NetRA Resources Assessment (NetRA)[1]

Dadhi Ram Adhikari – Economist[2]
Christopher Babis -Water Resources Policy
Richard L. Bernknopf- Economist
Craig D. Broadbent- Economist
David S. Brookshire- Economist
Emily Pindilli- Economist
Paul E. Pierce- Mining Engineer
Darius Semmens- Research Physical Scientist
David Soller- Geologist
Vince Tidwell- Hydrologist

[1]Funded by the USGS Science and Decisions Center cooperative agreements: A Collaborative Agreement between USGS & SILPE: A Focus on Ecosystems & Institutional Frameworks (G10AC00303) and A Focus on Natural Resource Economics & Value of Information (G13AC00076).

[2]Respectively Research Assistant, University of New Mexico; Research Assistant, University of New Mexico; Research Professor, University of New Mexico; Assistant Professor, Illinois Wesleyan University; Distinguished Professor (Emeritus) Director of SILPE, University of New Mexico; Economist, USGS Science and Decision Center; Mining Engineer, USGS Central Energy Resources Science Center; Research Physical Scientist, USGS, Geosciences and Environmental Change Science Center, Co-Director of the Science Impact Laboratory for Policy and Economics; Geologist, USGS; Distinguished Member of the Technical Staff, Sandia National Laboratories Earth Systems Analysis.

THE UNIVERSITY of NEW MEXICO

USGS science for a changing world

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Science Impact Laboratory for Policy and Economics

Setting: NetRA Context/Background

USGS Energy and Minerals Science Strategy (2013):

- Provide inventories and assessments of energy and mineral resources
- Understand the effects of energy and mineral development on natural resources and society

Secretarial Order 3330 (October 31, 2013):

- "The Order will ensure consistency and efficiency in the review and permitting of new energy and other infrastructure development projects
- …while also providing for the conservation, adaptation and restoration of our nation's valuable and natural and cultural resources."[1]

Net Resource Assessment:

- NetRA is an analytical component of a Multi-Resource Analysis
- Will be a Decision Support Tool (DST)

[1] "Secretary Jewell Offers Vision for Conservation, Balanced Development, Youth Engagement in National Press Club Speech." October 31, 2013

NetRA Purpose

Current societal decision making demands:

- **An expansion of natural resource assessments to include ecosystem services--- why?**

USGS Organic Act
USFS Organic Administration Act
Environmental laws passed in the last 45 years!

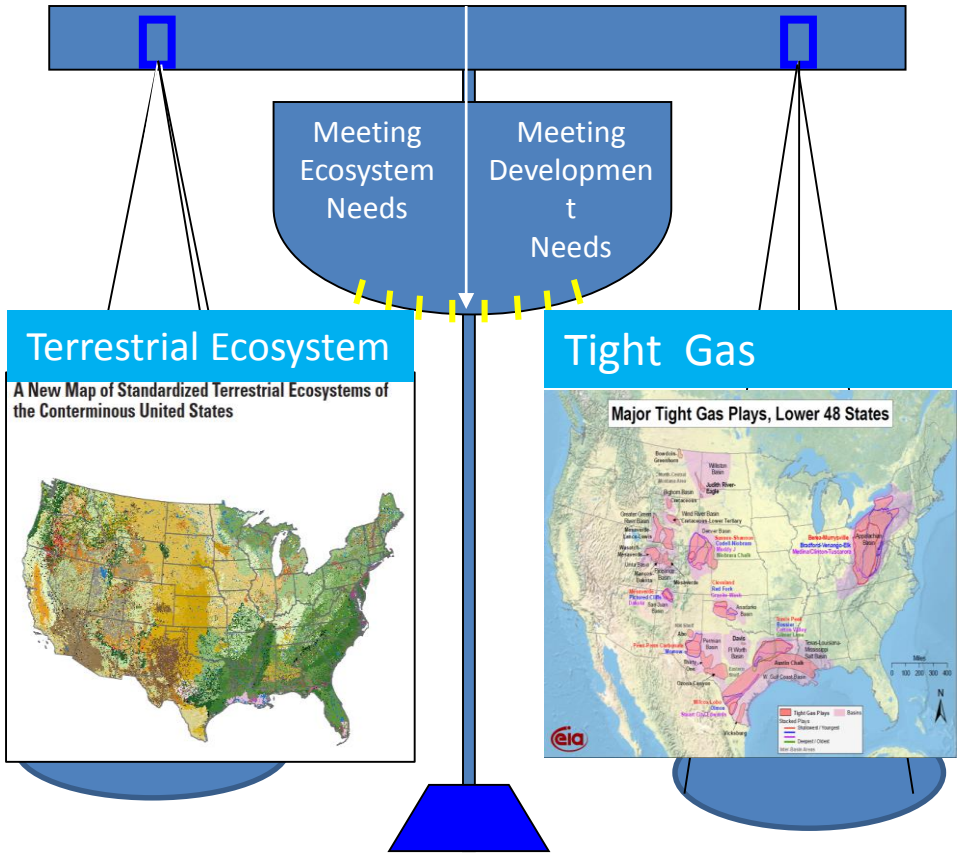
- **Suggest the Organic Act would have a broader focus**

<u>USGS Resource Assessments can be Broadened:</u>

- **By developing a Decision Support Tool (DST) oriented conceptual framework**
- **Which assesses the benefits, costs and societal tradeoffs associated with the collocation of natural resources and ecosystem services**

<u>DST Provides a Tool for Policy Analysis with Simulation Capabilities:</u>

- **The system dynamics model allows for the simulation of multiple resource development scenarios**
- **Provides a comparative analysis of the outcomes of different policies and practices**



Integrated Science, Economics & Policy is Required to find the Balance !!

