

Environmental effects of wood pellet production in the SE US for bioenergy

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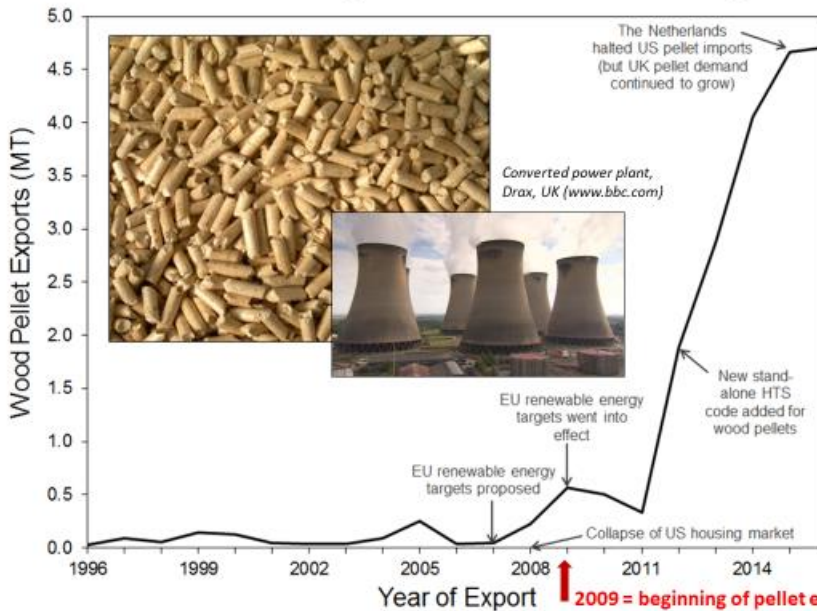


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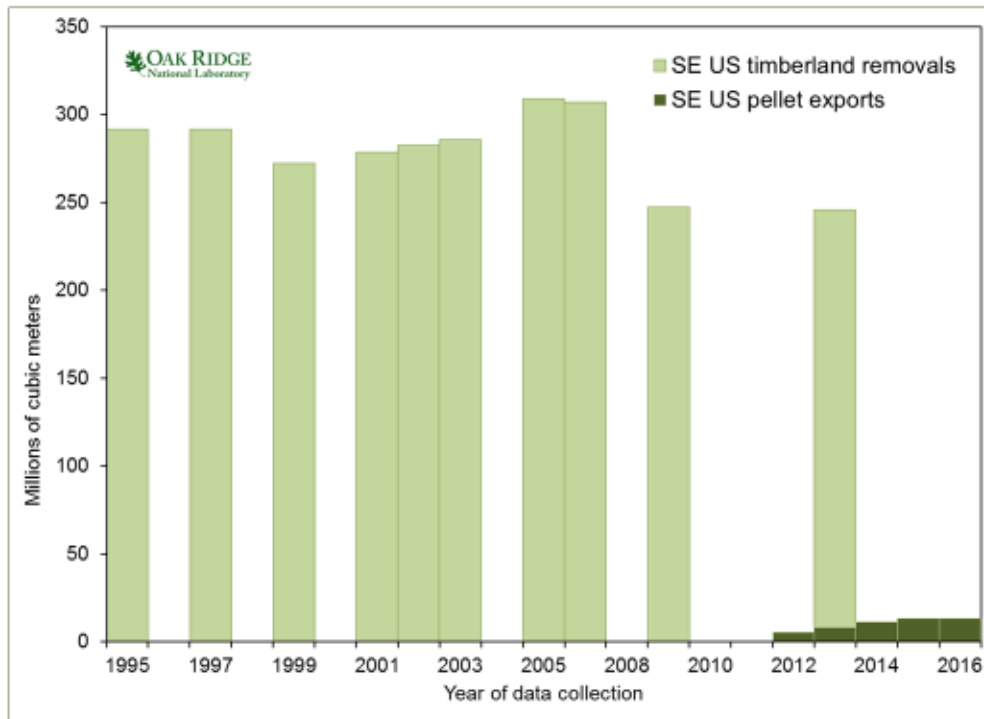


