



Land Resources

Dr. Ann Bartuska

USDA Research, Education and Economics

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Major Challenges

- **9 billion people by 2050**
- **25% of all land “highly degraded”**
- **60-75% of disease outbreaks from animals to humans**
- **By 2025, 1.8 billion potentially living with absolute water scarcity**
- **Uncertainty brought by climate change**

21st Century challenges

- What are land managers facing today?
 - Climate change
 - Large-scale disturbances – drought, fire, insects and disease
 - Loss of open-space
 - Challenging economics
 - An engaged – *and disengaged*- public



Changing face of forestry and natural resources

20th Century

- Sustainability for future generations
 - Wood
 - Water
- Managing with a growing nation and sense of unlimited resources

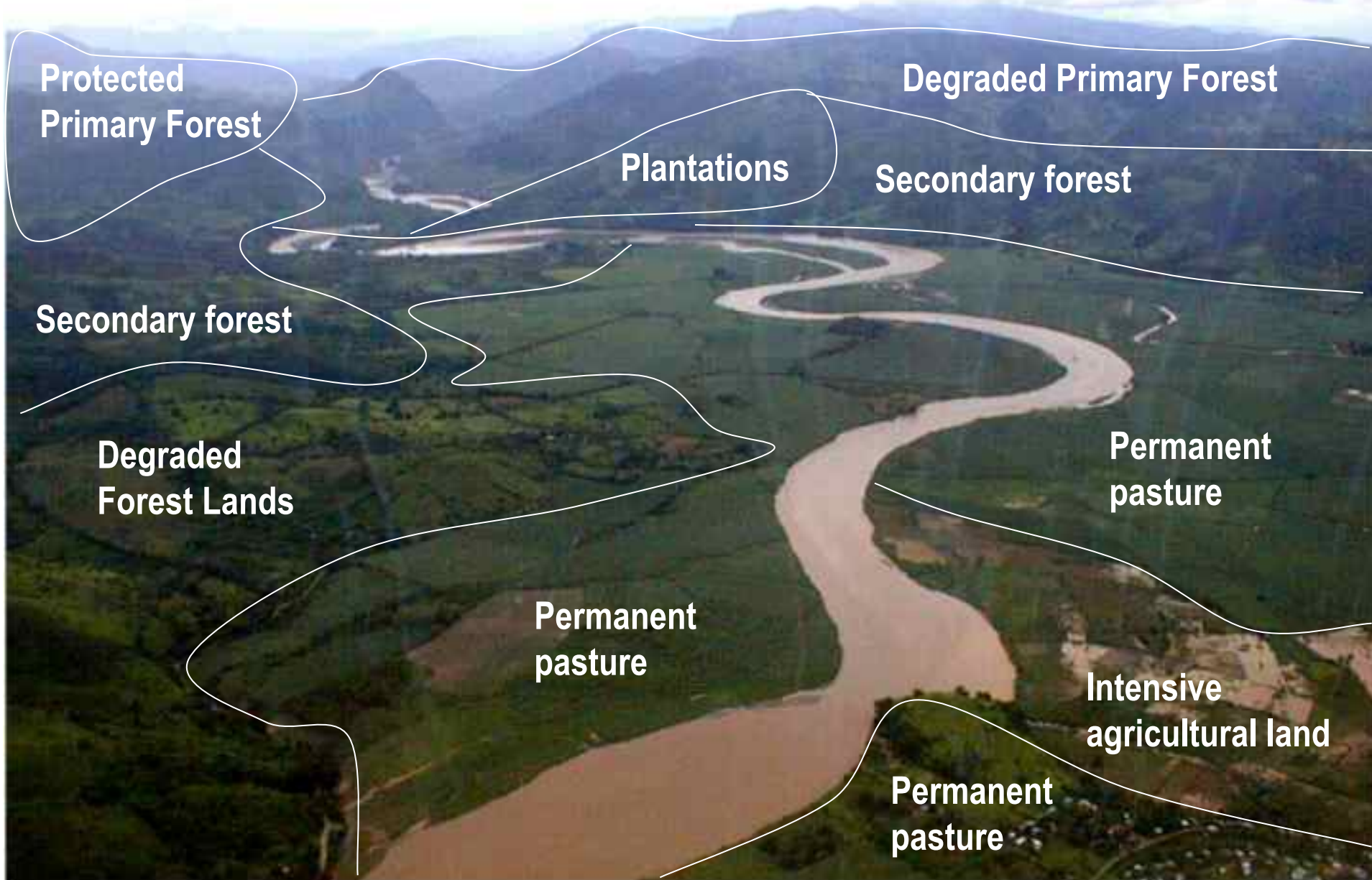


21st Century

- Sustainability for future generations
 - Access to open space and nature
 - Water
- Managing in face of large-scale disturbance and uncertainty
- Connecting rural to urban systems

Making the Connections

- Connecting the land – *landscape-scale conservation*
- Connecting the science – *new approaches, new technology*
- Connecting with the people – *in science and in practice*



