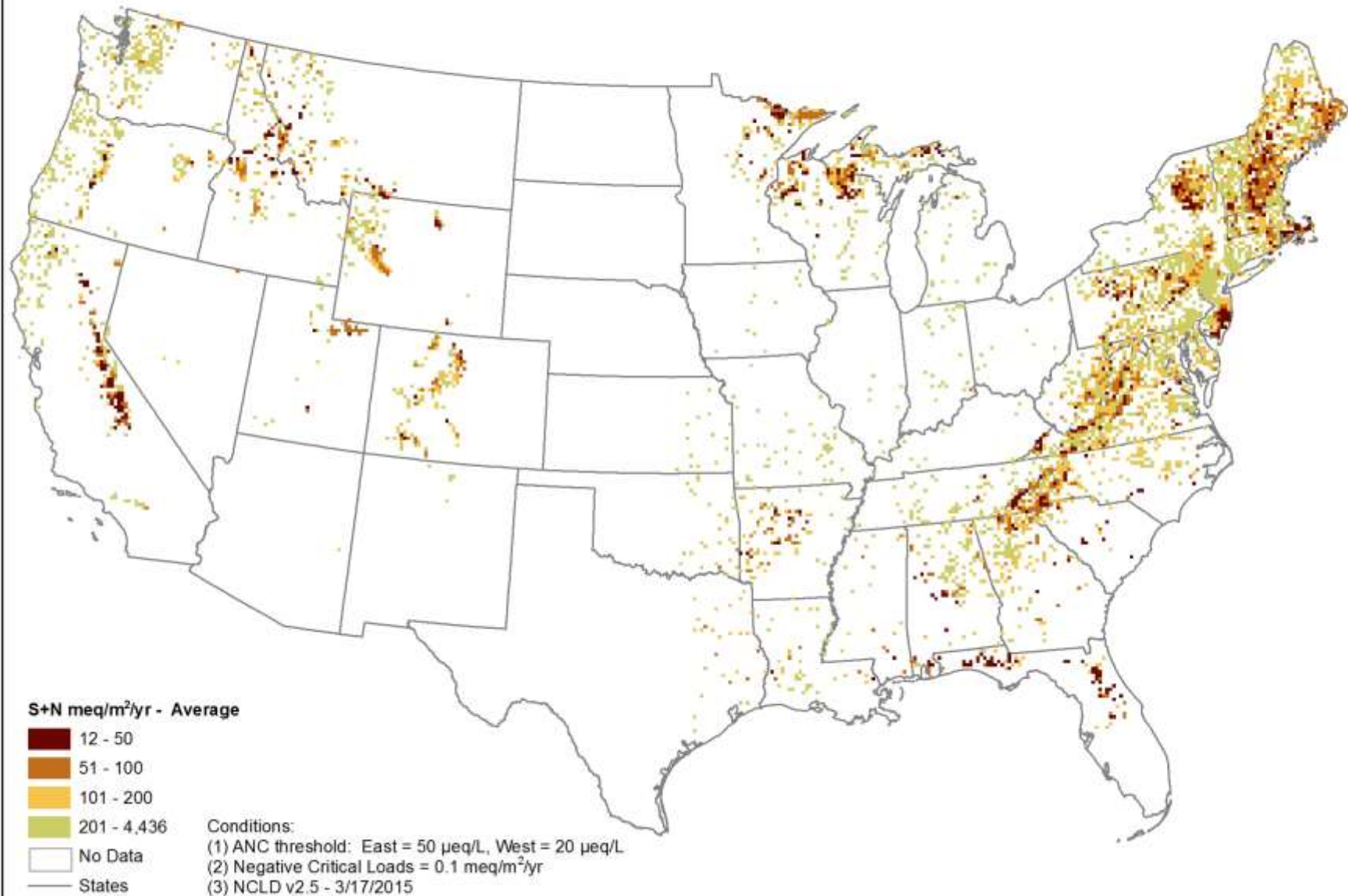
I. INTRODUCTION

The ecosystem services (ES) concept integrates economics and ecology among many other disciplines and is gaining in popularity as a decision making tool.^{1–5} Policy makers, analysts, and environmental advocates have been drawn to the idea that the services natural systems provide society can not only be