US industrial wood pellet trade has been growing



Source: Parish, Herzberger, Phifer, and Dale (2018) *Ecology & Society*

Only a small portion of SE US timberland removals are used for pellets



From E. Parish, V. Dale, K. Kline (2017) *World Biomass*

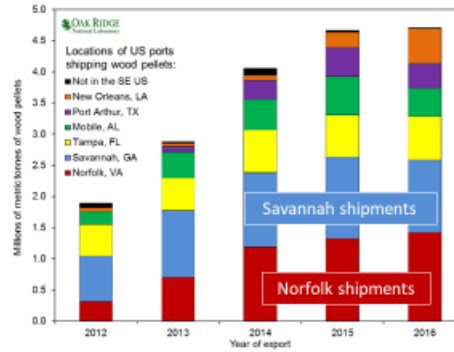
Issues pertaining to Sustainability

- **How does SE US pellet production for export to Europe differ from the business-as-usual case of no pellet production?**
 - Under what conditions does the pellet industry complement or compete with pulpwood use?
 - Will pellet industry alter amount of land staying in the forest?
- **Are there significant changes to key indicators?**
 - Biodiversity
 - GHG emissions
 - Soil quality
 - Jobs
 - Water & air quality
 - Preserving land as forest
- **How can forest conditions be monitored & good practices implemented?**
 - Analysis of Forest Inventory & Analysis (FIA) data
 - Best Management Practices (BMPs)
 - Sustainable Forestry Initiative's certified Fiber Sourcing Standard

Participants of ORNL's April 2016 Bioenergy Study Tour helped address these questions. See Dale et al. (2017) *GCB Bioenergy*



Over half of US wood pellets ship to Europe from Norfolk & Savannah



- We examined timberland changes in the two fuelsheds supplying these ports before and after export pellet production began in 2009.
- Our hypothesis was no change.

Source: E. Parish, V. Dale, K. Kline (2017) *World Biomass*

We used annual Forest Inventory and Analysis (FIA) data collected by the US Forest Service



FIA plot demonstration at UT Arboretum

Parish, Dale, Kline (2017) *World Biomass*

Considered 2 case study areas supplying wood to 2 major ports:

Fuelsheds: Counties within 120 km (75 miles) of pellet mills that supply ports

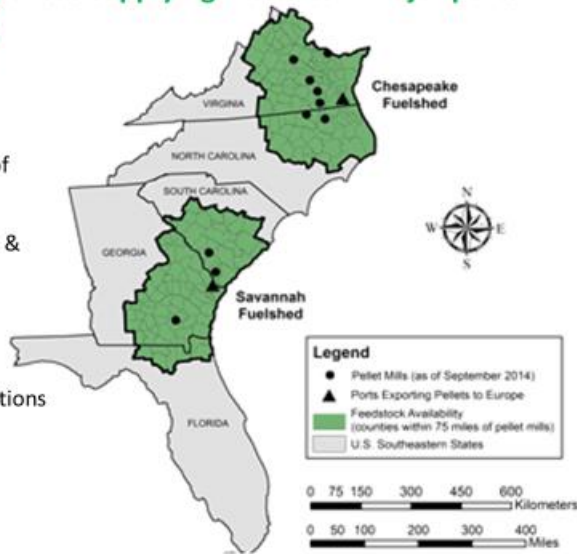
Each fuelshed area has an area of ~12 million ha.

Chesapeake Fuelshed: both pine & mixed hardwoods

- 33 NC counties
- 69 VA counties

Savannah Fuelshed: mostly intensively managed pine plantations

- 22 SC counties
- 54 GA counties
- 7 FL counties



Dale, Parish, Kline, Tobin (2017) How is wood-based pellet production affecting forest conditions in the southeastern United States? *Forest Ecology and Management* 396: 143-149.

Parish, Dale, Kline and Tobin (2017) Dataset of timberland variables used to assess forest conditions in two Southeastern United States' fuelsheds. *Data in Brief* 13: 278-290.