NetRA Capabilities

The NetRA is initialized with USGS natural resource and ecosystem data

<u>NetRA Capabilities:</u>

- Integrates multiple collocated resources
  - To develop useable and useful development scenarios

- Contains both spatial and temporal components
  - To estimate the net societal benefits for a scenario of regional natural resource development

- Applies DST systems dynamics model
  - To evaluate specific resource development scenarios
    - …which results from landscape conversion

Site Selection Process

Site Selection Criteria:

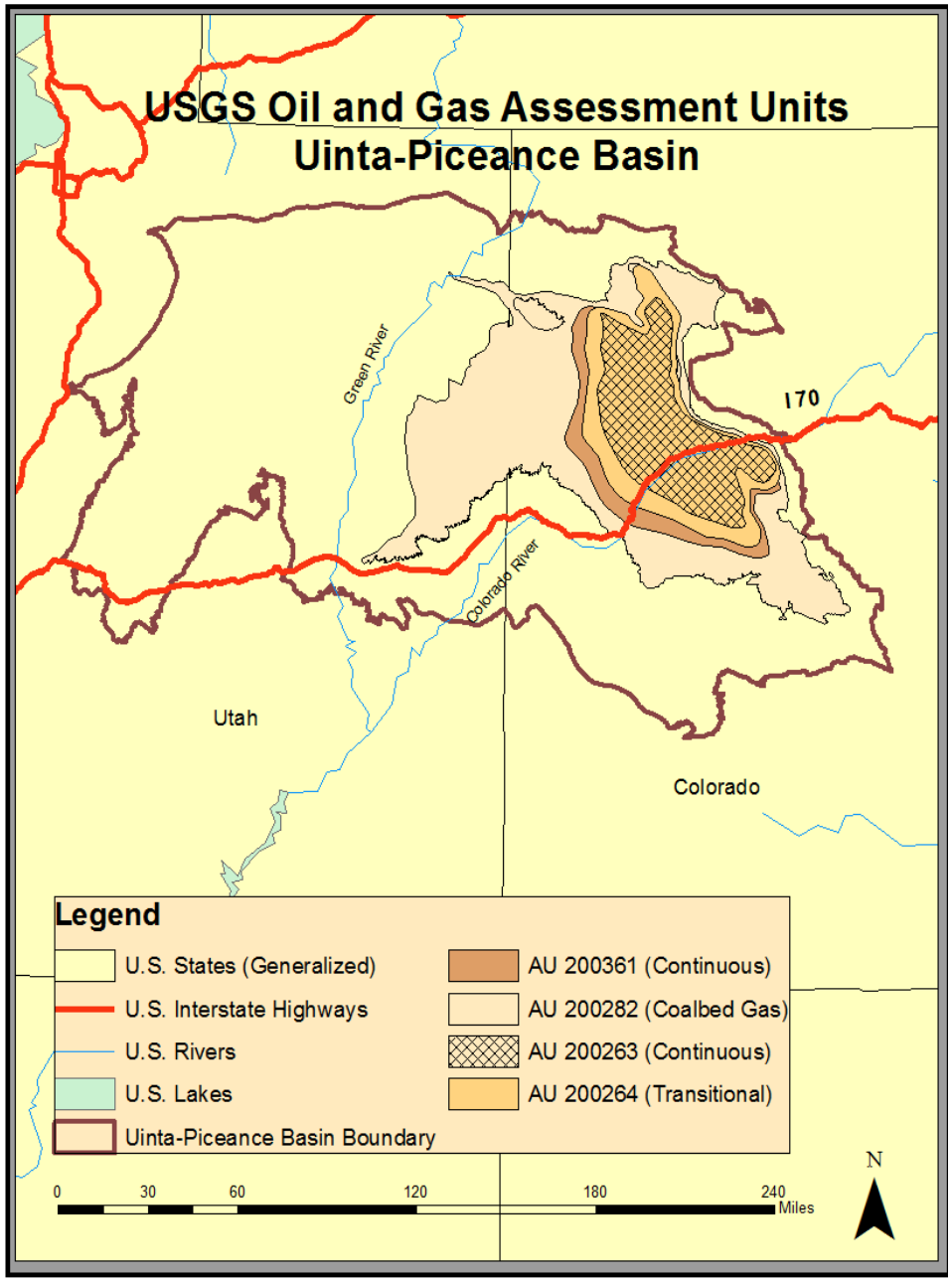
- Active or potential development
- Ecosystem services/trade-offs of interest
- Collocated
- Public land
- Available data
- Potential Decisions (BLM decision process)

Candidate Sites:

- Greater Green River Basin
- San Juan Basin
- Piceance Basin
- Bakken Shale Formation
- Uranium Time-Out Area

Site:

- Piceance Basin selected
- Site approved by USGS Director



Resource Assessment Units- RAU

- Reserves available under current economics conditions, for production of energy and mineral
- Areal unit for estimation of natural resources

