

Integrating policy, market, and technology in sustainability governance of agriculture-based biofuel and bioeconomic development in the US

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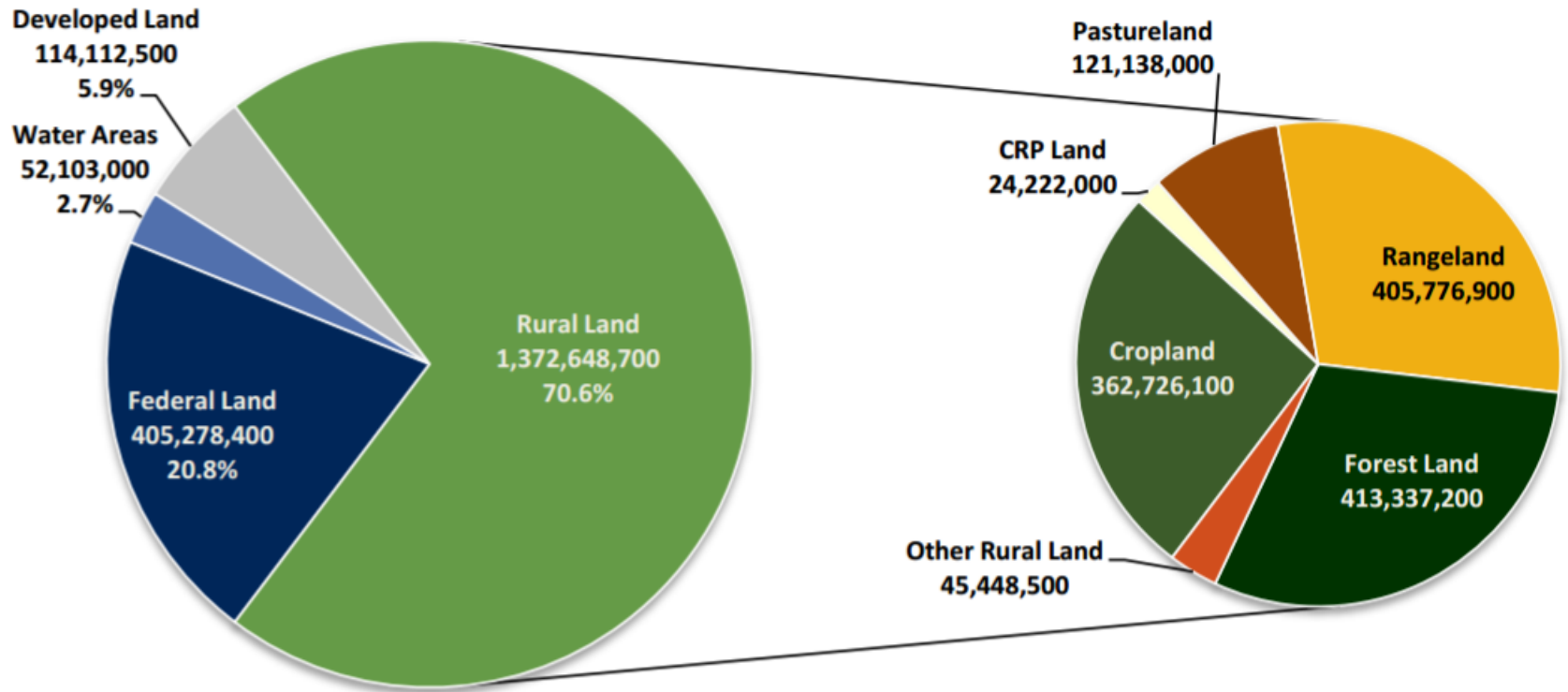
Göthenburg, Sweden