Ten timberland variables pulled from FIA data

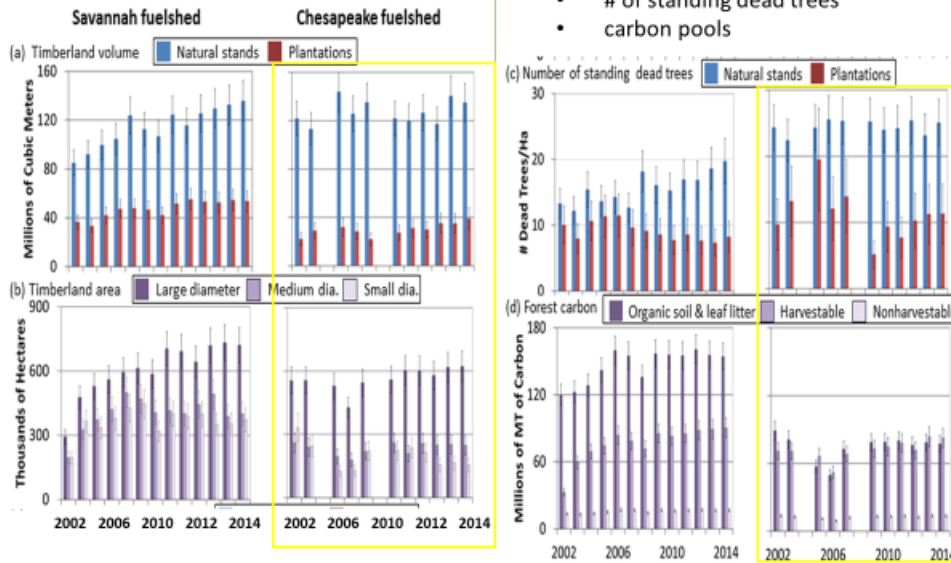
Variable Name	Variable Description
Vol Nat	Volume of Natural stands (millions of cubic meters)
Vol Plan	Volume of Plantations (millions of cubic meters)
Area LD	Area of Large Diameter stands (thousands of hectares)
Area MD	Area of Medium Diameter stands (thousands of hectares)
Area SD	Area of Small Diameter stands (thousands of hectares)
StDead Nat	Standing Dead trees in Natural stands (number per hectare)
StDead Plan	Standing Dead trees in Plantations (number per hectare)
Carbon SLL	Carbon stored in Soil & Leaf Litter (millions of metric tons)
Carbon HM	Carbon stored in Harvestable (live) woody Material (millions of metric tons)
Carbon NHM	Carbon stored in NonHarvestable (dead) woody Material (millions of metric tons)

From Parish, Dale, Kline, Tobin (2017) *Data in Brief*

Are pellet exports affecting SE US forests?

Analyzed FIA data for changes in:

- timberland volume & area (natural vs. plantation)
- tree diameters
- # of standing dead trees
- carbon pools



Results of ORNL's assessment of SE US timberland characteristics pre- and post- export pellet production in 2009

Note that the Chesapeake fuelshed is most similar to Maryland forests

Timberland Characteristic	Savannah Fuelshed	Chesapeake Fuelshed
Naturally regenerating stand volume	Increased	No change
Plantation volume	Increased	Increased
Large-diameter tree area	Increased	Increased
Medium diameter tree area	No change	No change
Small diameter tree area	No change	No change
Standing dead tree density of natural stands (#/ha)	Increased	No change
Standing dead tree density of plantations (#/ha)	Decreased	No change
Carbon content of soil and leaf litter	Increased	No change
Carbon content of live harvestable material	Increased	Increased
Carbon content of dead non-harvestable material	Increased	No change

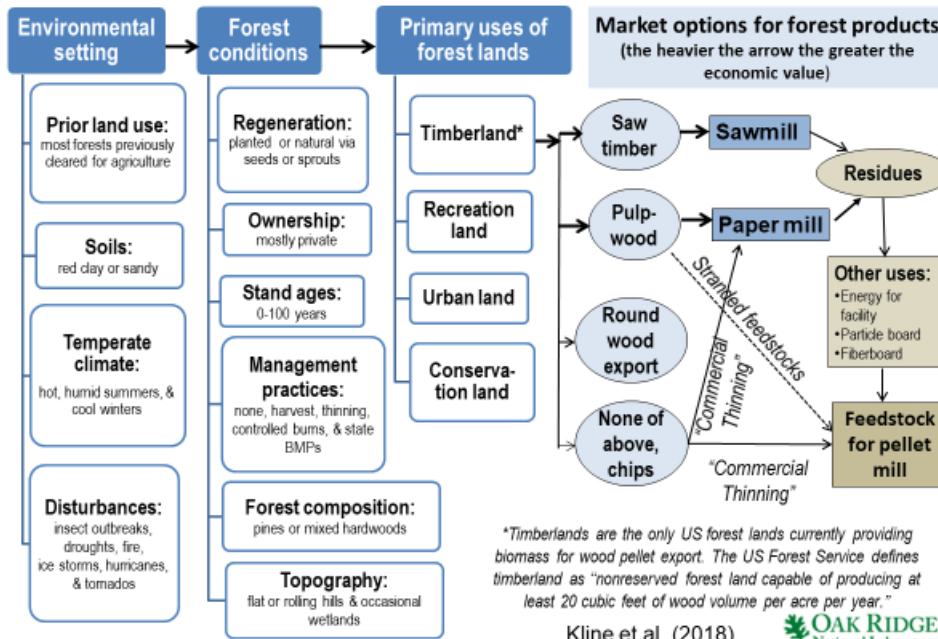
Dale et al. (2017) Forest Ecology and Management 396: 143-149.

