Updates to Modelling Framework to Improve SAF iLUC Values

Presented to:
ISCC Regional Stakeholder Meeting North America

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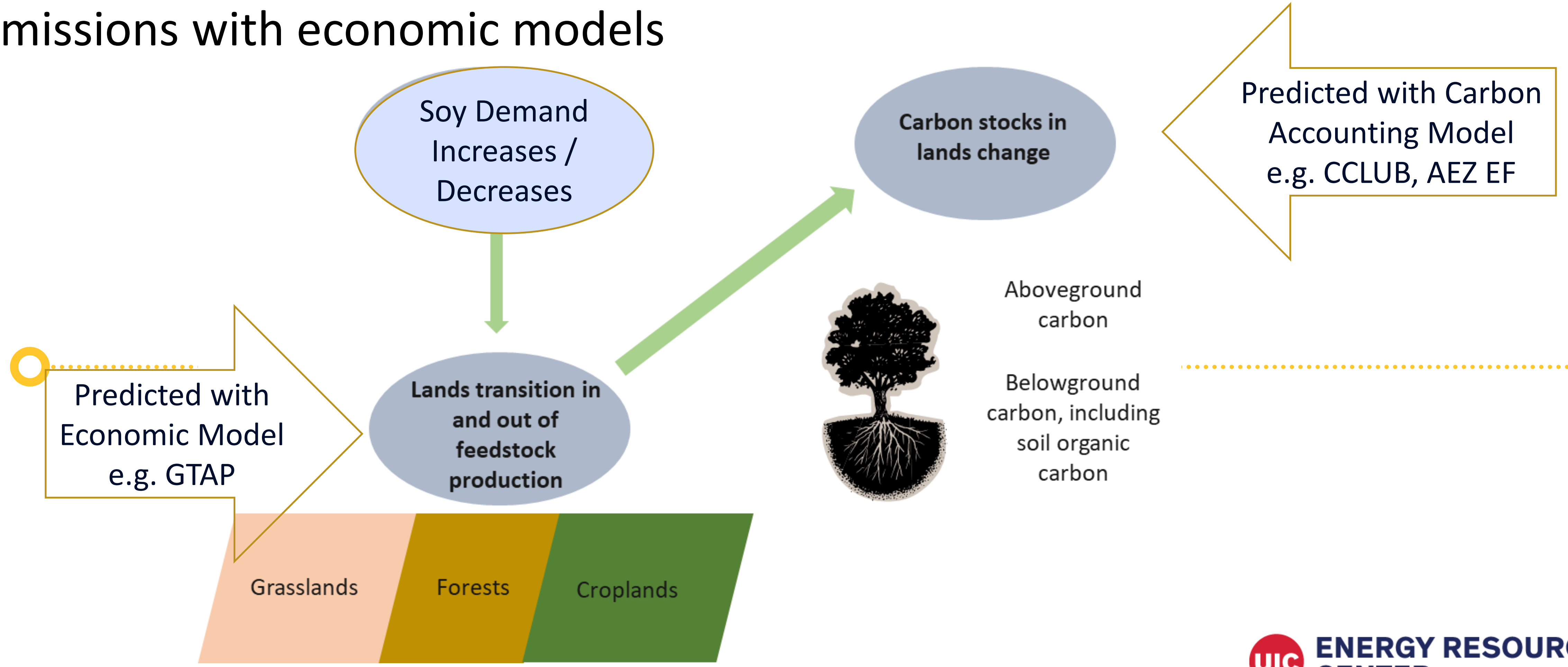
Presentation Overview

- Background: LCA iLUC Carbon Accounting
- SAF iLUC Modeling Updates
- Low LUC Risk Land

Background: Amortization Period and LCA iLUC Carbon Accounting

iLUC Modeling & Carbon Accounting

Approach to modeling land use change and corresponding GHG emissions with economic models



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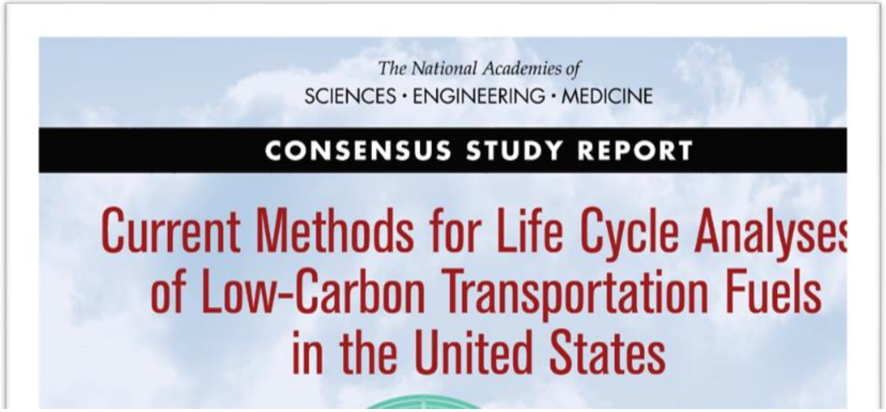
Amortization Period