**Protected
Primary Forest**

Degraded Primary Forest

Plantations

Secondary forest

Secondary forest

**Degraded
Forest Lands**

**Permanent
pasture**

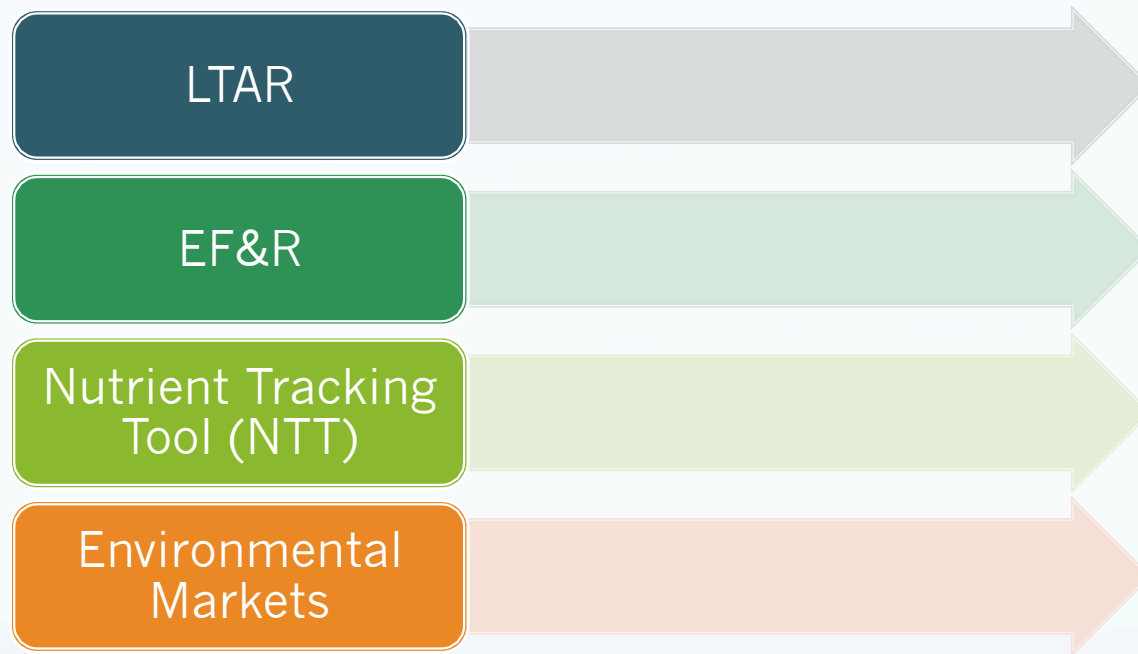
**Permanent
pasture**

**Intensive
agricultural land**