Parish, Dale, Kline (2017) Has pellet production affected Southeastern US forests? *World Biomass* p. 38-42. <http://www.dcmproductions.co.uk/flippages/flipbook/index.html?page=40>

Wood markets are needed to retain SE US land in forest.
 The greatest cause of forest loss in the SE US is development (Wear & Greis 2013)



Influences on SE US export wood pellet production



Biomass stranded without markets (“unloved wood”)

- Eventually burns or decays
- Reduces incentives to keep private lands forested



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Situation in Tennessee

- Papermills shut down and were not replaced by an alternative demand for wood.
- There are no pellet plants.
- The abundance of low value wood is one of the top challenges for Tn according to the Tn Department of Forestry.
- Concern about insect outbreaks and fires is high.
- Development is the main cause of forest loss, and that wood is often burned.



Gatlinburg Fire

Biomass stranded without markets (“unloved wood”)

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Pellet production allows forest owners to conduct forest management (e.g., thinning) that reduces risks of fire & insect outbreaks

A



B



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Parish, Dale, Kline (2017) *World Biomass*

Consideration of noncorporate forest land owners' perspectives regarding wood-based energy

Survey of ~900 family forest land owners in eastern US on biomass for energy:

- Concern for the environment is paramount
- Potential impacts on existing industries are a concern
- There was a willingness to support use of biomass for energy as long as
 1. Land health is not compromised
 2. The price is right

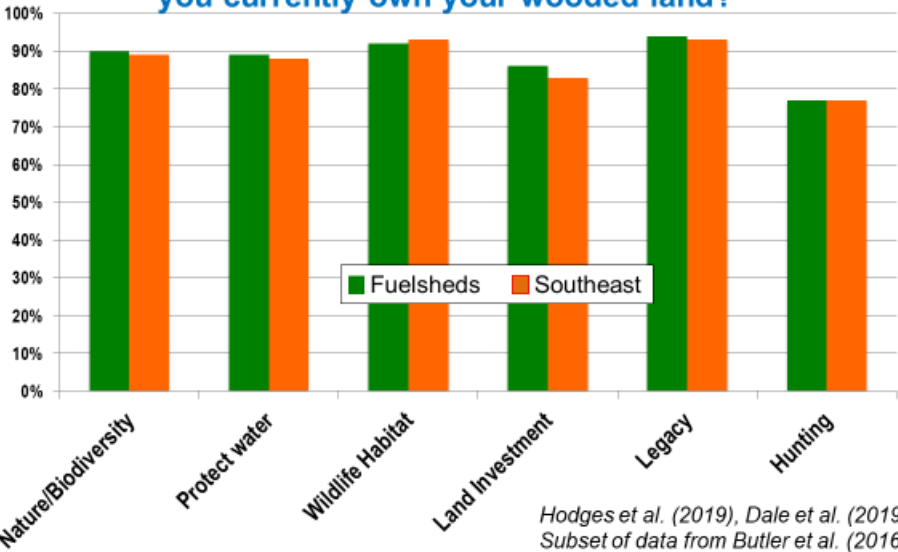


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Hodges et al. (2019), Dale et al. (2019)