May 18, 2017

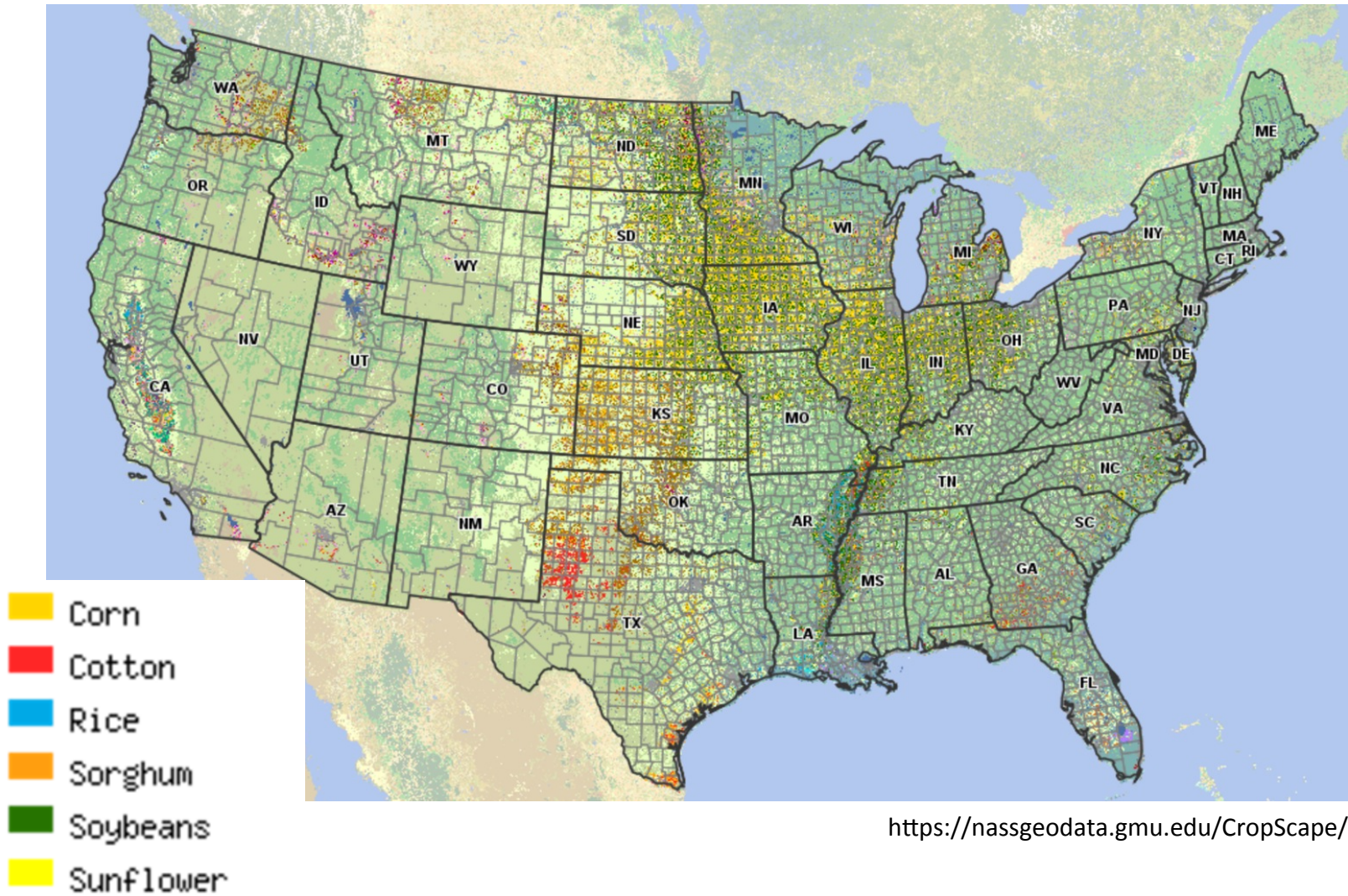
Outline

- Background
 - US agricultural land use
 - Field crops and energy feedstock production
- Evolution of US bioenergy policy
- Output of US agriculture-based biofuels
- Sustainability concerns about scaling-up of agriculture-based biofuel production
- Sustainability governance
 - Interactions among policy, market and technology
 - Sustainability governance mechanism

US agricultural land use



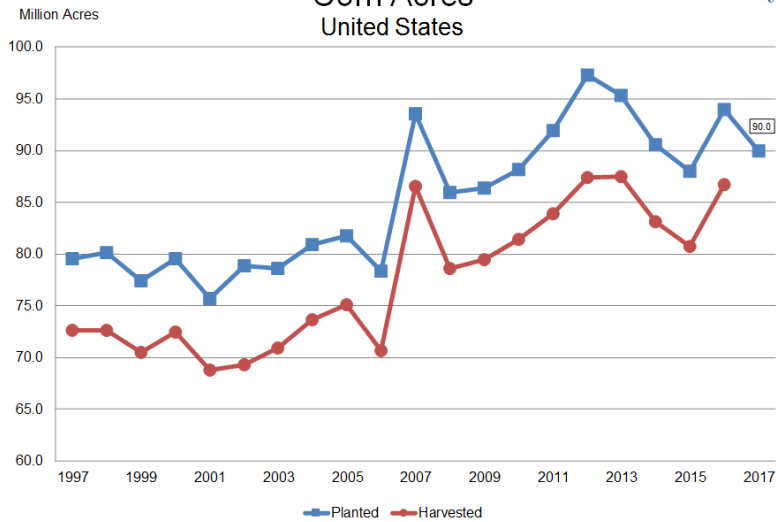
US cropscape (2016)