Study Site RAU

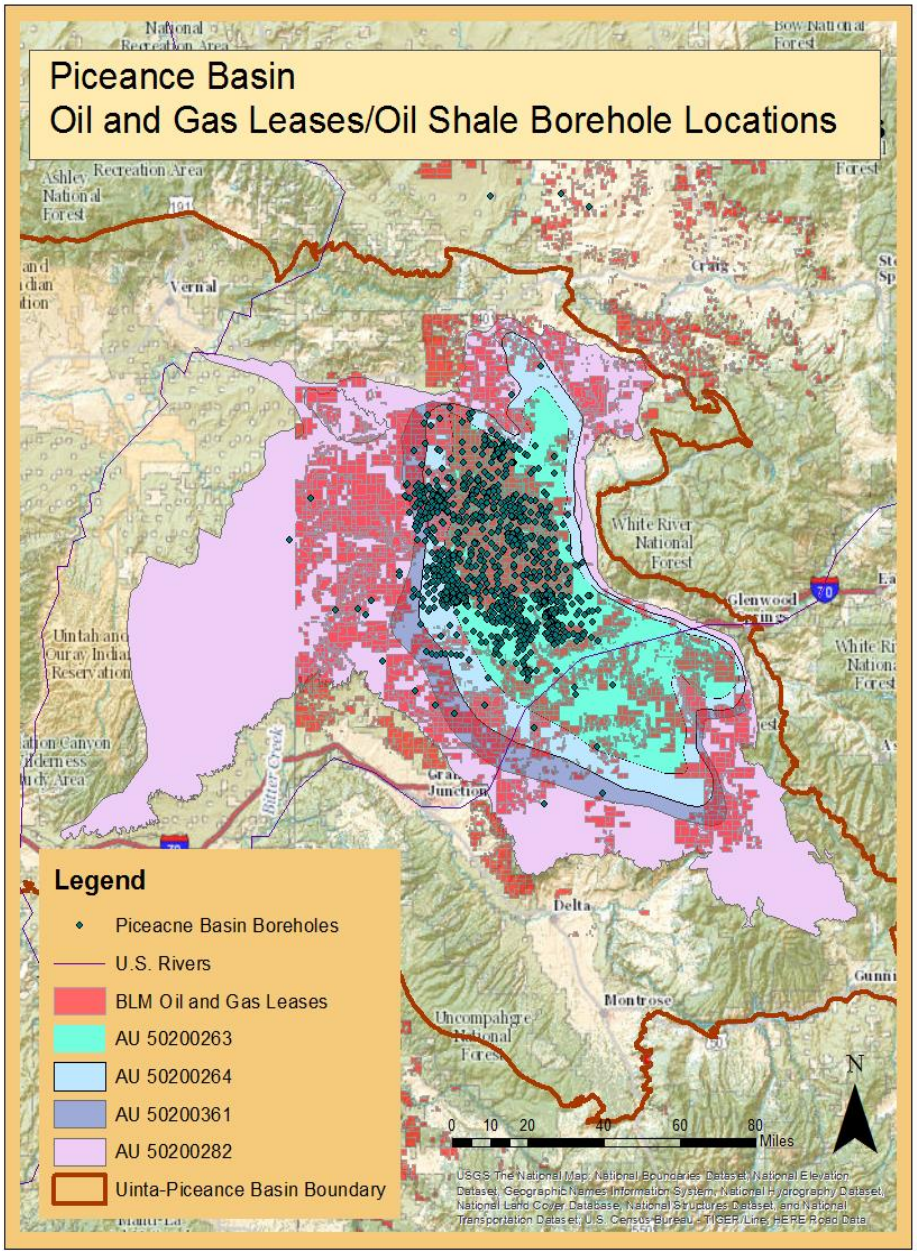
- Tight Gas (Sand)

