U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2015 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Sustainability & Strategic Analysis

Kristen Johnson
Technology Manager

Introduction: Analysis & Sustainability (A&S)

- The Team
- Goals & Objectives
- Challenges
- Approach & Partnerships
- Budget
- Key Accomplishments
- Future Directions
- Upcoming Activities

Introductions: Analysis & Sustainability Staff

Alison Goss Eng

Alicia Lindauer

Kristen Johnson

Zia Haq

Max Broad (BCS)

Nick Massey (CNJV)

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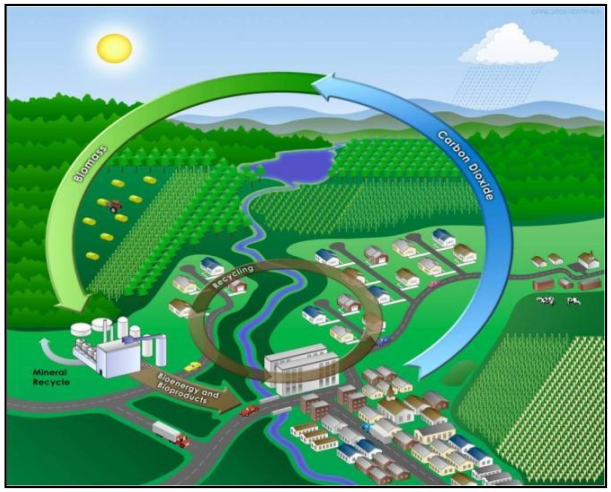
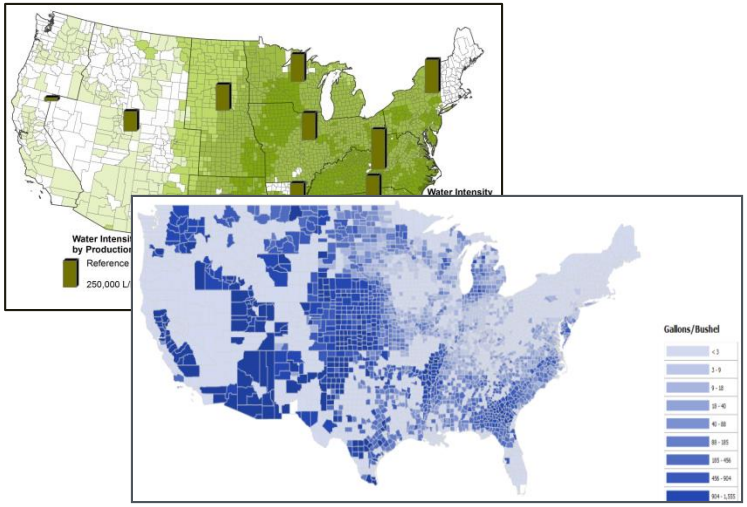
Analysis & Sustainability: Critical to BETO's Mission

Proactively addresses issues that affect the scale-up potential, public acceptance, and long-term viability of the Office's technology investments.



Equips DOE with analyses and expertise to inform national and global dialogues on the benefits and impacts of bioenergy.



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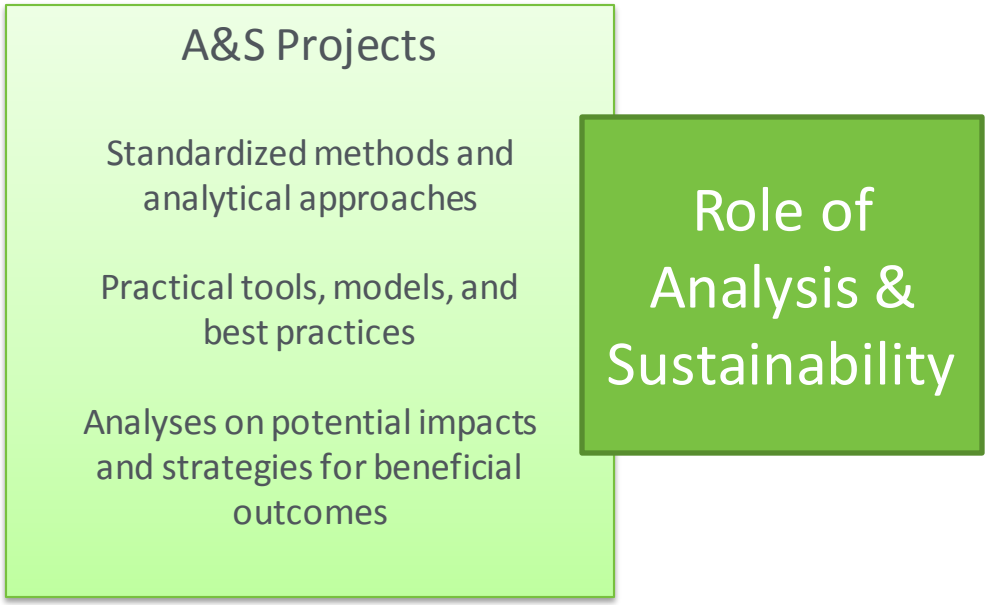
Goals and Objectives

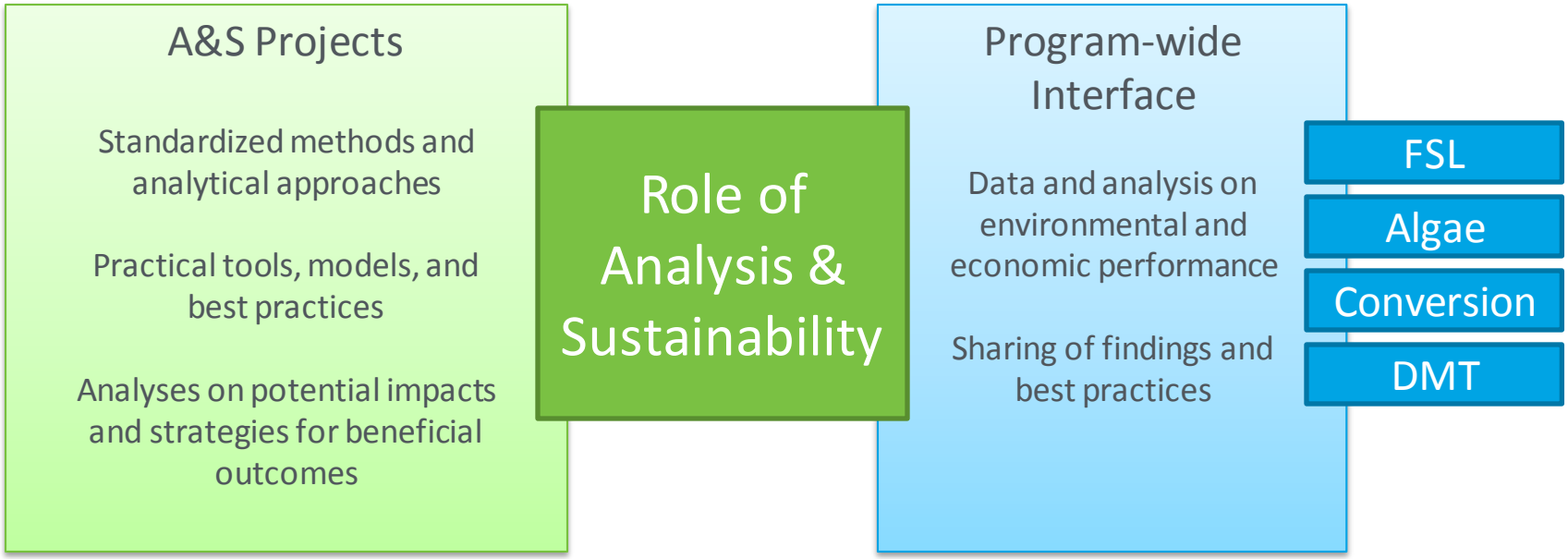
Strategic Analysis	Cross-Cutting Sustainability
Provide context and justification for decisions at all levels by establishing the basis of quantitative metrics, tracking progress toward goals, and informing portfolio planning and management	Understand and promote the positive economic, social, and environmental effects and reduce the potential negative impacts of bioenergy production activities