US corn production



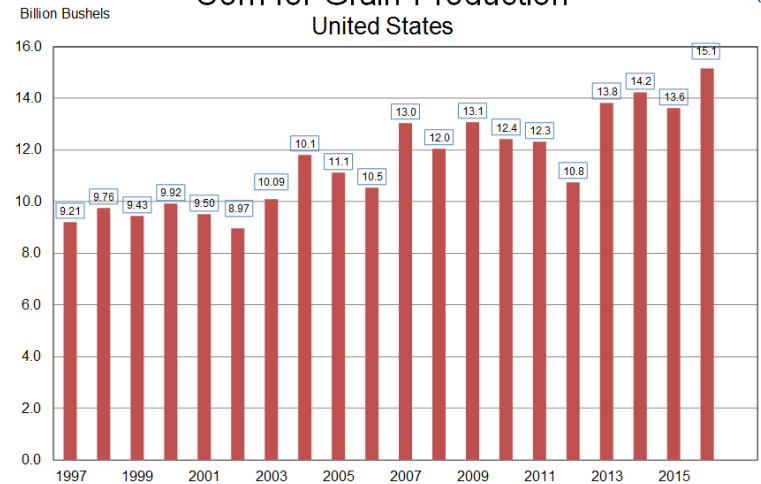
Corn Acres
United States



USDA-NASS
3-31-17



Corn for Grain Production
United States

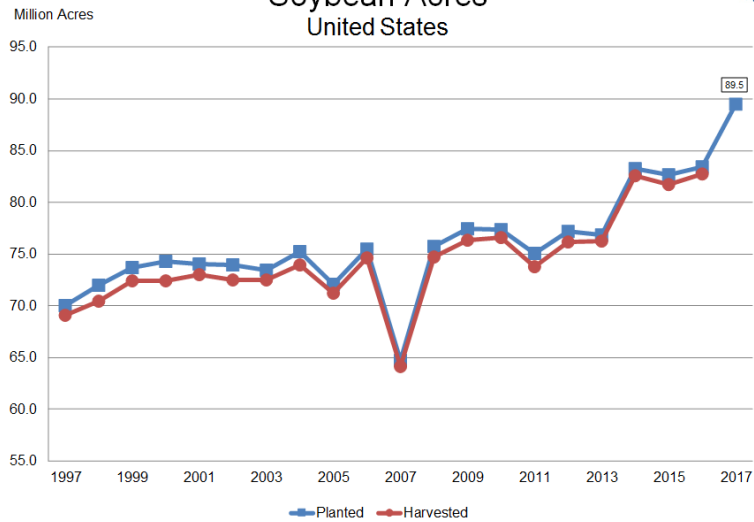


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US soybean production



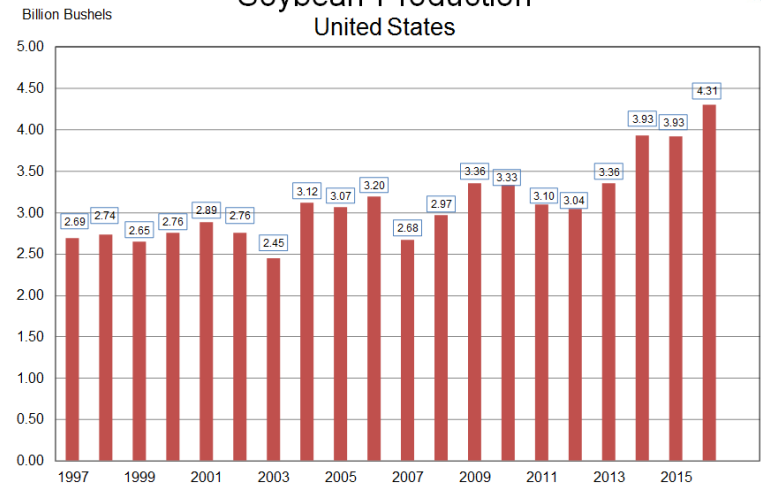
Soybean Acres
United States



USDA-NASS
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Soybean Production
United States