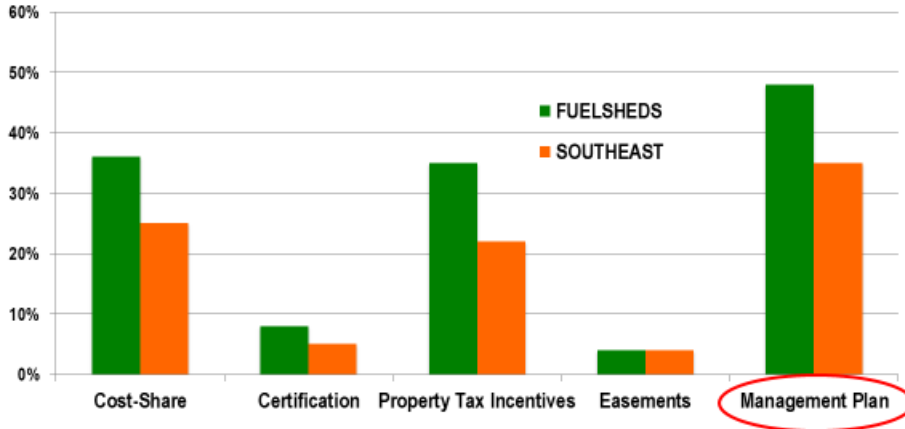
There is little difference between owners in fuelsheds and in SE regarding reasons for owning forests

How important are the following as reasons for why you currently own your wooded land?



There is difference between owners in fuelsheds and in SE regarding management plans

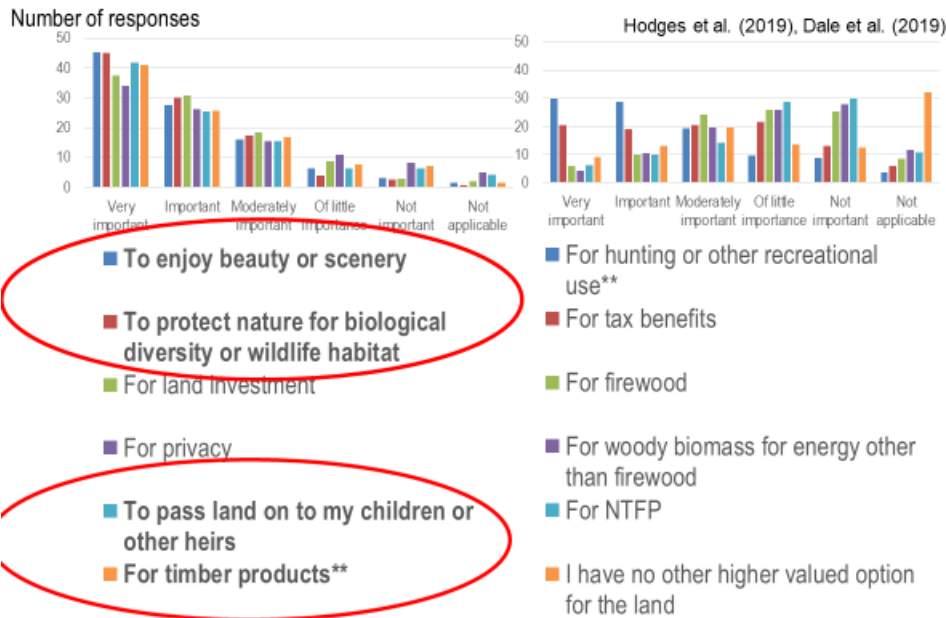
Is your wooded land enrolled in any of the following written management or stewardship plan?



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Hodges et al. (2019), Dale et al. (2019)
Subset of data from Butler et al. (2016)

Diverse reasons that landowners keep their land in forest in two fuelsheds



Views on effects of markets & policy on willingness to sell biomass for energy



Benefits of logger training

- Only 17% of harvested wood is certified in SE US
- Yet, mills that export pellets require feedstock to originate from sites supervised by foresters trained in habitat conservation, water quality, & other BMPs (best management practices).
- Logger training is a component of the Sustainable Forestry Initiative's (SFI's) certified Fiber Sourcing Standard.
- Focus on forests attributes rather than paperwork.