Dimensions of Bioenergy Sustainability

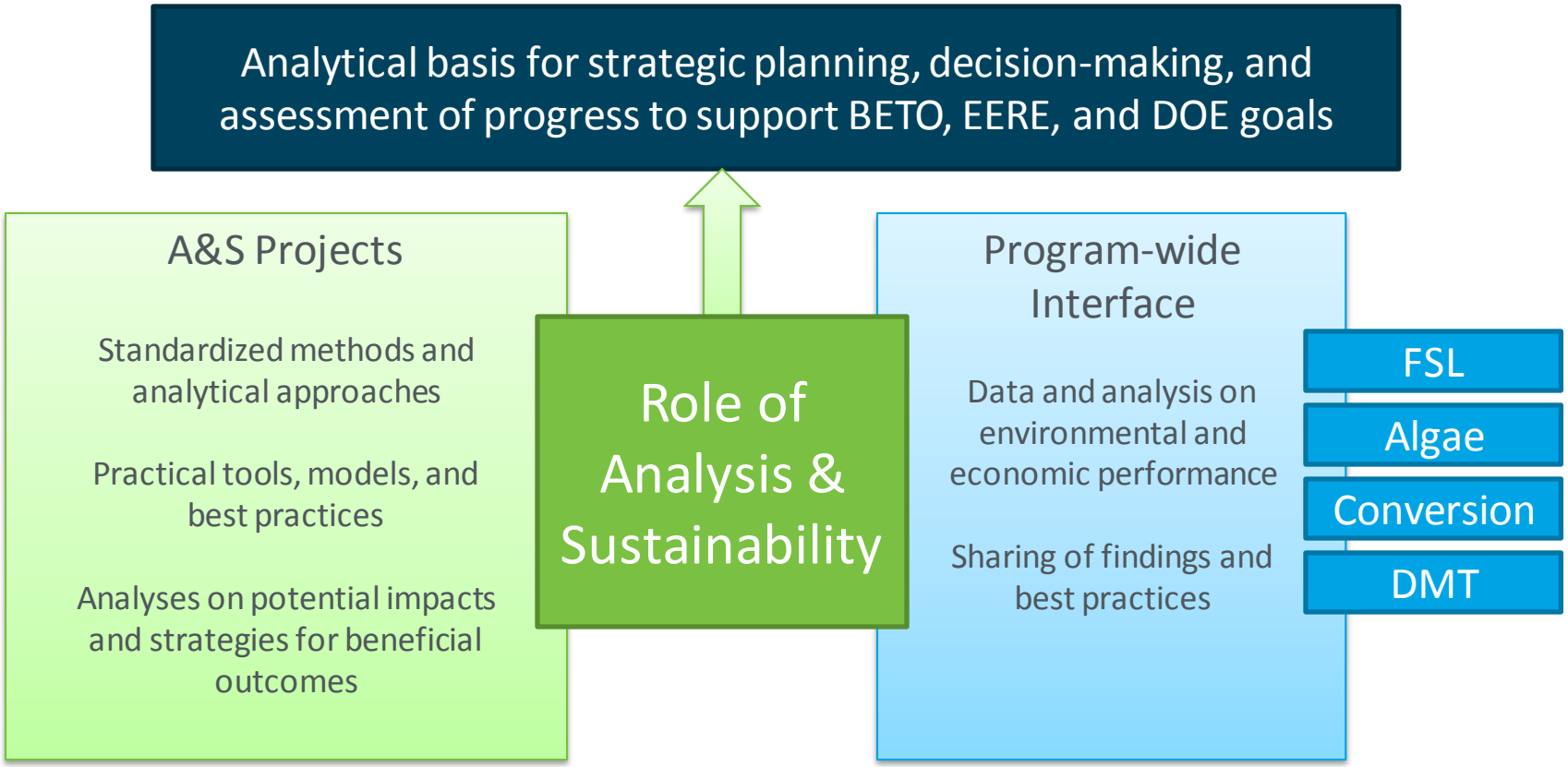
A&S Plays a Cross-cutting Role



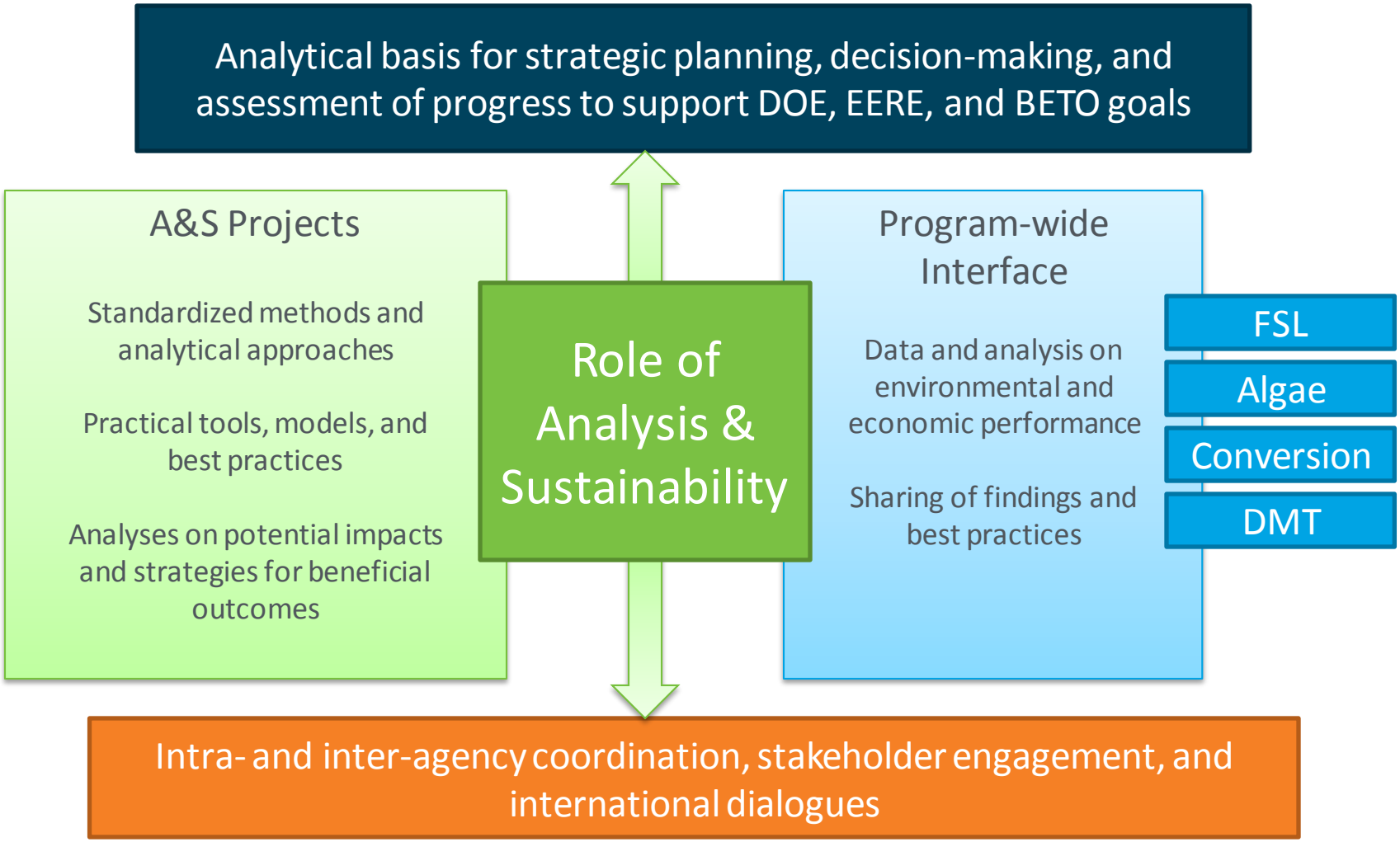
A&S Plays a Cross-cutting Role



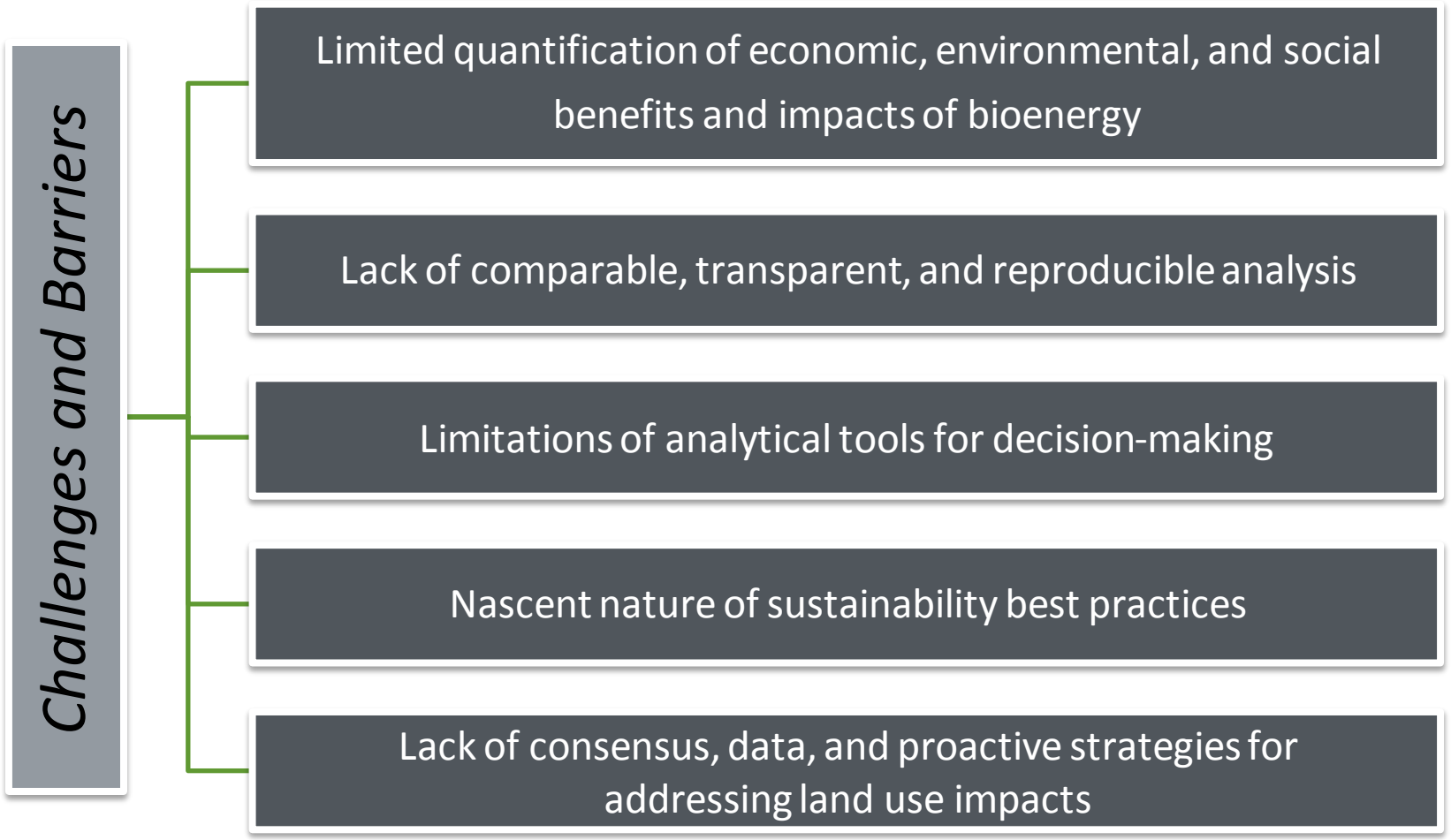
A&S Plays a Cross-cutting Role



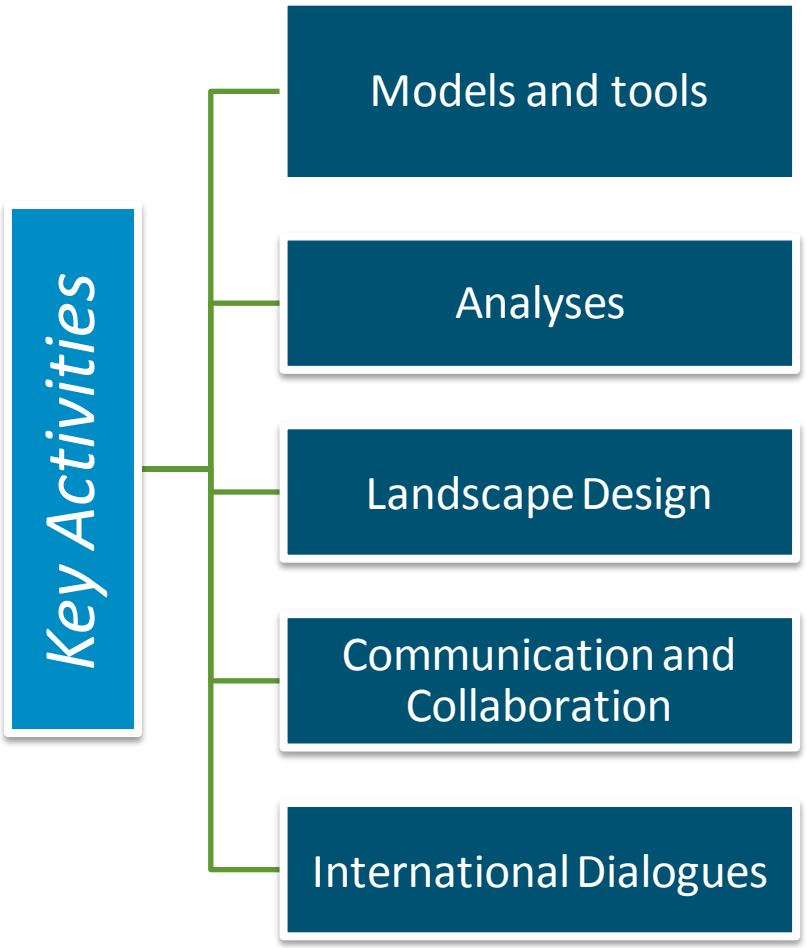
A&S Plays a Cross-cutting Role



Key Challenges



Key Activities and Partners