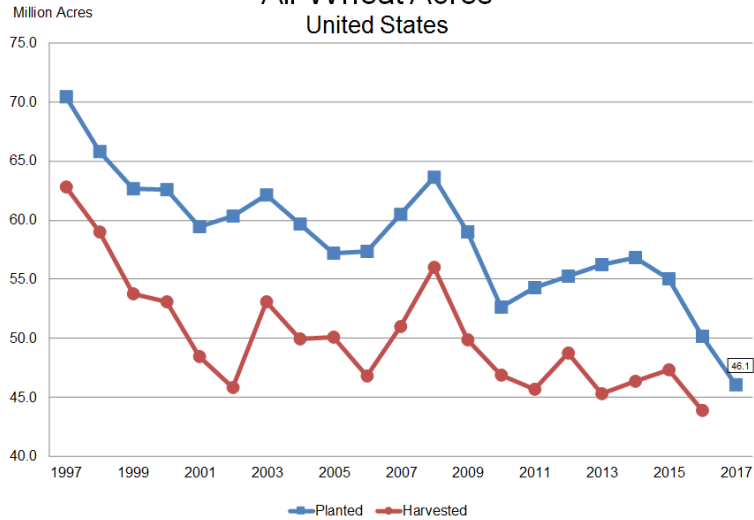


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US wheat production



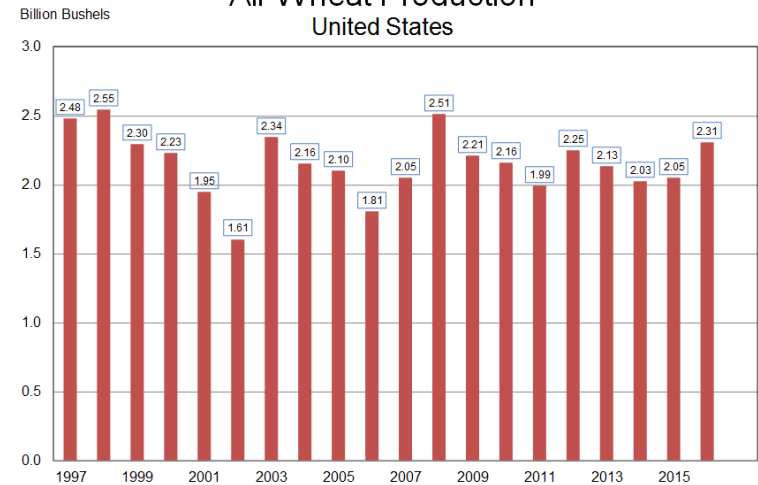
All Wheat Acres
United States



USDA-NASS
3-31-17

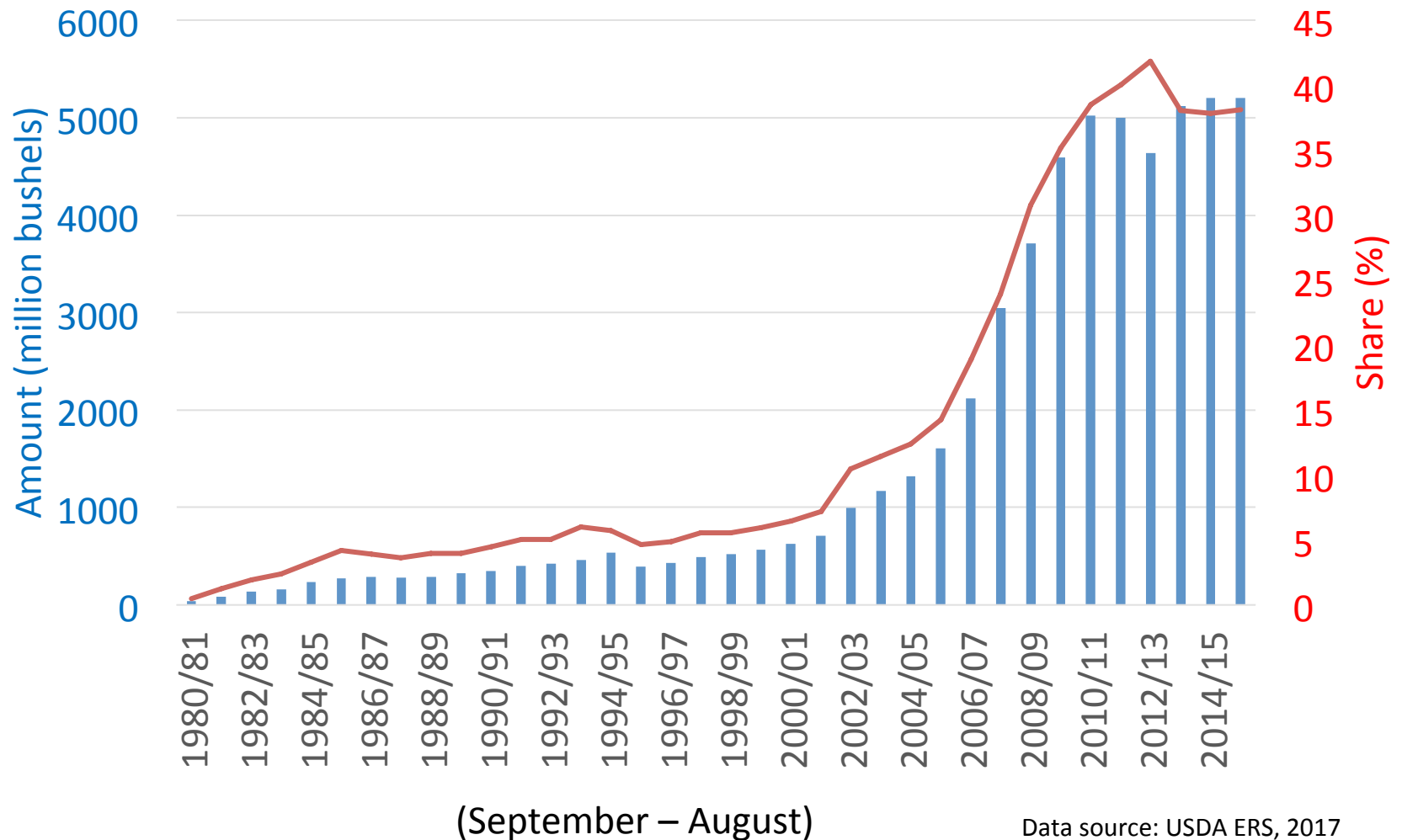


All Wheat Production
United States



USDA-NASS
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US corn used for ethanol production