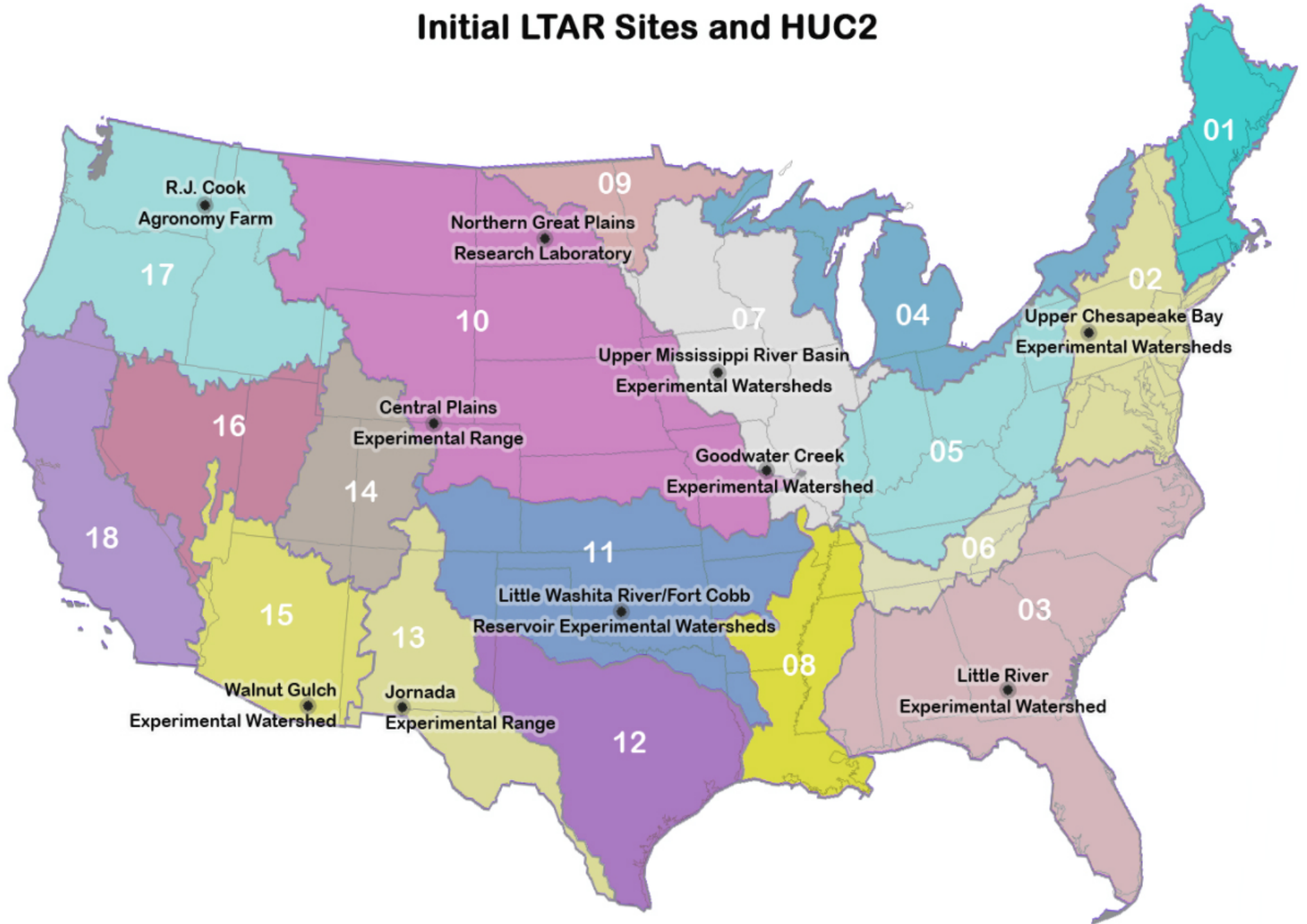
**Permanent
pasture**



Mechanisms of Innovation



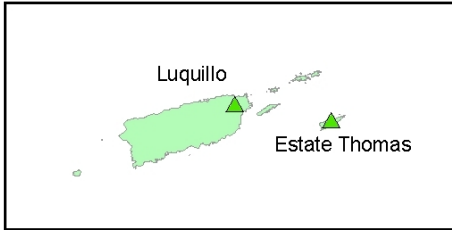
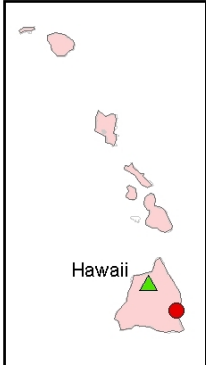
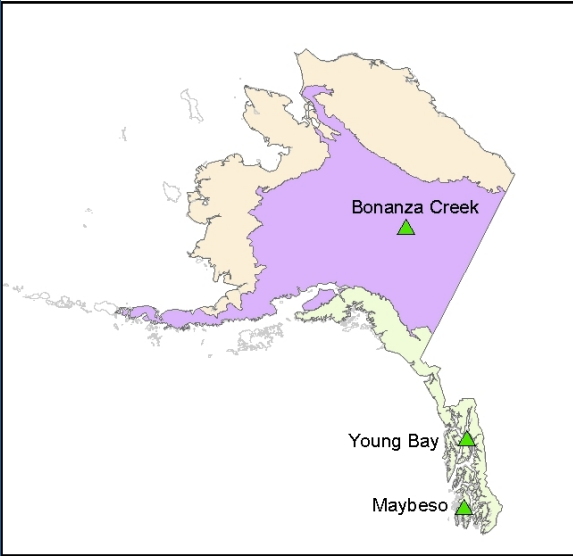
Initial LTAR Sites and HUC2