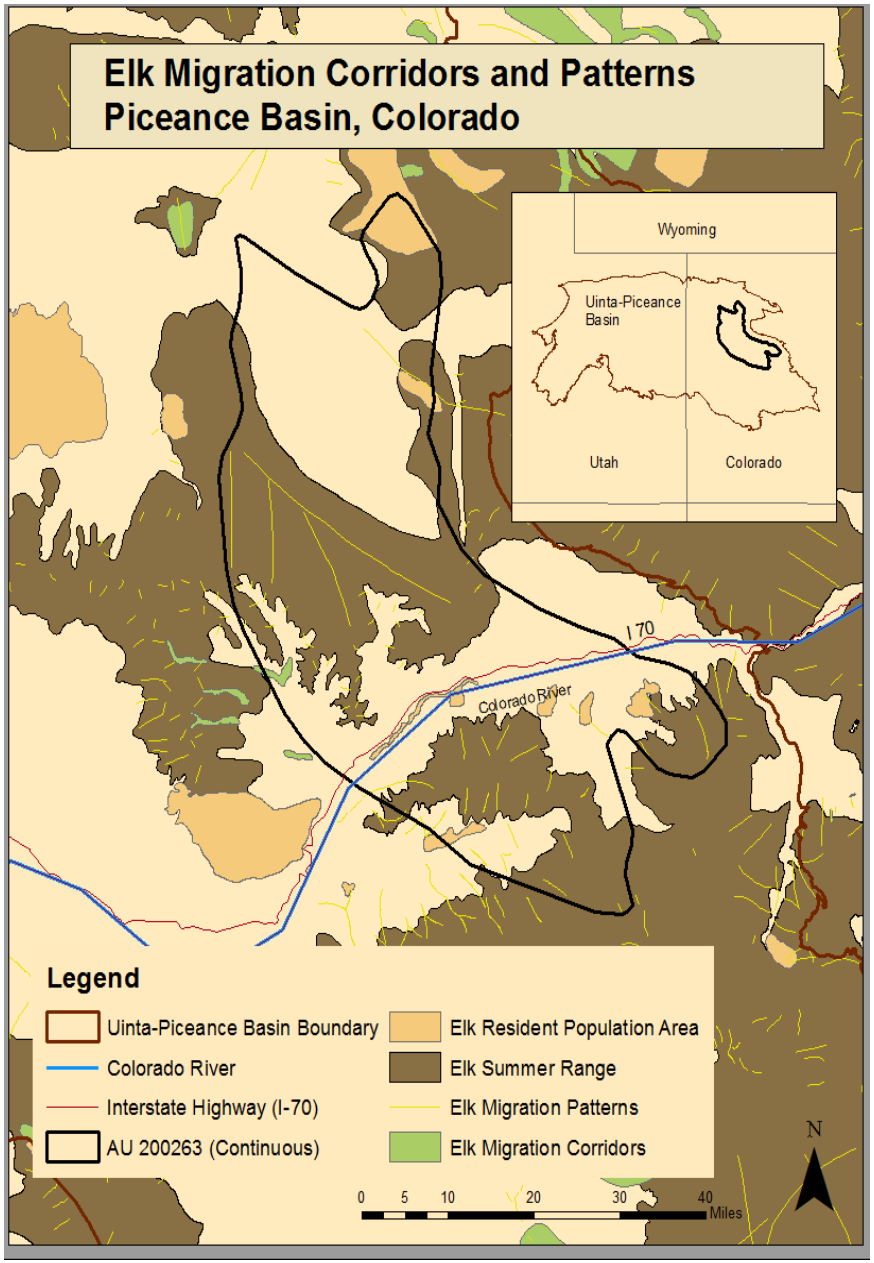
Ecological Assessment Unit –EAU

- Geographic boundaries, surface and subsurface components
- Clearly identifiable/measurable ecosystem services

Possible Study Site EAUs

- Habitat Fragmentation
- Water Quality
- Large Fauna (Elk)


Piceance Basin
Oil and Gas Leases/Oil Shale Borehole Locations
Legend
Piceacne Basin Boreholes
U.S. Rivers
BLM Oil and Gas Leases
AU 50200263
AU 50200264
AU 50200361
AU 50200282
Uinta-Piceance Basin Boundary
Vernal
Craig
White River National Forest
Glenwood Springs
Grand Junction
Delta
Montrose
Uncompahgre National Forest
Bitter Creek
0 10 20 40 60 80
Miles
N

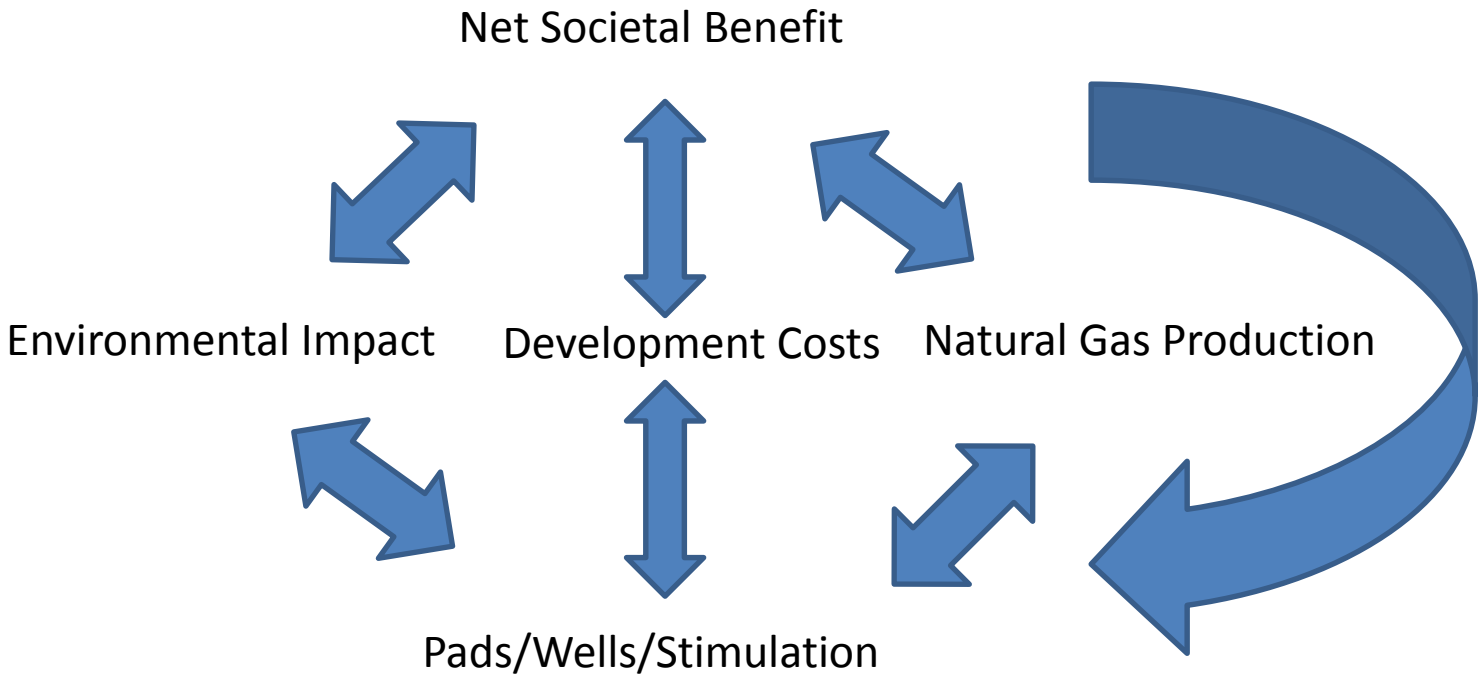

Elk Migration Corridors and Patterns
Piceance Basin, Colorado
Wyoming
Uinta-Piceance Basin
Utah
Colorado
I 70
Colorado River
Legend
Uinta-Piceance Basin Boundary
Colorado River
Interstate Highway (I-70)
AU 200263 (Continuous)
Elk Resident Population Area
Elk Summer Range
Elk Migration Patterns
Elk Migration Corridors
0 5 10 20 30 40
Miles
N