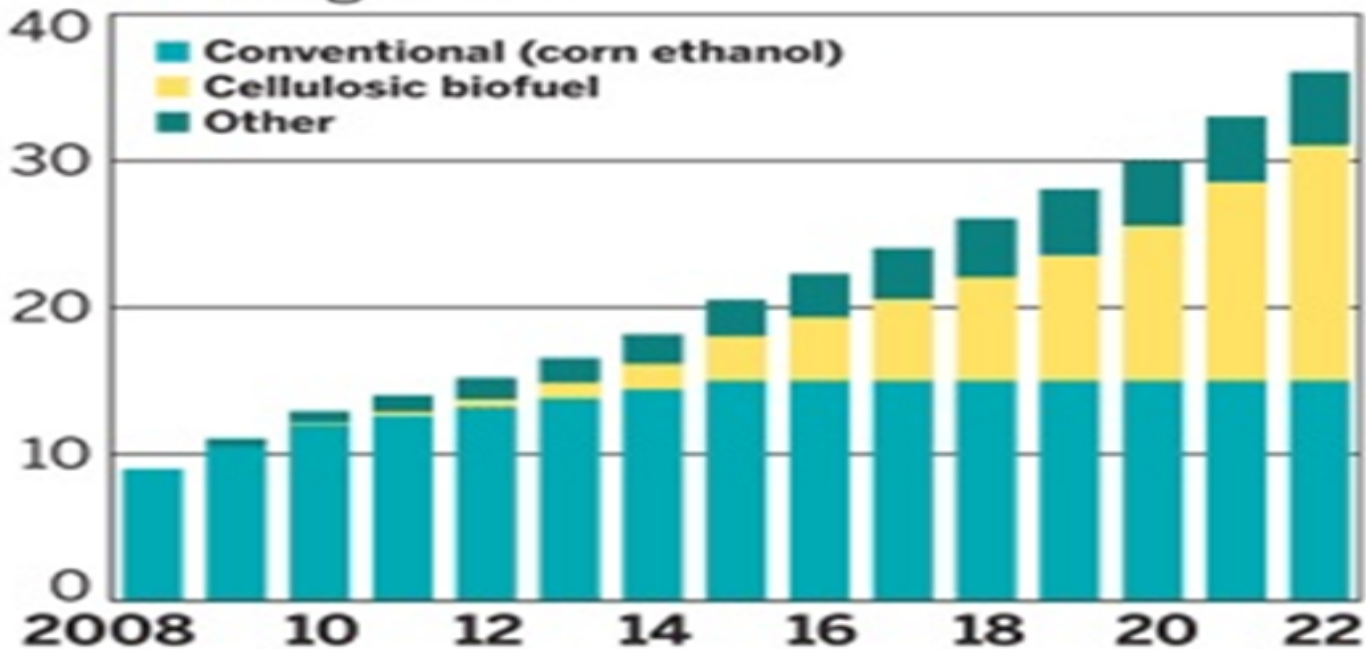


US biofuel mandates

RENEWABLE FUELS STANDARD

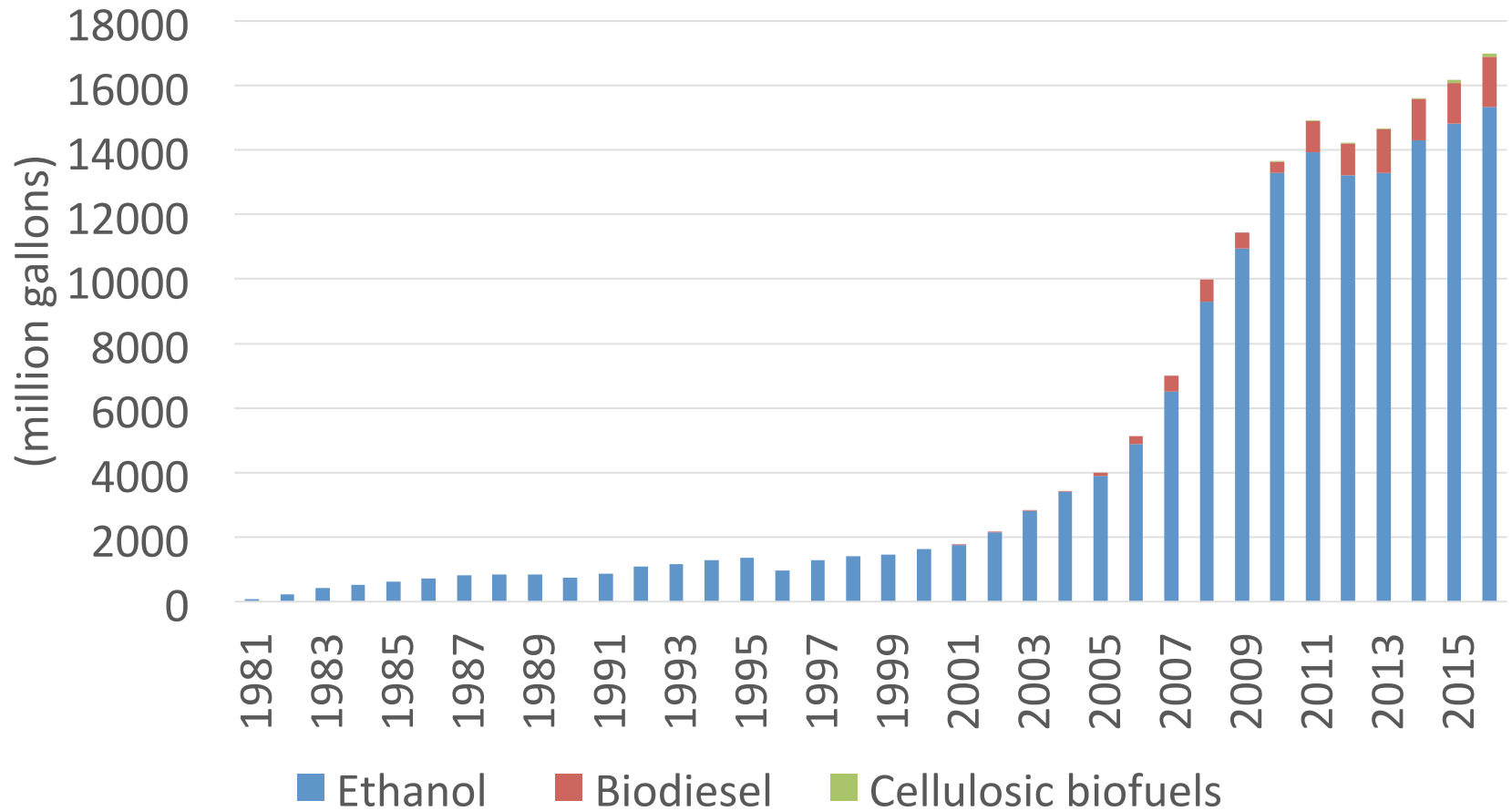
Proportion of renewable fuels requirement from cellulosic biofuels will increase

Billions of gallons



SOURCE: Energy Independence & Security Act of 2007

US biofuel production



Data source: USDA ERS, 2017

US bioenergy policy

- Tax exemptions/incentives
 - Energy Tax Act of 1978
 - Surface Transportation Assistance Act (1982)
 - Tax Reform Act (1984)
 - Omnibus Budget Reconciliation Act (1990)
 - Transportation Efficiency Act of the 21st Century (1998)
 - Job Creation Act (2004)
 - Farm Bills
- Production quotas (Renewable Fuel Standards)
 - Energy Policy Act (2005)
 - Energy Independence and Security Act (2007)

Major drivers of US biofuel policy

- High oil price
- Energy security
- GHG emissions
- Farm income
- Political and economic interests

Consequences on land use

- Land use expansion
 - Land use change (including iLUC)
- Land use intensification
 - Intensified management/utilization of land

Both can lead to sustainability concerns.