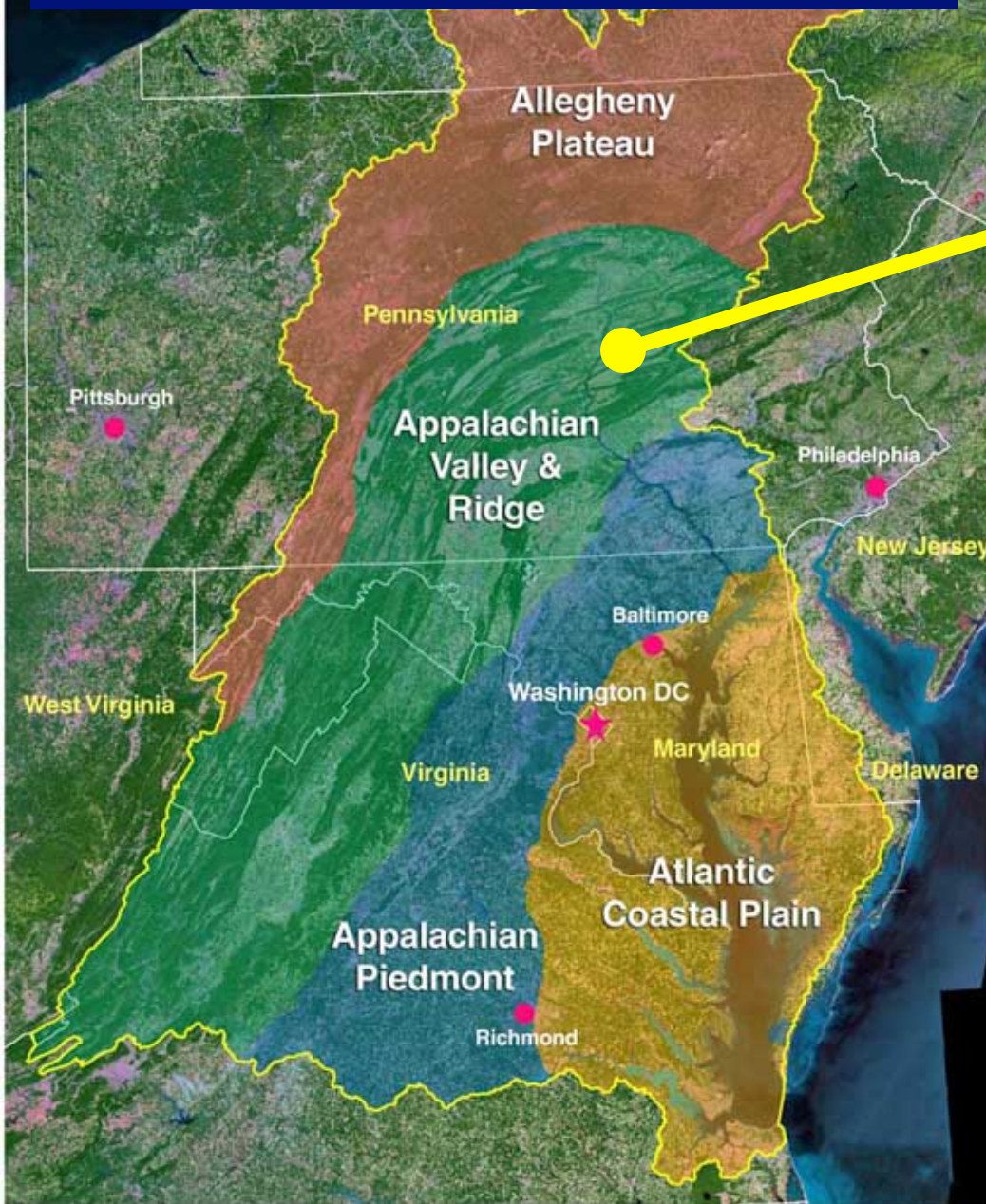
USDA Forest Service Experimental Forests and Ranges, other relevant USDA (ARS) Experimental Areas and Watersheds, and NEON Domains.