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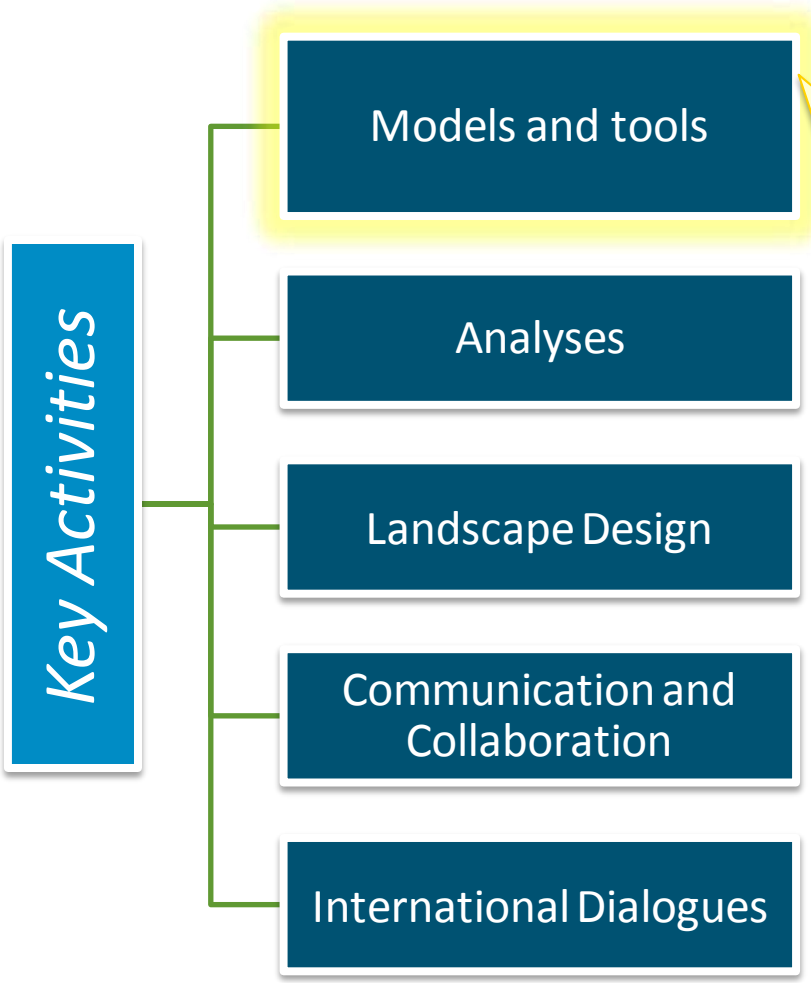

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Argonne NATIONAL LABORATORY

INL Idaho National Laboratory

Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET)

Water Assessment Tool for Energy Resources (WATER)

Biomass Scenario Model (BSM)

Landscape Environmental Assessment Framework (LEAF)

Jobs & Economic Development Impact (JEDI)

Soil & Water Assessment Tool (SWAT)