Another potential source of unsustainability

- **Increased residue collection** at the harvest site
 - Driven by economic incentive to collect more biomass at a given area

Sustainability concerns

- Socio-economic
 - Food vs Feed vs Fiber vs Fuel
 - Benefit-cost distribution/redistribution across stakeholders
- Environmental
 - Soil
 - Water
 - Carbon
 - Biodiversity
 - Others

Factors influencing sustainability/ unsustainability

- Market
- Policy
- Technology
- Others (certification, etc.)

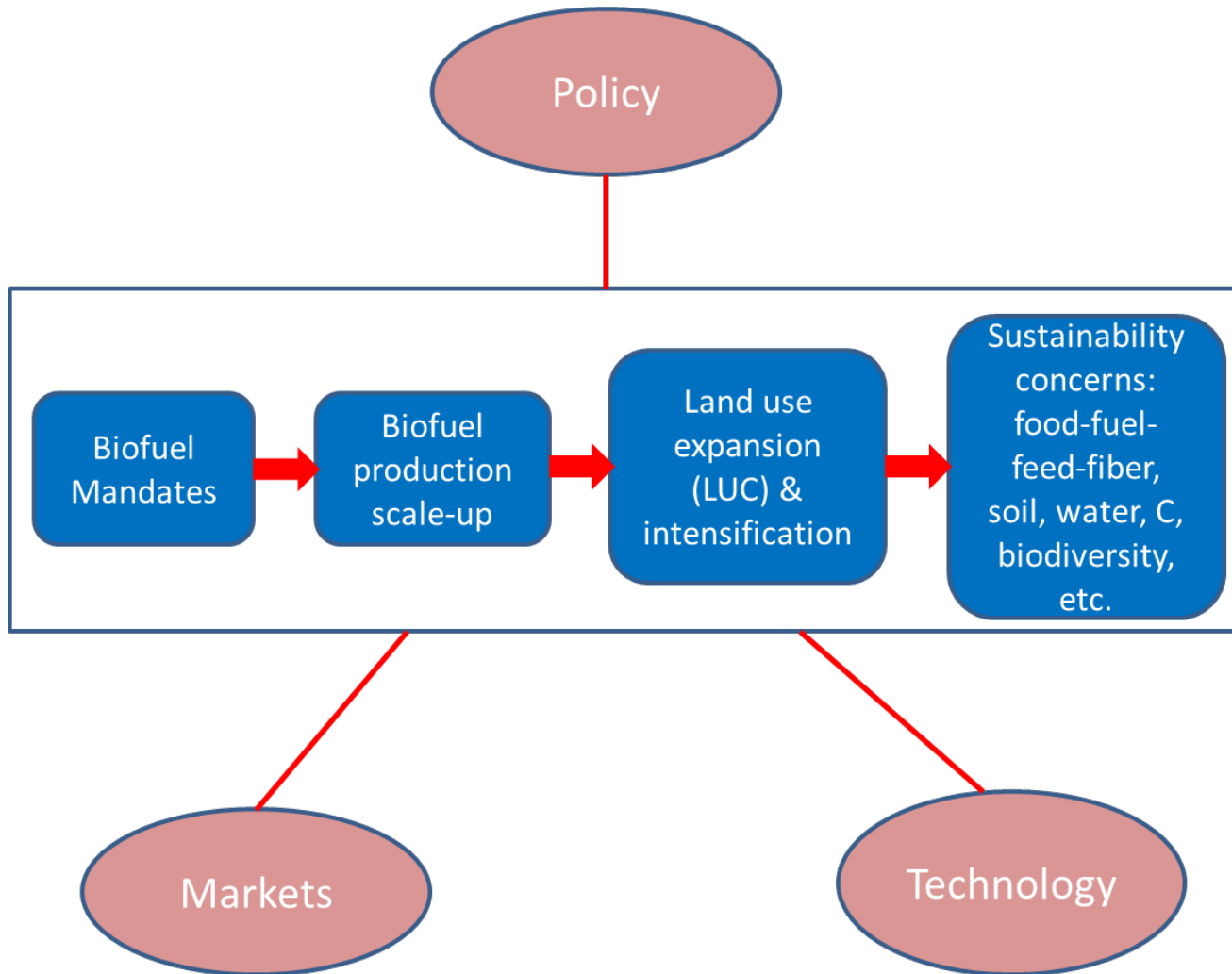
Market forces and interactions

- Fossil fuel and other renewable energy markets
- Markets of nonbiofuel products derived from land
- Domestic vs. foreign markets