- Legend**
- ARS Research
 - ARS Watersheds
 - ▲ USFS Exp. Forest/Range
- NEON Domain**
- Appalachians / Cumberland Plateau
 - Atlantic Neotropical
 - Central Plains
 - Desert Southwest
 - Great Basin
 - Great Lakes
 - Mid Atlantic
 - Northeast
 - Northern Plains
 - Northern Rockies
 - Ozarks Complex
 - Pacific Neotropical
 - Pacific Northwest
 - Pacific Southwest
 - Prairie Peninsula
 - Southeast
 - Southern Plains
 - Southern Rockies / Colorado Plateau
 - Taiga
 - Tundra



University Park, PA Chesapeake Bay Watershed



Mahantango Creek Watershed



WE-38 (7.2 km² subcatchment)

40 yr record in STEWARDS
Published in Water Resources Research



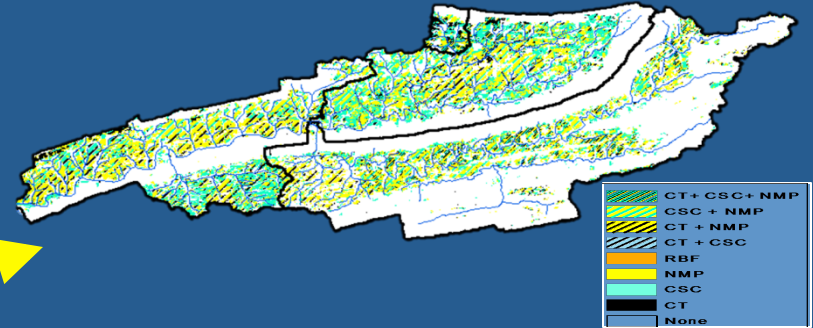
Runoff studies
underpin P Index
and other models



Tools for fertilizer and
manure management

University Park, PA Chesapeake Bay Watershed

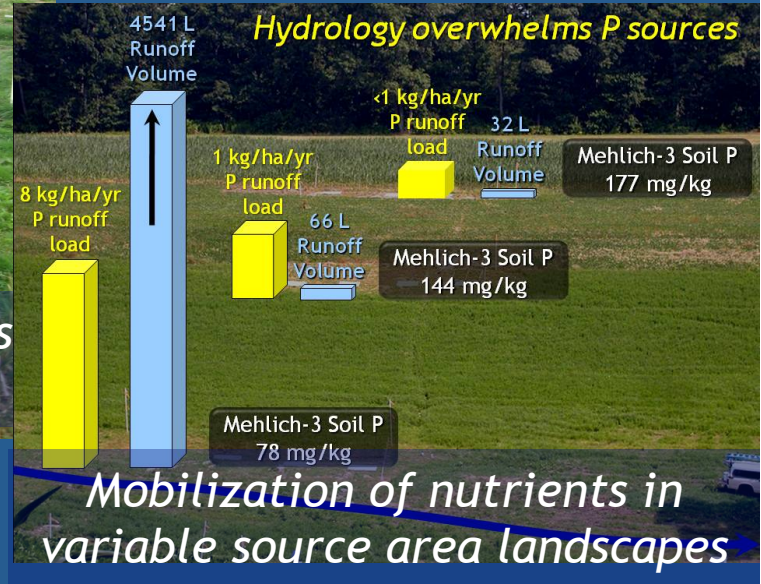
Optimized BMP placement for cost efficient watershed strategies



Research to improve identification and management of critical sources and flow pathways