OAK RIDGE National Laboratory

Pacific Northwest NATIONAL LABORATORY

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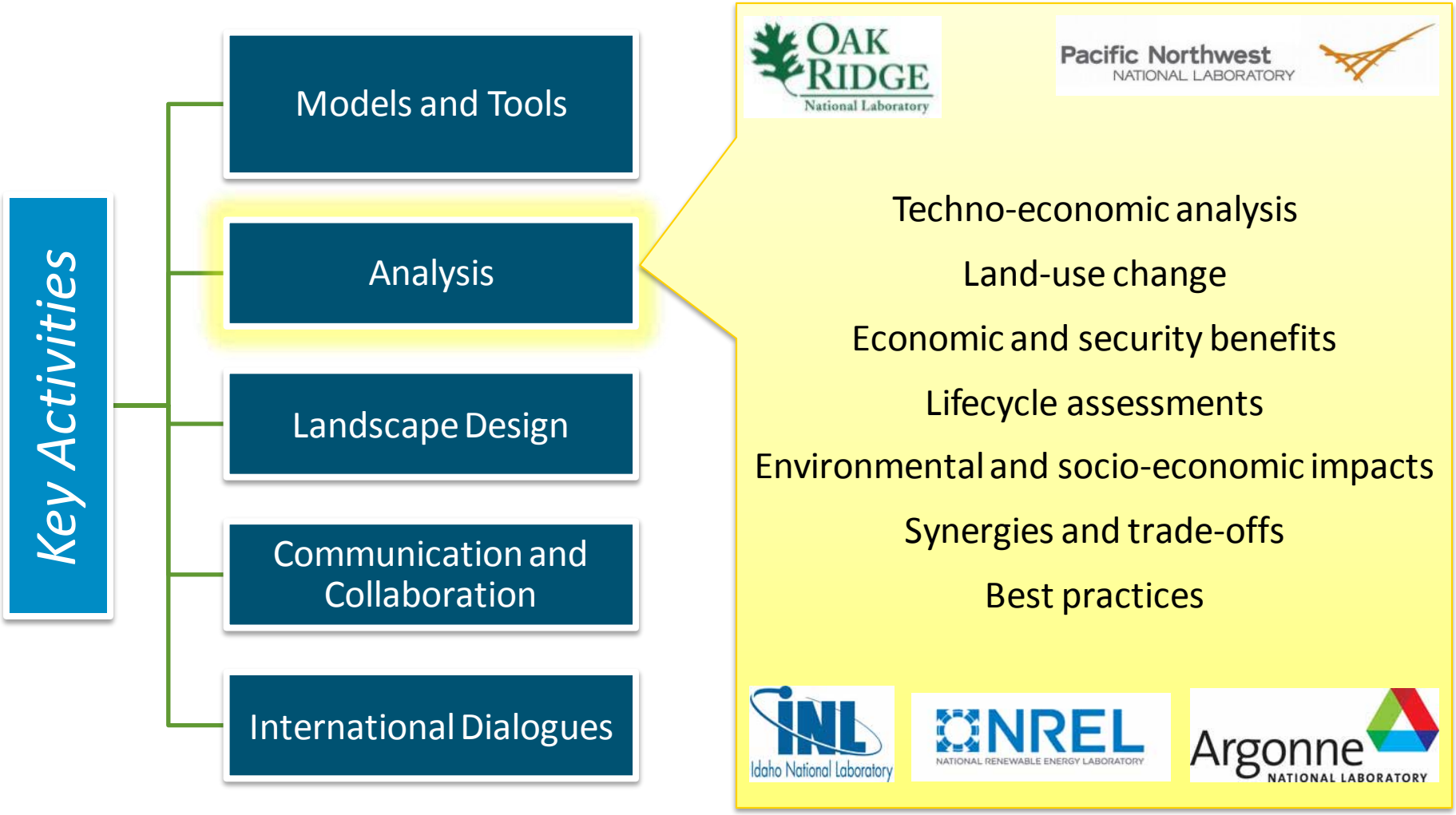
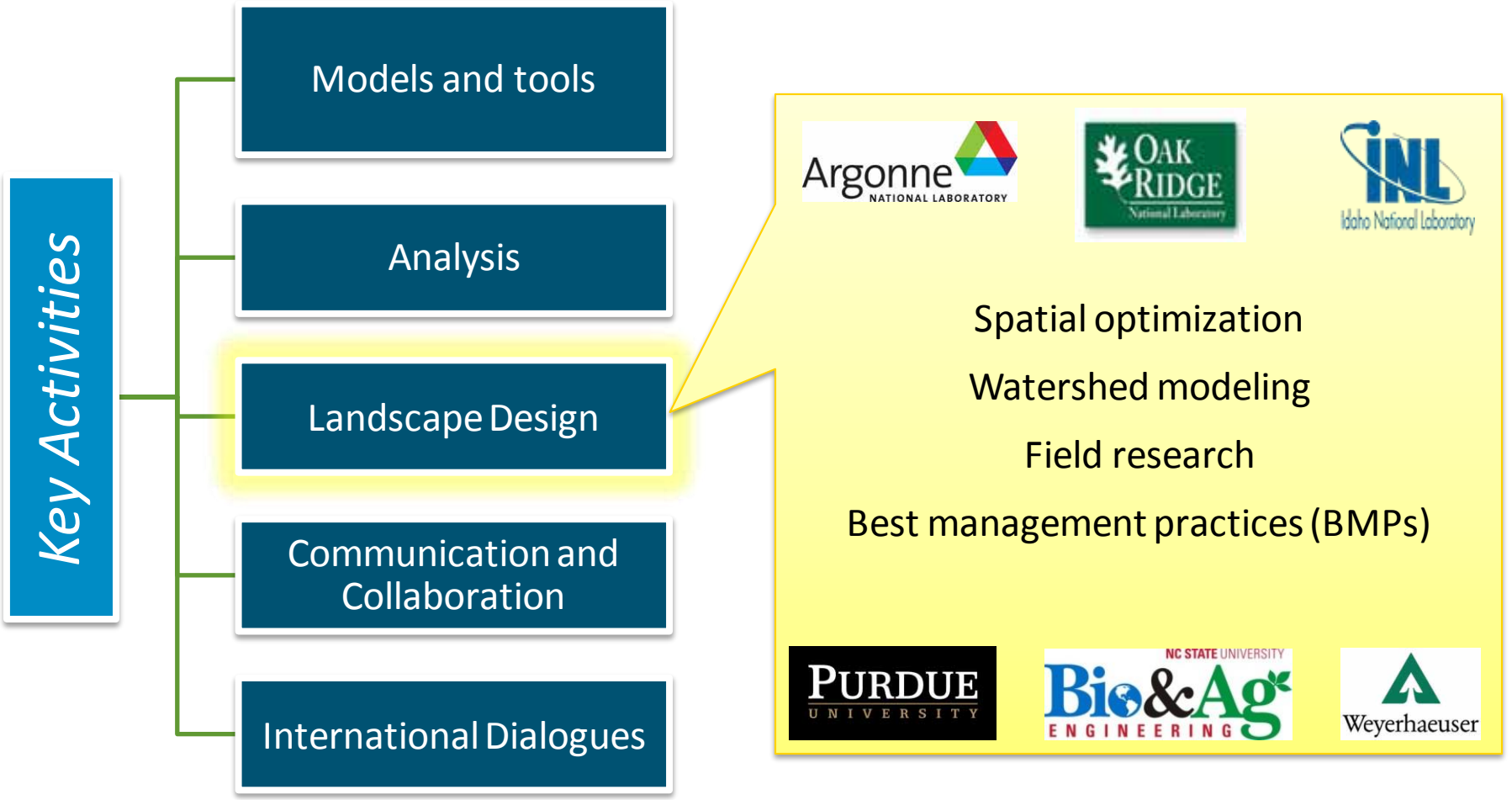