<u>From NAS Report: Variation Due to the Choice of Amortization Time Period</u>

- The choice of amortization time horizon directly affects the size of ILUC values.
- Some existing ILUC practices simply amortize induced land use emissions due to a biofuels volume over the number of years the biofuels policy is presumed to be in effect.
- Some studies have used 20 years other studies have used 30 years for the time horizon following U.S regulatory emissions guidelines. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA, 2021), which represents an international scheme for offsetting and emissions reduction, has applied a 25-year time horizon, a compromise between the U.S. and EU time horizons. Some studies have adopted a 100-year time horizon approach.

Amortization Period

From NAS Report:

- However, the choice of the amortization periods in ILUC modeling may be a political decision and subject to the time period for policy goals. There is no single correct choice for amortization period.
- Schmidt et al. (2015) state: “Applying an amortization period, however, introduces arbitrary assumptions, inconsistencies and strange cause-effect relationships (Schmidt et al., 2015).”
- One potential alternative is “Baseline Time Accounting” which derives ILUC values independent of amortization periods but takes into account global land use dynamics and the fact that land used for biofuels production can return to food production (Kløverpris and Mueller, 2013; Schmidt et al., 2015).

New Research with Current Focus on Sustainable Aviation Fuel

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"Biofuels induced land use change emissions: The role of implemented emissions factors in assessing terrestrial carbon fluxes"

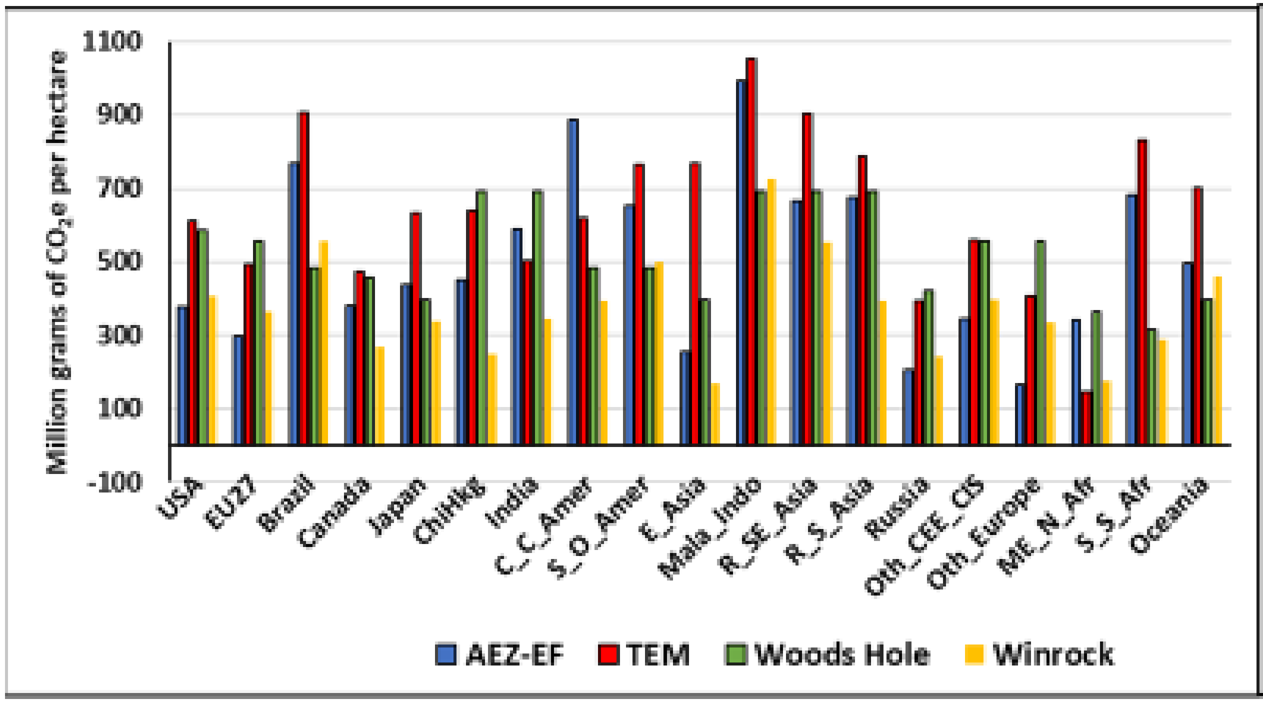
https://ageconsearch.umn.edu/record/322289/files/23039.pdf