Watershed and greenhouse gas implications of seeps





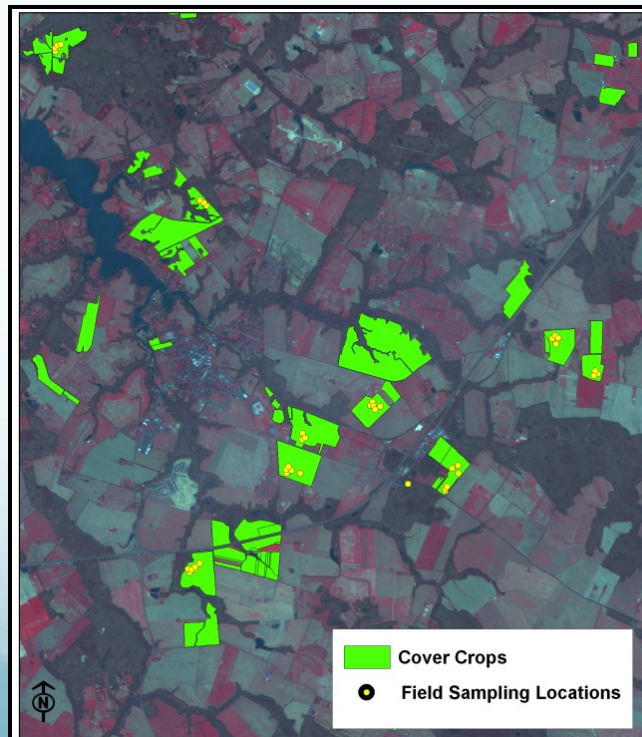
Nutrient Tracking Tool (NTT)



Features...

- User-Friendly
- Web-based
- Scientifically Credible
- Facilitates Environmental Trading

- farm-scale simulator*
- Supported by existing models*



Calculates 'delta' for...

- Nitrogen
- Phosphorus
- Sediment
- Carbon
- N_2O

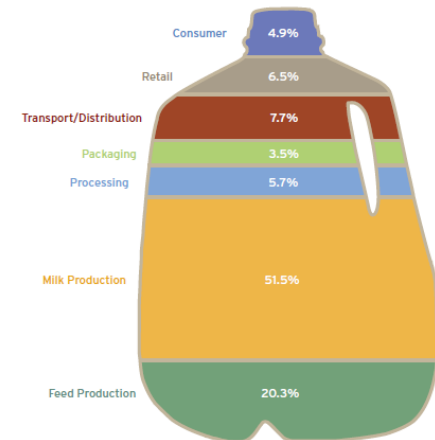
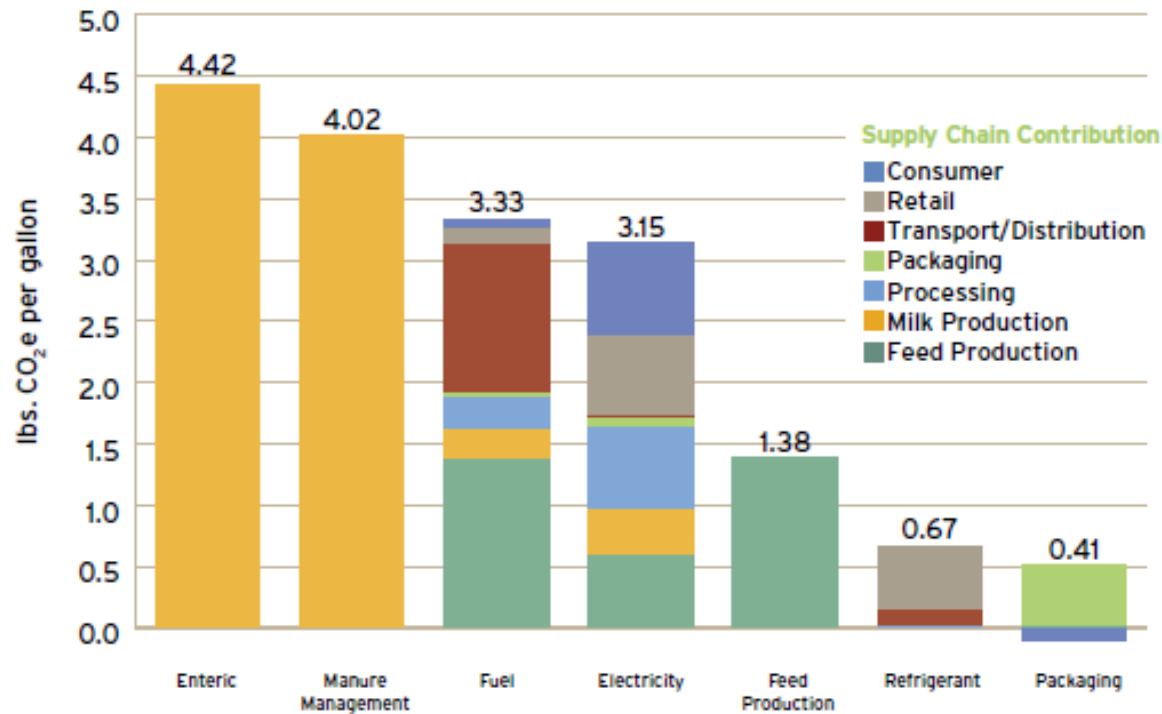