Overview of Decision Support Tool

- **What will our Decision Support Tool (DST) (i.e. our conceptual framework) do?**
  - Incorporate biology, ecology, geology, hydrology, economics, and engineering
  - Integrates natural resource / economics value concepts, methods, and data
  - Couples models and scientific data with market and nonmarket prices

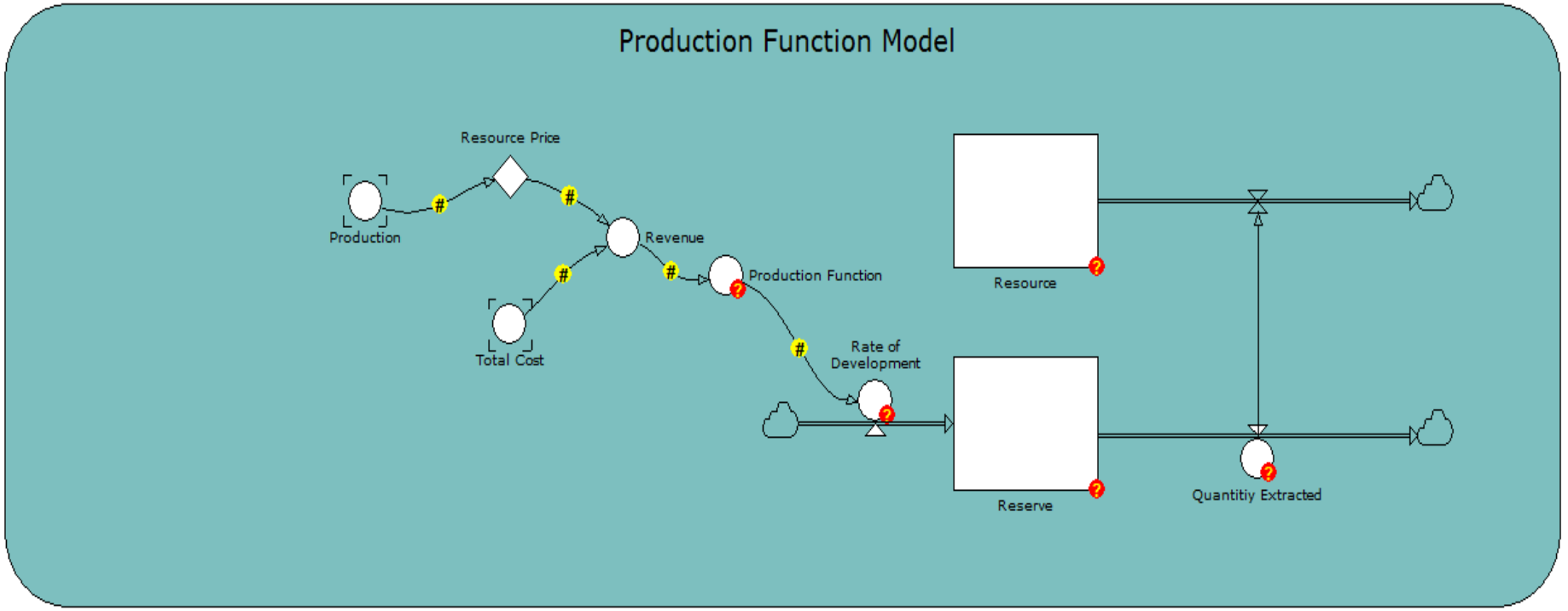
- **A Decision Support Tool:**
  - Estimates the net societal benefits of all natural resources developed and preserved
  - Apply at multiple scales (large and within a region)
    - Temporal
    - Can operate in multiple regulatory constraint frameworks

DST: Informed Resource Development



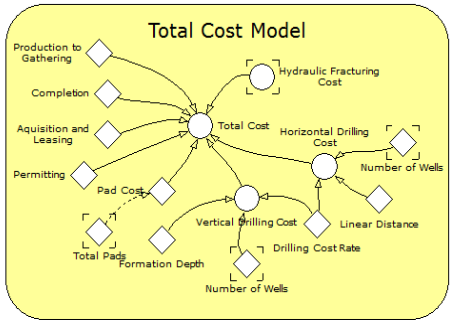
The Decision Support Tool:

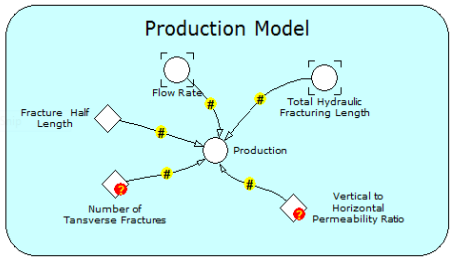
- Systems are modeled as a network of stocks and flows
- Feedbacks are key between the various stocks and flows comprising the system
- Temporally dynamic (e.g. annual time step) and spatially aggregated (e.g. regional scale)