A&S: Key Activities and Partners



A&S: Key Activities and Partners



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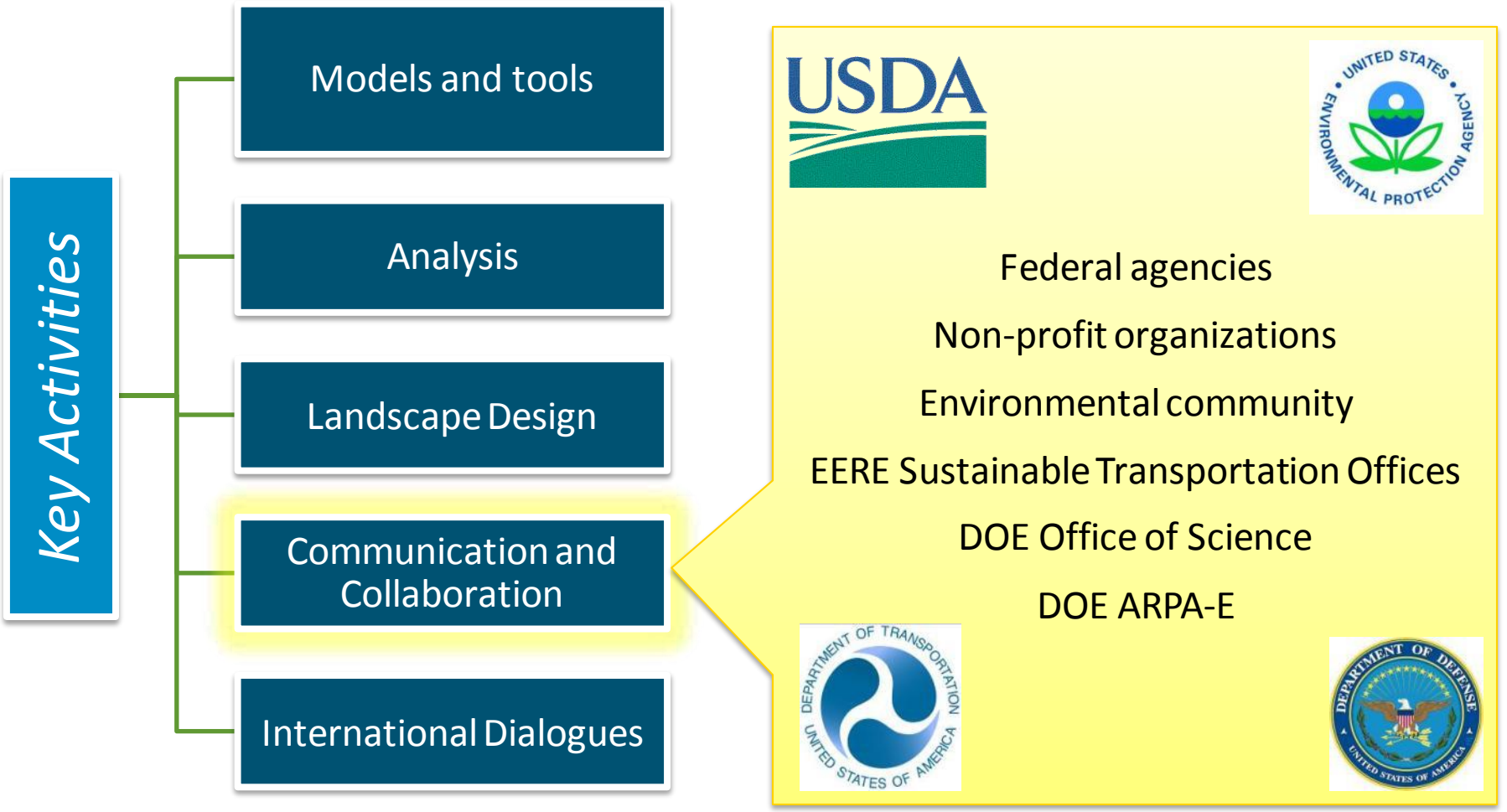