What makes an Environmental Market Successful?

- Low transaction costs
- Clear rules/protocols for market transactions and trades
- Credible measurements and reporting
- Certainty/low risk
- Adequate number of buyers and sellers
- Buyers

United States Department of Agriculture
National Agricultural Library
LCA Digital Commons
Data and Community for Life Cycle Assessment

[Home](#) [About the Project](#) [Contact Us](#) [LCI Database](#)



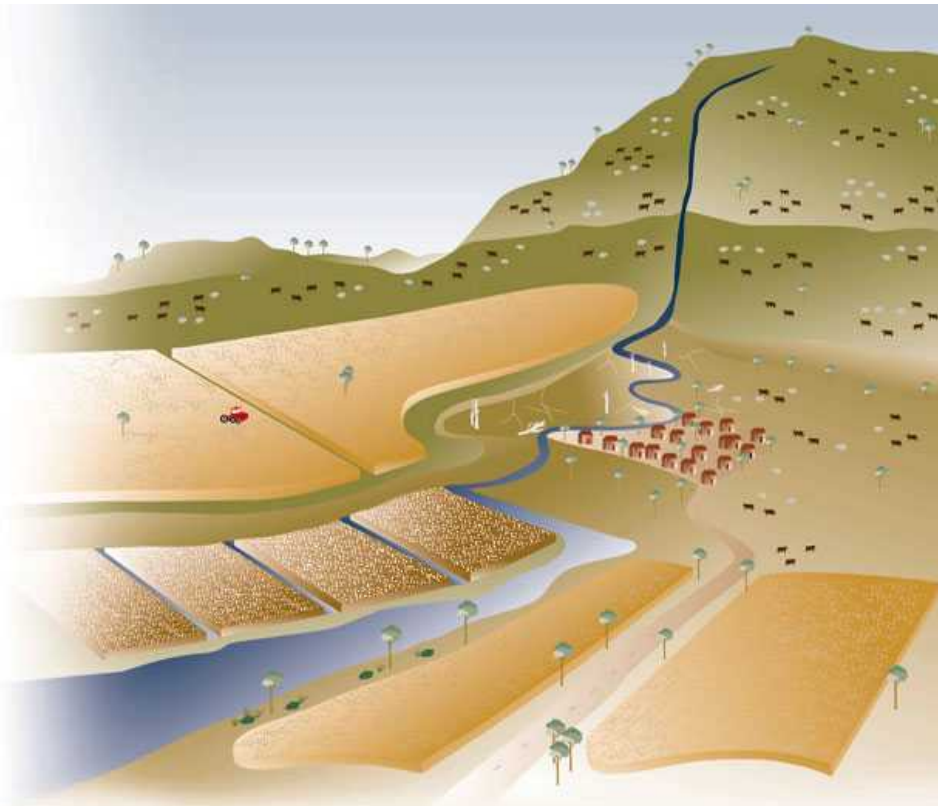


The challenge: meeting the food, water, and energy needs of the future

Agroforestry – a practical approach



Pine and switchgrass interplant - *Catchlight*



P R E S E N T

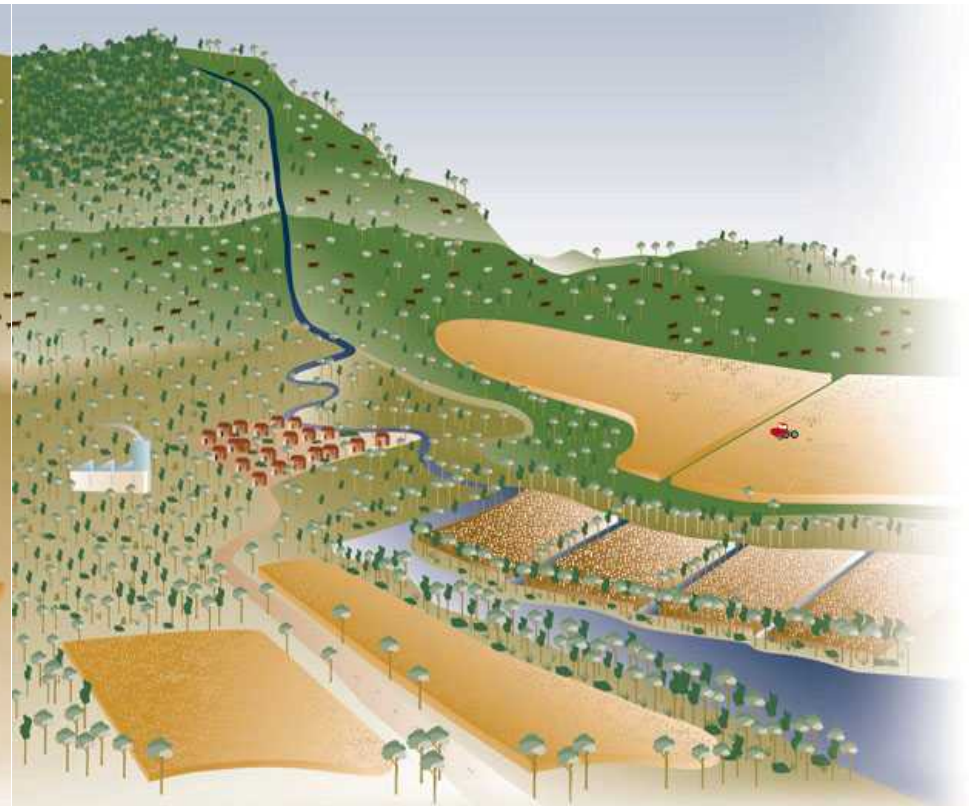
The existing rural landscape.

LAND USE

OUTPUT	AREA (ha)	REVENUE (000's)
Sheep	250,000	25,000
Cattle	250,000	118,000
Wheat	150,000	112,000
Canola	150,000	490,000
Cotton	150,000	490,000
TOTAL	1,000,000	785,000

ENVIRONMENTAL PROBLEMS

- ◆ Dryland salinity increasing
- ◆ Rising water tables and saline discharge
- ◆ Nutrients leaching into waterways
- ◆ Low biodiversity
- ◆ Soil erosion and turbid waterways



F U T U R E

Planted forests in the landscape create a more diverse economy and a healthier environment.

LAND USE

OUTPUT	AREA (ha)	REVENUE (000's)
Sheep	150,000	18,000
Cattle	120,000	28,000
Wheat	200,000	94,000
Canola	120,000	90,000
Cotton	150,000	490,000
Timber	26,000	12,000
Bioenergy	117,000	9,000
Charcoal	117,000	14,000
Carbon credits		41,000
Salinity credits		26,000
TOTAL	1,000,000	822,000

ENVIRONMENTAL BENEFITS

- ◆ Dryland salinity reduced
- ◆ Lower water tables and clean discharge
- ◆ Nutrients retained on farm
- ◆ Biodiversity increased
- ◆ Soil erosion reduced


NewForests

Six Strategic Platforms

Open Access to
Scholarly
Publications

Open Access to
Germplasm
Collections

Open Access to
Genetic and
Genomic Data

Accelerated
Technology
Transfer

Improved
Statistics

Assembling
Chief Scientists
of R&D