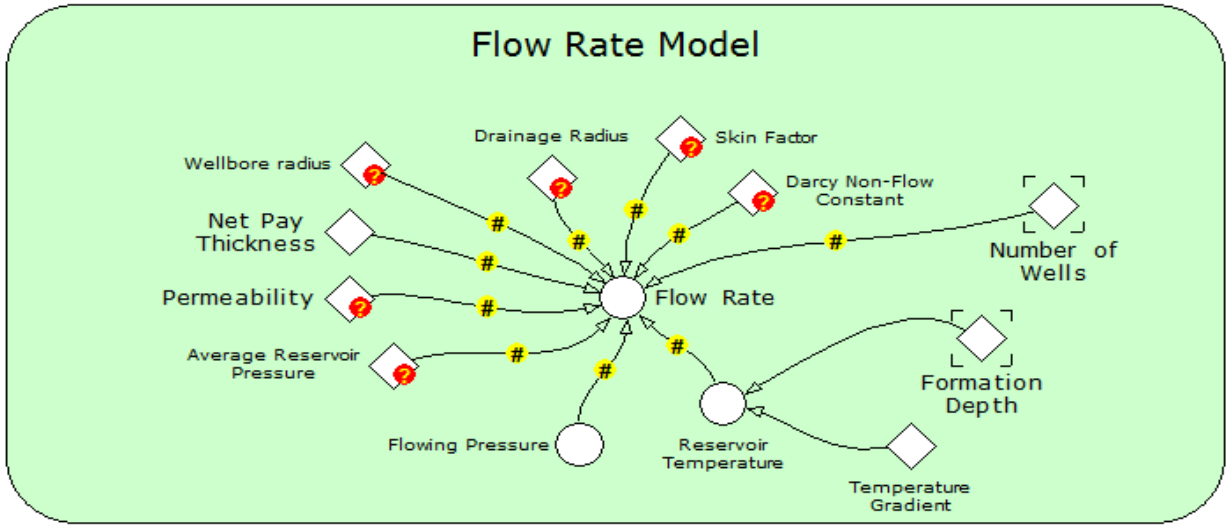


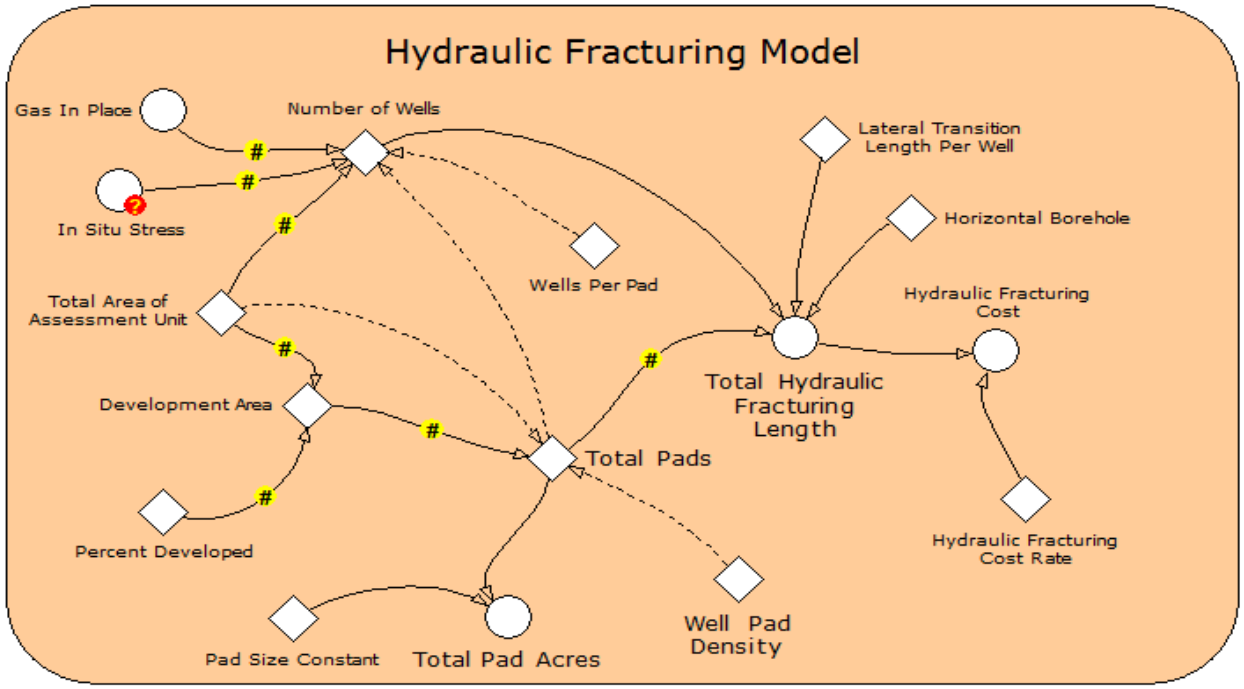
Yellow– Data source is yet to be determined
Orange—No function assigned as of yet