A&S: Key Activities and Partners

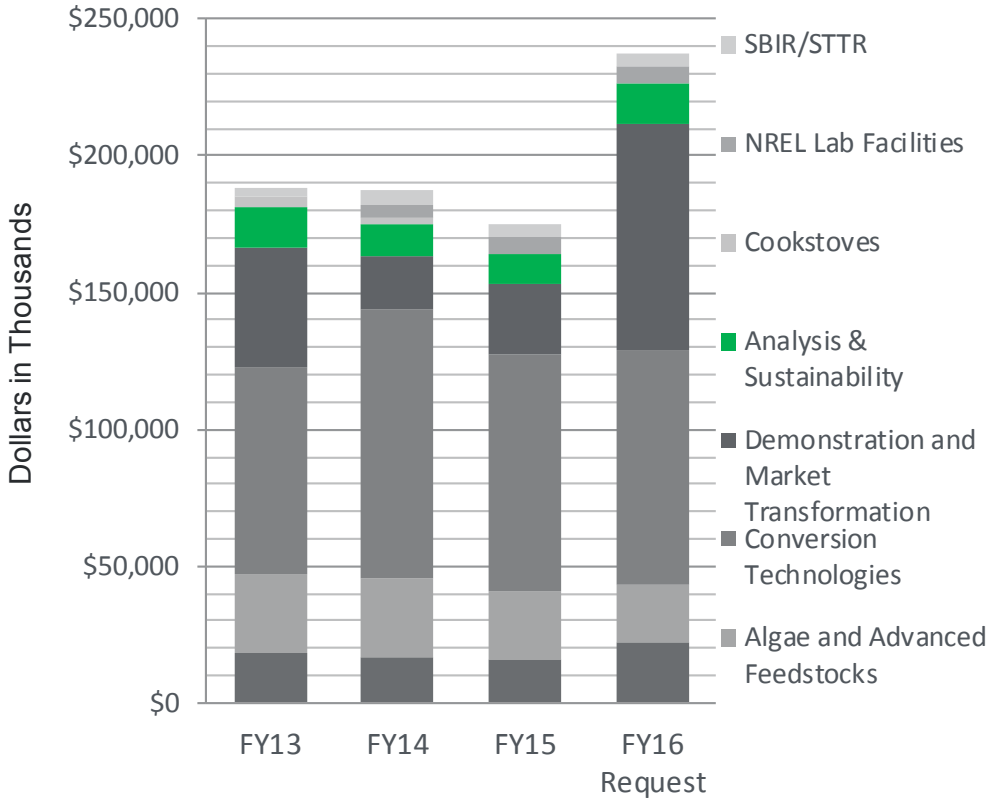
Budget (FY13-FY15)

Annual budget about $11 M

- Strategic Analysis
- Cross-cutting Sustainability

Currently 29 projects

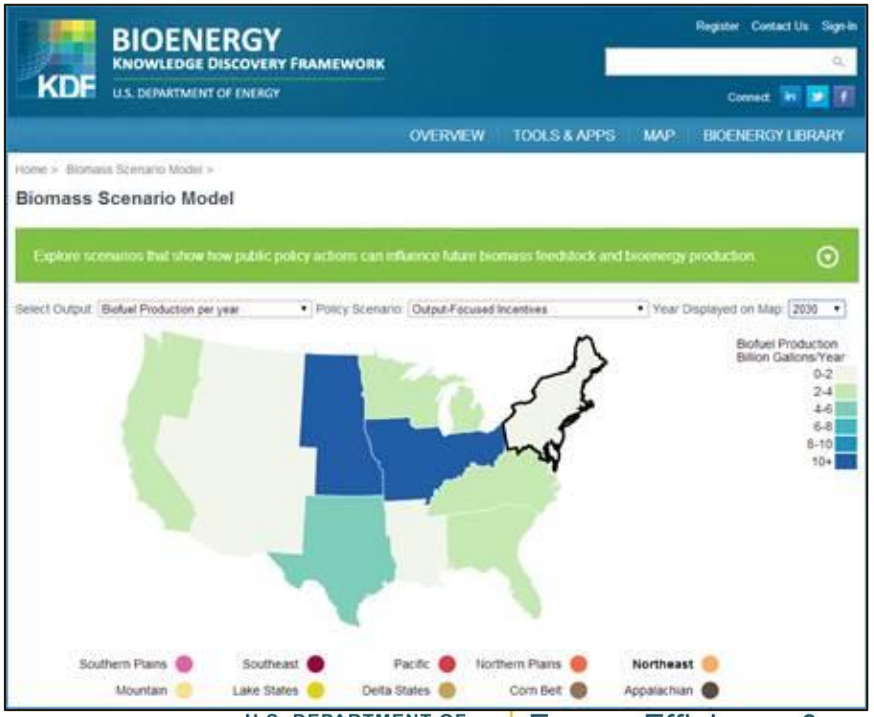
- 25 national lab projects
- 4 academic/industry projects (existing competitive projects not funded by A&S)

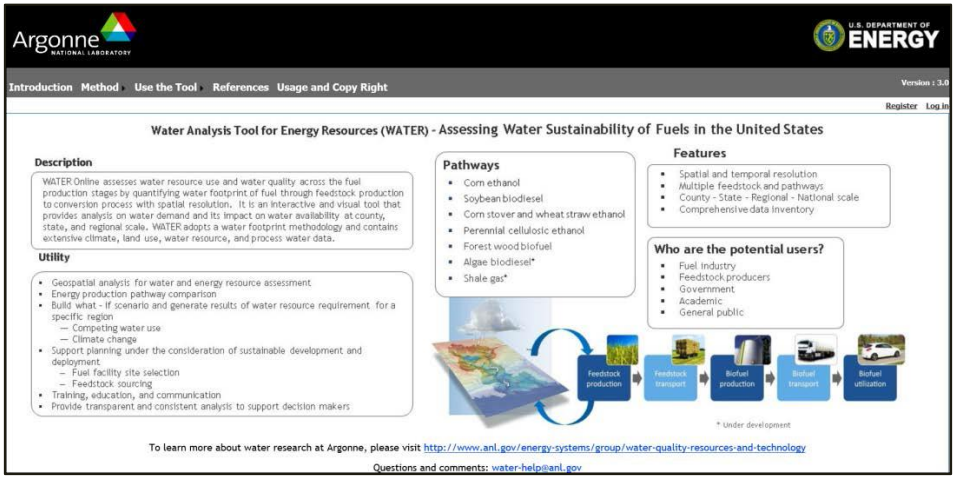


Key Accomplishments

Enhanced widely used tools and models

- GREET.net 2014
- Biomass Scenario Model (BSM) on KDF
- WATER 3.0 2015
- Simulation of bioenergy crops and ag residue in SWAT model (Purdue)
- Suite of Jobs and Economic Development Impact (JEDI) models