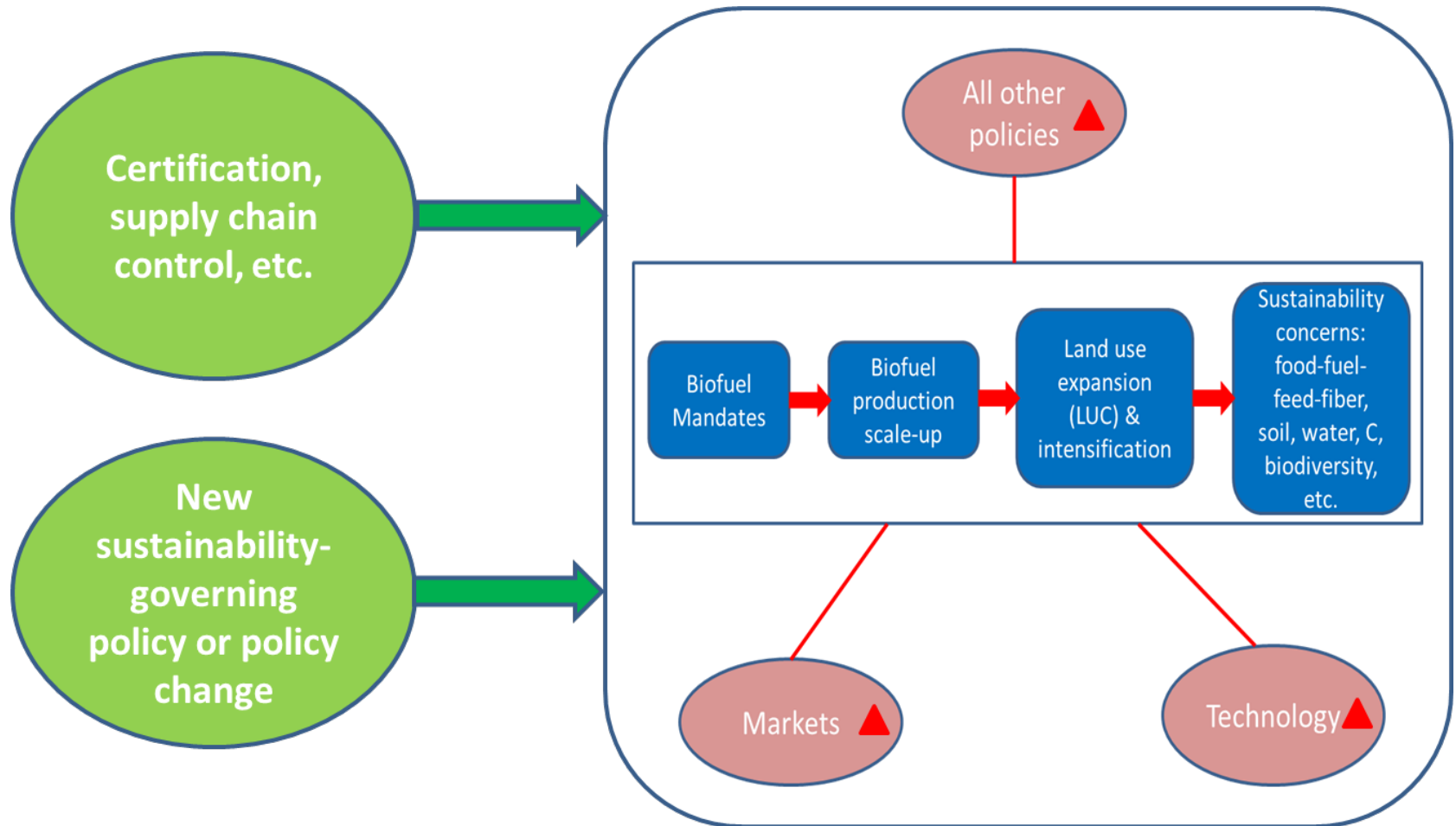
Some existing policy, practices and technology for agriculture-related environmental protection

- Conservation incentive or cost sharing programs
- Conservation practices (BMP, contouring, nontil, etc.)
- Precision agriculture (tech)

Complex web of relationships



Sustainability governance: Put all together



Challenges for sustainability governance

- Policy-induced unsustainability
- Variability from case (location) to case (location)
- Lack of a good understanding of interrelationships (biophysical and socio-economic) among components in the system
- Lack of a good understanding of (acceptable) tradeoffs among various benefits/costs or outcomes

Additional thoughts for sustainability governance

- Adjust biofuel tax incentives and mandates
- Payment for biodiversity protection and other ecosystem service instead of punishment for degrading ecosystems
- Leverage on existing mechanisms
- Restrict unsustainable land-use conversion
- Utilize new technology (e.g. RS) in sustainability monitoring and governance
- Better understanding of tradeoffs and interrelationships
- Focus on **key concerns** and keep **simplicity** in mind when designing sustainability governing mechanisms

Thanks!