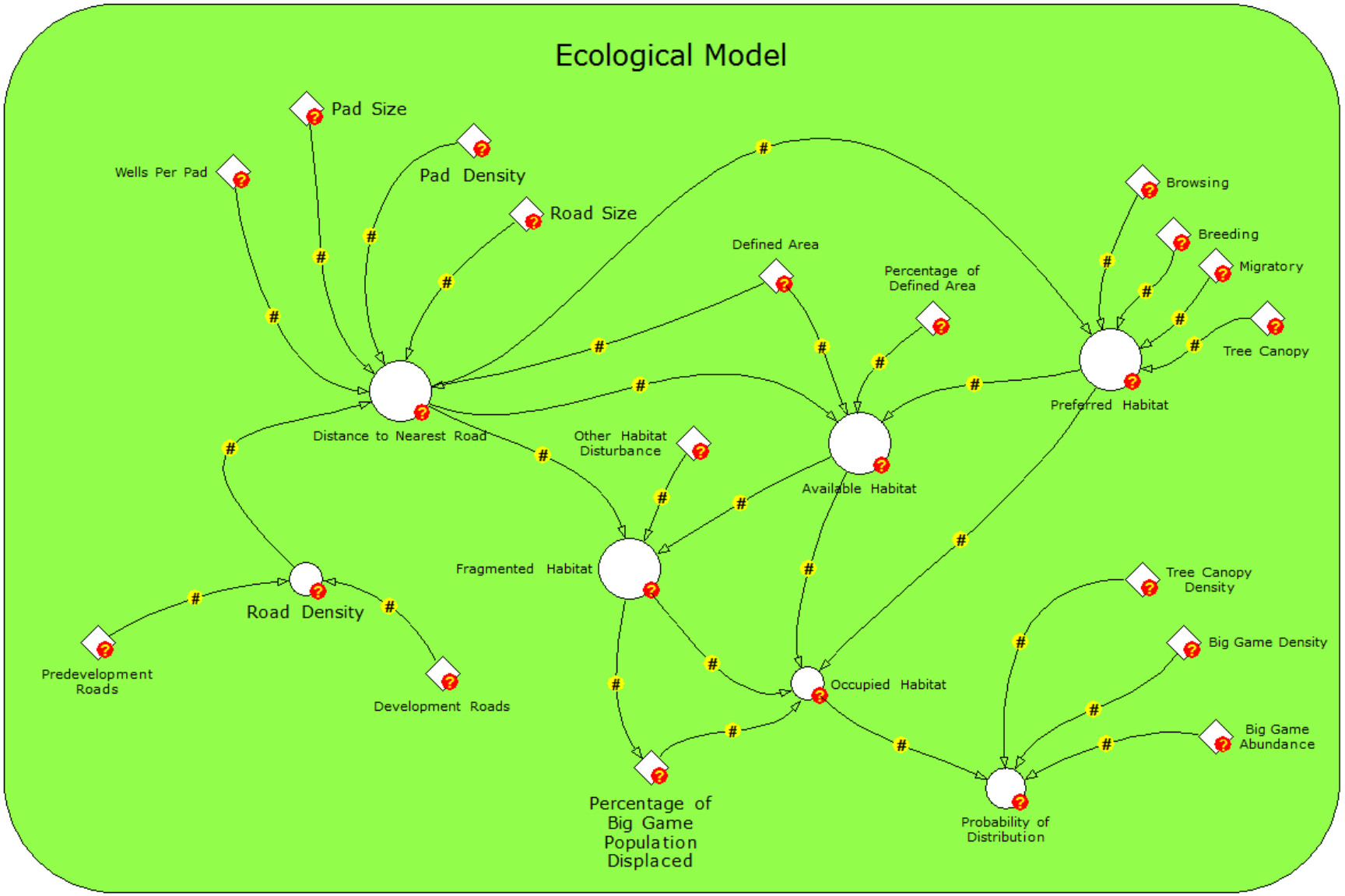
Hydraulic Fracturing Sub-models



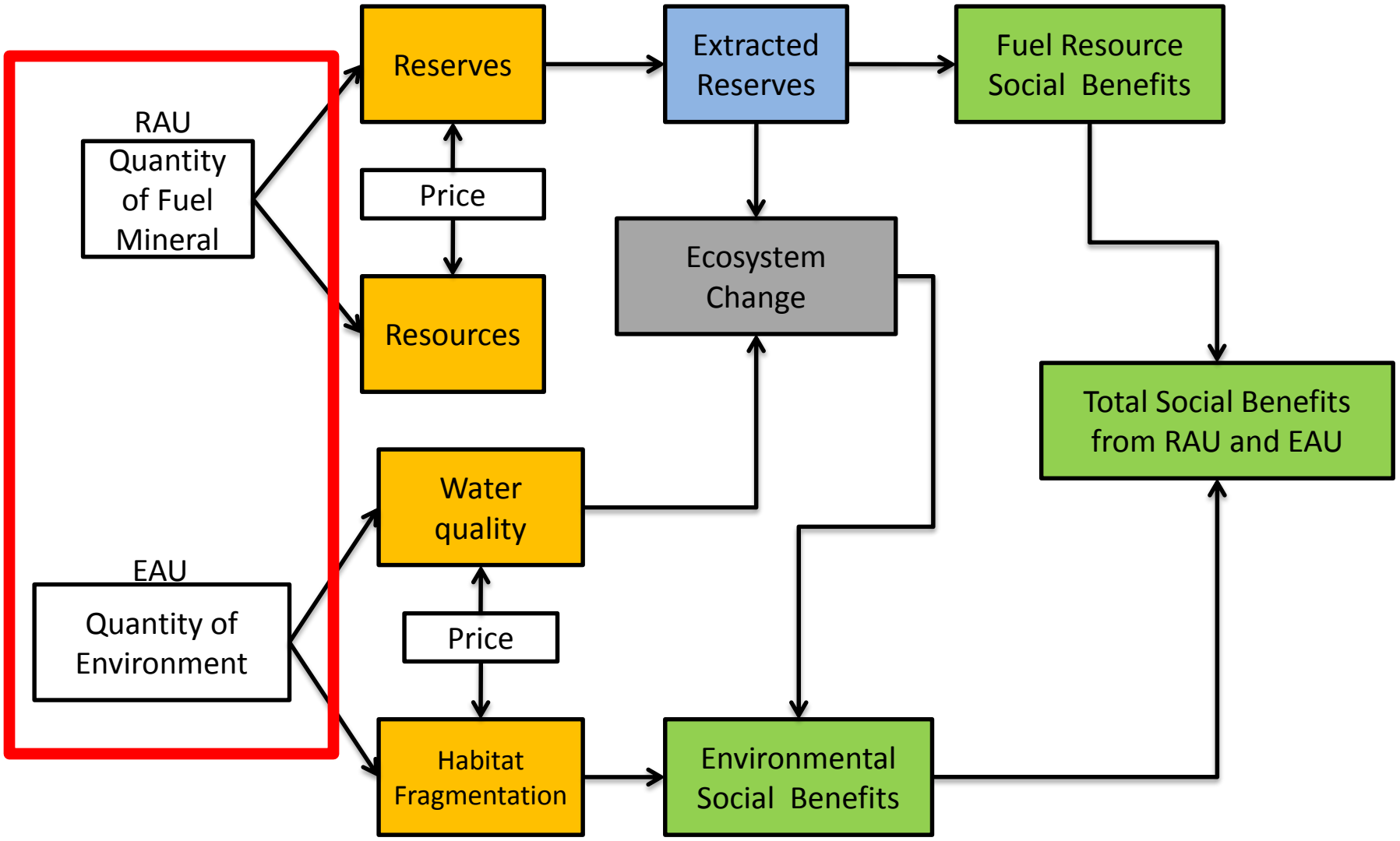







Ecological Model
Pad Size
Wells Per Pad
Pad Density
Road Size
Defined Area
Percentage of Defined Area
Browsing
Breeding
Migratory
Tree Canopy
Distance to Nearest Road
Preferred Habitat
Other Habitat Disturbance
Available Habitat
Fragmented Habitat
Road Density
Predevelopment Roads
Development Roads
Tree Canopy Density
Big Game Density
Occupied Habitat
Big Game Abundance
Percentage of Big Game Population Displaced
Probability of Distribution

NetRA Flow Diagram

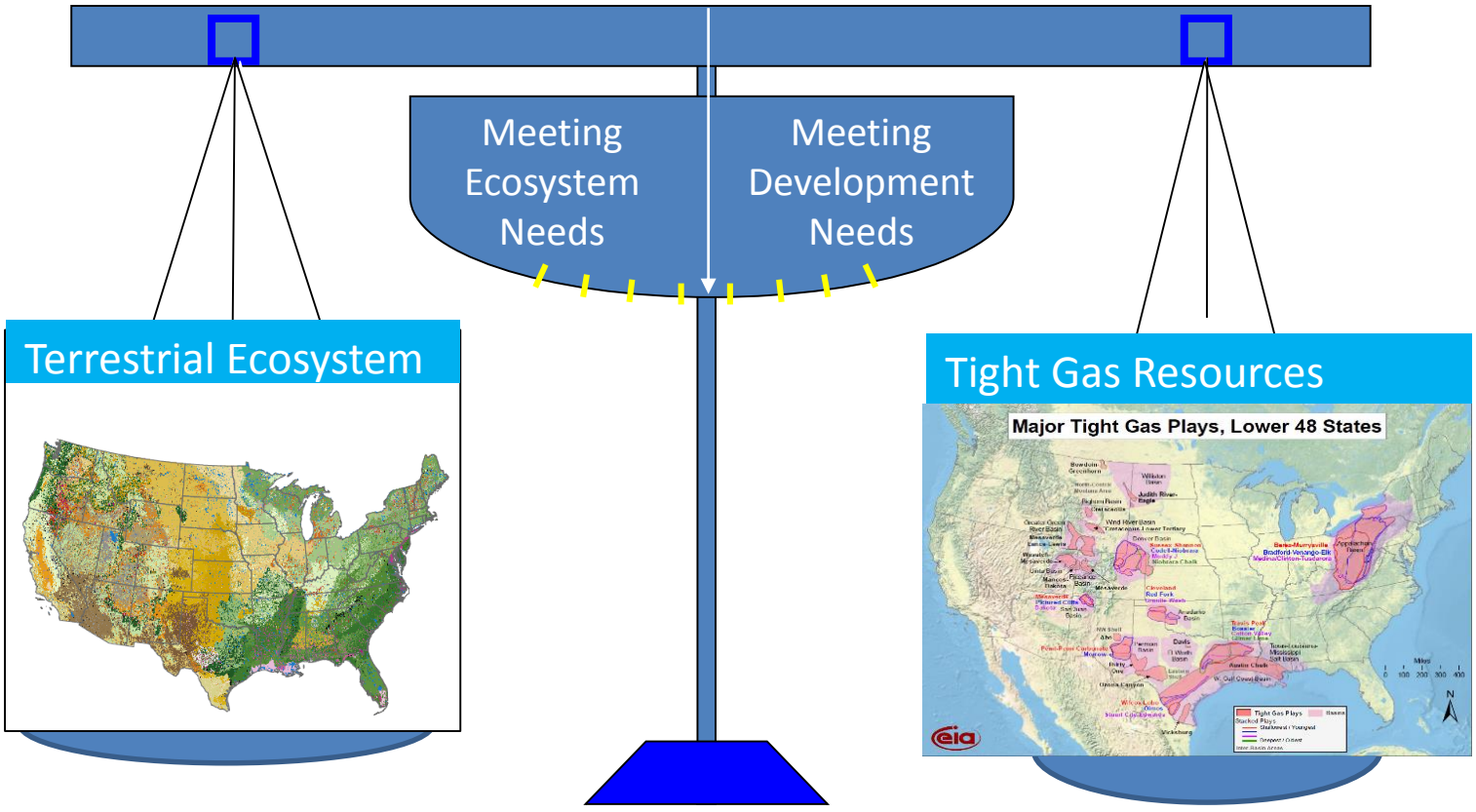


Status and Next Step

- **Proof of concept:**
  - Realization of a certain method or idea to demonstrate its feasibility… who's purpose is to verify that some concept… has the potential of being used
- **Inputs**: Data resolution, map scales, and model compatibility will be evaluated
  - Data and model gaps will be identified
    - Earth science for natural resource stocks, engineering economics, biophysical and ecological data for ecosystem services stocks, market prices, regulations, and nonmarket values
- **Output:** A limited modeling framework that demonstrates the functionality of the DST
- **Example:** *Stepping backwards to make a leap forward*

Model of oil and gas drill pads and resource roads overlying National Aerial Imagery Program (NAIP) imagery, near Rifle, Colorado, 2007 (USGS sir20105064 2010)

Thank You



NetRA: Integrated Science, Economics & Policy to find a Balance