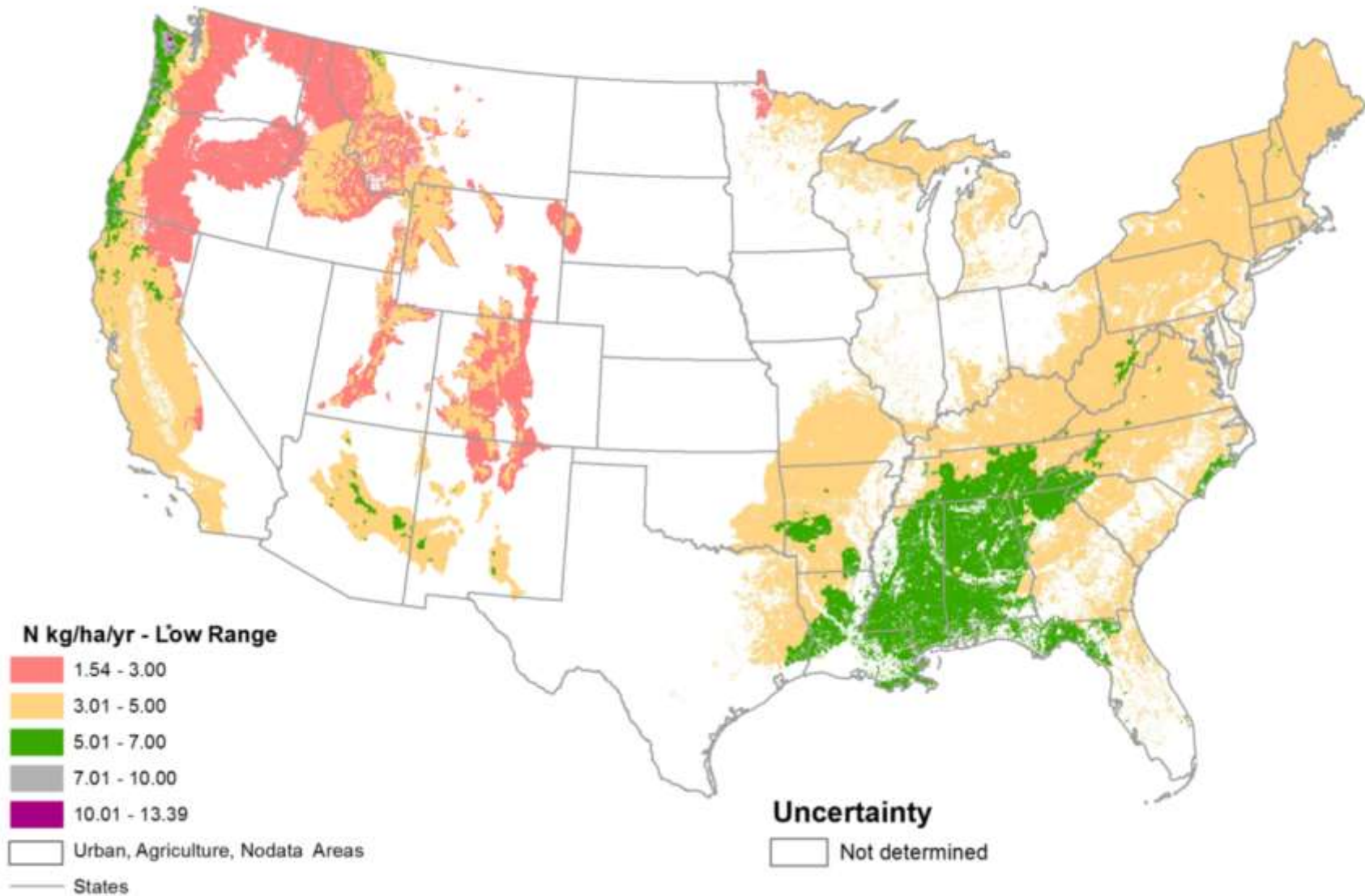
public health, including "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. For the secondary standards, the Administrator of the EPA "shall specify a level of air quality...requisite to protect the