Pellet mill in Ahoskie, NC

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Dale + 34 coauthors (2017) GCB-Bioenergy

Benefits of producing wood pellets in the SE US

- Provide rural jobs
- Mitigate climate change
 - By replacing coal
 - By enhancing forest sequestration in forests with improved management
- Reduce inefficiencies
- Improve forest habitat
- Retain forests
 - As demand for wood increases, net forest area typically expands
- Decrease risks of
 - Insect outbreaks & disease
 - Destructive wildfire



Cowie et al. (2013) IEA Bioenergy
Dale + 34 authors (2017) GCB Bioenergy
Hodges et al. (2019) RSER
Forest2Market (2017)
Miner et al. (2014) Journal of Forestry
Parish et al. (2018) Ecology & Society

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Controversy surrounds climate change benefits of this renewable energy resource

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Report
IN THE U.S. SOUTHEAST, NATURAL FORESTS ARE BEING FELLED TO SEND FUEL OVERSEAS

Dirtier than coal?
 Why Government plans to subsidize burning trees are fuel sources for the planet

BIOMASS UNDER FIRE

SHARE
 Is wood a green source of energy? Scientists are divided

Misconceptions about climate effects of forest bioenergy

Misconceptions are due to

1. **Wide diversity of bioenergy systems and associated contexts**
2. **Differences in assessment methods as influenced by**

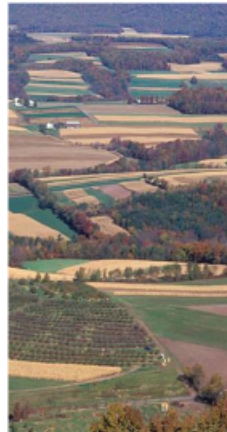
A. Narrow time perspective:

- 1) The most important climate change mitigation action is keeping fossil carbon in the ground by transforming energy, industry, & transport systems.
- 2) Narrow perspectives obscure the significant role that bioenergy plays in displacing fossil fuels & supporting energy system transition.

B. Lack of system perspective:

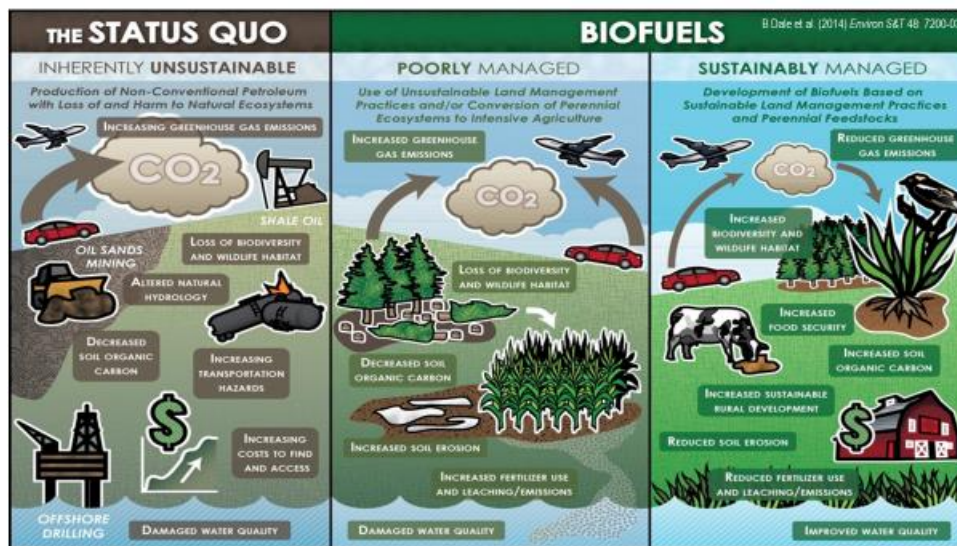
- 1) Shouldn't focus on carbon balance of individual forest stands
- 2) Shouldn't compare emissions at the point of combustion or neglect system interactions influencing climate effects of forest bioenergy.
- 3) Instead
 - Consider the full life cycle of bioenergy systems, including effects of the associated forest management & harvesting on broad-scale carbon balances;
 - Identify how forest bioenergy can best support energy-system transformation required to achieve climate goals;
 - Incentivize forest bioenergy systems that augment the mitigation value of the forest sector

C. Reference (counterfactual) scenarios need to be realistic & provide the same services



Source: Cowie et al. 2021

Appropriate Management of Biofuels can Support Sustainability Goals



Source: Bruce Dale et al. (2014)



Thank you!



CBES
Center for BioEnergy
Sustainability

<https://cbes.ornl.gov/>



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