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Key Accomplishments

Increased integration of techno-economic and environmental analyses

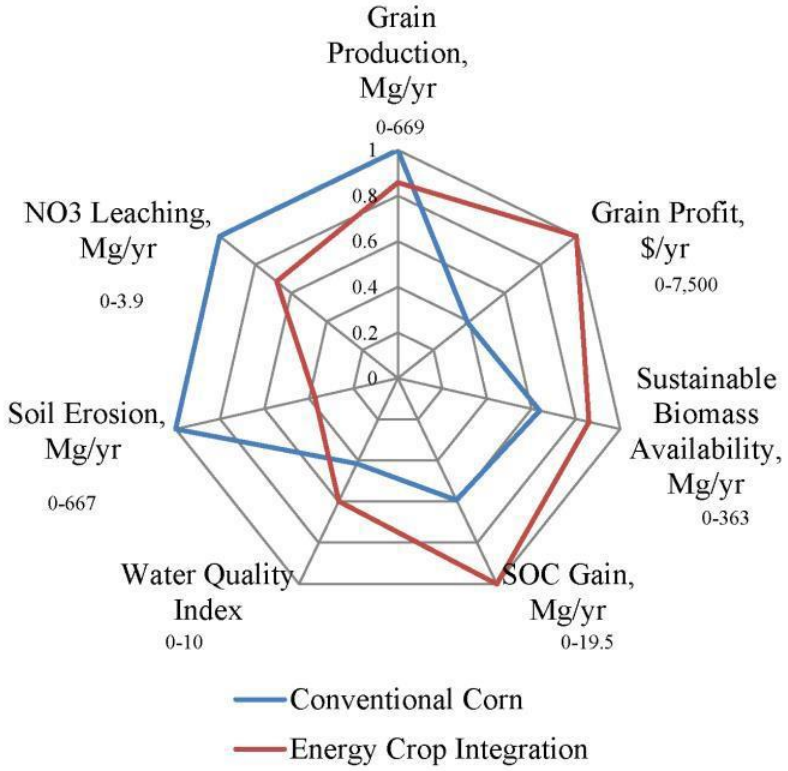
- Design cases of biofuel pathways
  - Environmental sustainability metrics for conversion stage
  - GREET analysis of full pathway to identify drivers of GHG emissions
    - Corn stover to ethanol via fermentation
    - Southern pine to ethanol via gasification
    - Hybrid poplar to renewable gasoline and diesel by fast pyrolysis
    - Algae hydrothermal liquefaction
    - Additional pathways underway
  - Assessment of federal air pollutant emission regulations potentially applicable to a biorefinery (fast pyrolysis and sugars-to-hydrocarbons)
  - Estimates of maximum potential emissions of regulated air pollutants for a biomass depot (for fast pyrolysis and sugars- to-hydrocarbons biorefineries)
- Coordination between INL, NREL, PNNL, and ANL
  - Sharing data and results
  - Developing pathways in GREET and WATER models

Key Accomplishments

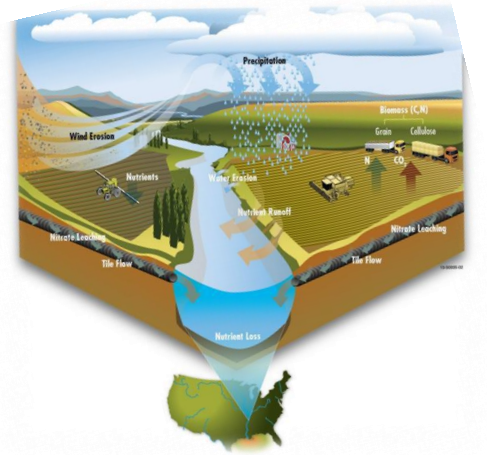
Developed innovative approaches to multi-attribute sustainability assessments

Applied LEAF to identify opportunities for energy crop production based on subfield-scale distribution of profitability

- Increase profit and productivity
- Reduce erosion and nitrate runoff



Idaho National Laboratory



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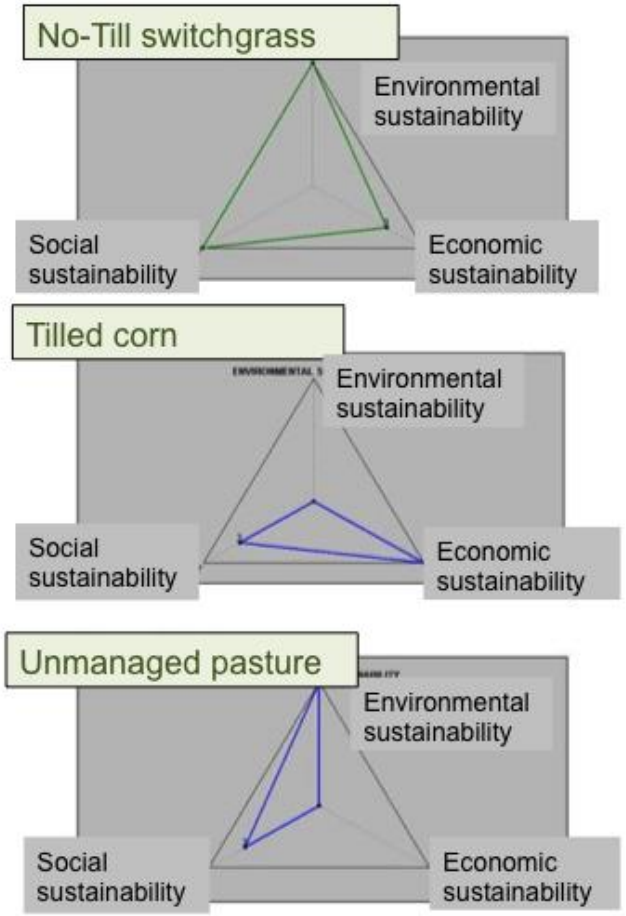
Key Accomplishments

Developed innovative approaches to multi-attribute sustainability assessments

Developed framework for using indicators to assess progress toward bioenergy sustainability

- Uses Multi-Attribute Decision Support System (MADSS)
- Determines relative contributions of three "pillars" to overall sustainability
- Applied to bioenergy crop production system in East Tennessee