Surface Water Critical Loads for Acidity



Empirical Critical Load for Nitrogen - Lichens

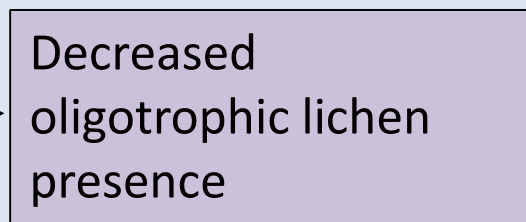
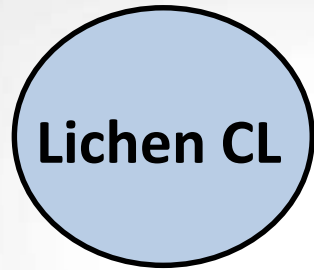


Empirical Critical Loads for Nitrogen - Herbaceous Plants & Shrubs



Example of How to Connect Effects with Potential Ecosystem Endpoints

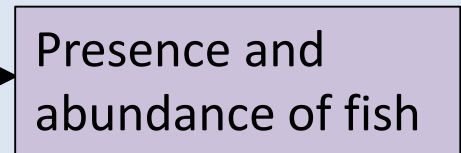
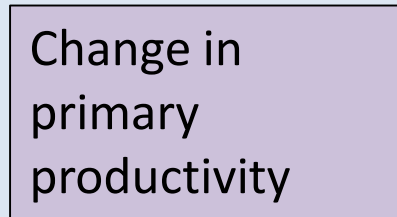
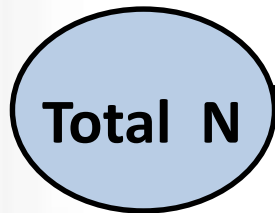
Marine West Coast Coniferous Forests



- Ecosystem Services Examples
- Food for caribou, elk, deer
 - Pharmaceuticals/Medicinal
 - Fiber and textiles
 - Dyes

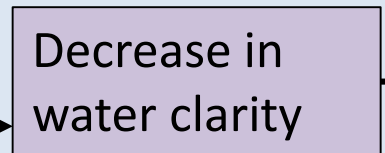
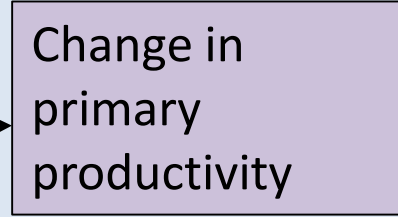
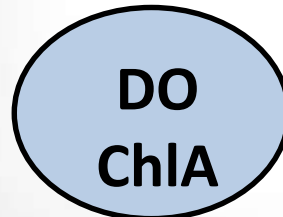
Note: Arrow thickness indicates strength of relationship.

Non-Alpine Lakes



- Ecosystem Services Examples
- Subsistence fishing
 - Recreational fishing
 - Local economic impacts
 - Boaters/Swimmers