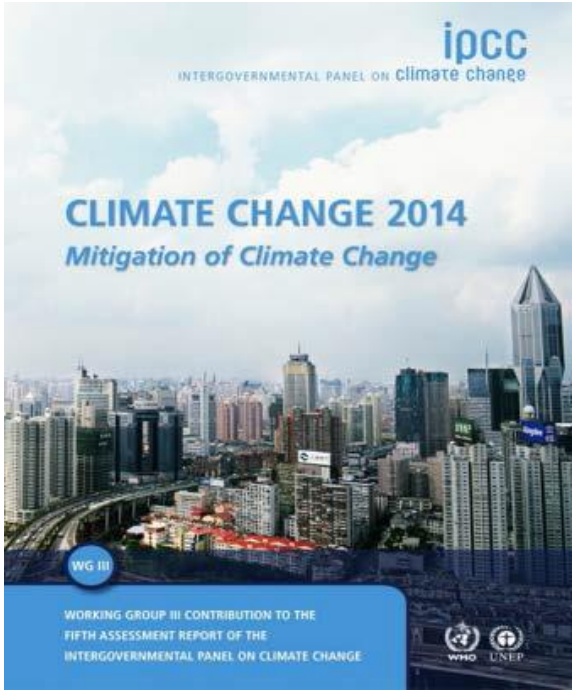
OAK RIDGE National Laboratory

CBES Center for BioEnergy Sustainability

Key Accomplishments

Contributed to high-profile international dialogues and publications

- Intergovernmental Panel on Climate Change (IPCC)
- SCOPE Bioenergy & Sustainability Project: Bridging the Gaps
- Draft standard ISO13065, Sustainability Criteria for Bioenergy
  - Systematic methodology based on evidence
  - Measurable, reproducible, verifiable
  - Clarify accounting for fossil and biogenic carbon
  - Methods for detection of soil carbon change
  - Life-cycle assessment methods



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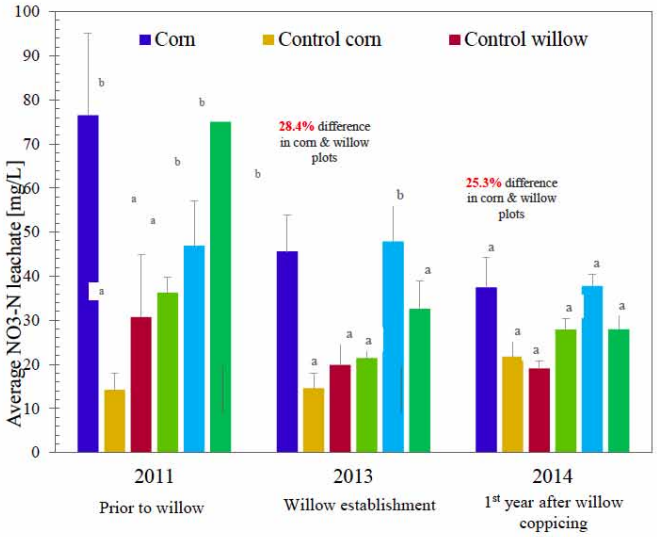
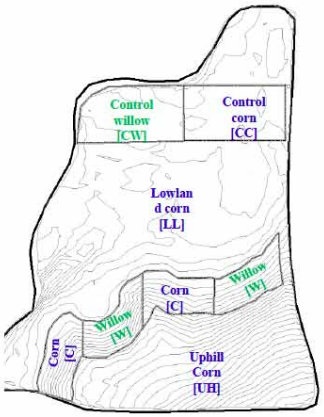
Key Accomplishments

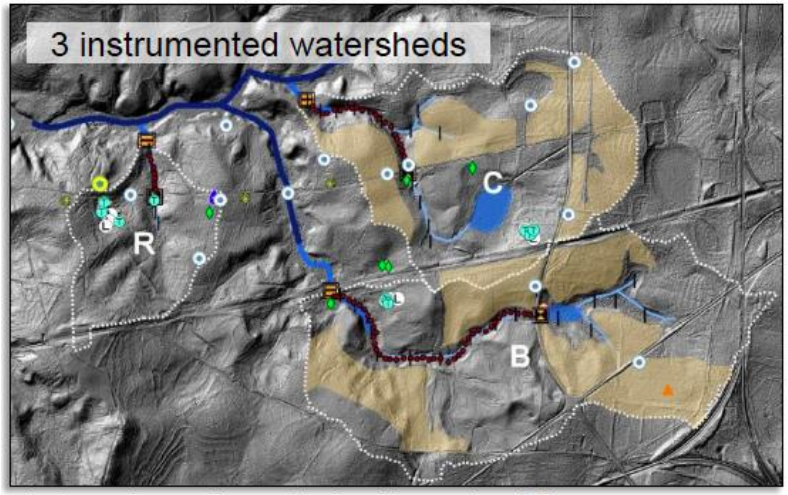
Continued field monitoring and testing of management practices

ANL: Nitrogen recovery by bioenergy crop buffer





ORNL-USFS: Intensive short-rotation pine management



Intensive pine silviculture for bioenergy on 40% of Watersheds B and C (130 ha total; yellow shading on map).

Workshops on Landscape Design

Incorporating Bioenergy into Sustainable Landscape Designs

Two workshops exploring the science and practice of bioenergy landscape design

Workshop 1- March 2014, New Bern, NC

- Focus on woody/forestry systems
- Organized by ORNL and NCASI

Workshop 2- June 2014, Argonne, IL

- Focus on Midwest/agricultural systems
- Organized by ANL

Workshop agendas, presentations, and other materials:

- https://bioenergykdf.net/content/incorporating-bioenergy-sustainable-landscape-designs-workshop
- http://web.ornl.gov/sci/ees/cbes/workshop.shtml

Jointly supported by Analysis & Sustainability and Feedstock Supply & Logistics

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Funding Opportunity Announcement

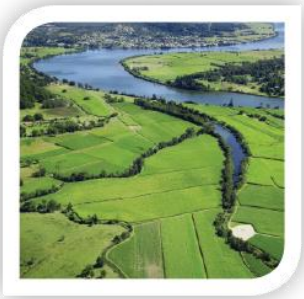
Landscape Design for Sustainable Bioenergy Systems — Announced on October 20, 2014

- DOE announced up to $14 million to support landscape design approaches that maintain or enhance the environmental and socio-economic sustainability of cellulosic bioenergy through the improvement of feedstock production, logistics systems, and technology development.

Jointly supported by
Analysis & Sustainability and
Feedstock Supply & Logistics

Future Directions

- Further understand and document evolving markets of biofuels and bioproducts
- Continue work to develop and maintain analytical tools, models, methods, and datasets to advance the understanding of bioenergy and its related impacts
- Further integrate sustainability into strategic planning, goal setting, and techno-economic/state-of-technology assessments
- Communicate successes and findings on bioenergy sustainability to the public, other agencies, stakeholders, and international community

Upcoming Activities

- June 23 & 24, Bioenergy 2015
  - Plenary and break-out session on Sustainability

- Landscape Design Funding Opportunity Selection Announcement

- 2016 Billion Ton Update: Sustainability analysis

Peer Reviewers

- John Sheehan (Lead Reviewer) - *Colorado State University*
- Stephen Costa – *U.S. Department of Transportation*
- Jody Endres – *University of Illinois at Urbana-Champaign*
- Michael Shell – *U.S. Environmental Protection Agency*
- Candace Wheeler – *General Motors*