Estuaries



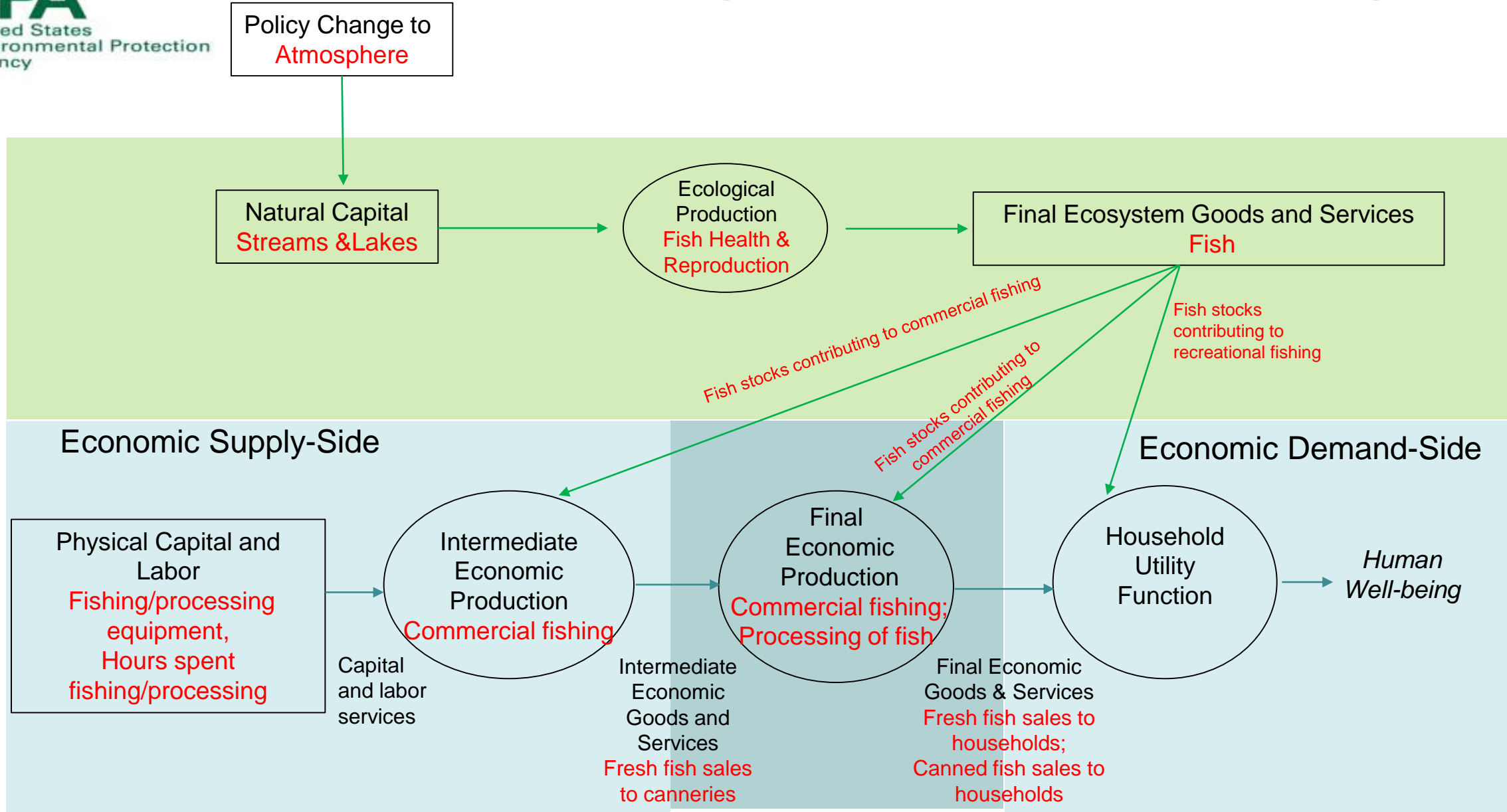
- Ecosystem Services Examples
- Subsistence fishing/hunting
 - Recreational fishing/hunting
 - Local economic impacts
 - Boaters/Swimmers

* For each ecosystem there are existence and other services not listed.

From Policy Change to Human Well-being

Ecosystem Service Supply-Side

Ecosystem Service Demand-Side





Summary

- **Ecosystem Services are being used by EPA when reviewing secondary air standards**
- **Science has progressed since last review**
 - **Critical Loads Database**
 - **Regional & National Assessments**
 - **Refined Case Studies**
- **Review is organized around ecosystems rather than ecological endpoints**
 - **Ecosystem Services facilitate a systematic review**
 - **Using NESCS & FEGS ES developed by ORD**