Research Goals

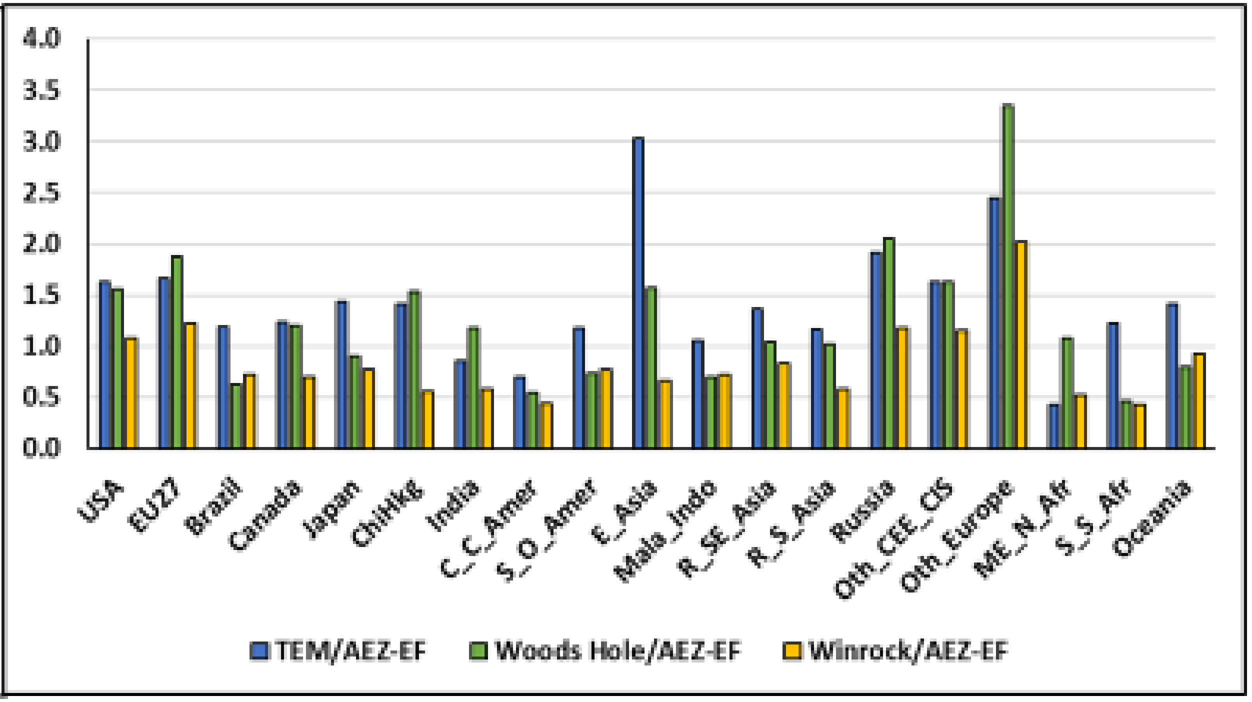
- This research aims at:
  - Highlighting uncertainties in data on land use emission factors,
  - Collecting and review the existing data sources including TEM; Woods Hole, Winrock International, and IPCC and other sources to determine their prose and cons.
- To compare two carbon accounting models (AEZ-EF and CCLUB) that have been developed to covert GTAP-BIO results to ILUC values:
  - AEZ-EF has been developed by Plevin et al. (2014) and adopted by CARB
  - CCLUB has been adopted by Argonne National Laboratory and used in combination with the GREET model.
- To evaluate ILUC values for various Sustainable Aviation Fuels (SAF) using both the AEZ-EF and CCLUB accounting models and in combination with the projections on land use changes obtained from the GTAP-BIO model.

Comparison (1)
Forest to cropland emissions factors by GTAP-BIO regions and data source

Absolut emissions per hectare



Emissions relative to AEZ-EF



These figures show major differences across data sources

Comparison of ILUC Values

Work in Progress

Estimated ILUC values for various SAF pathways using different emissions accounting models for 25- and 30-years amortization time periods (gCO_2 e/MJ)

Pathways	CORSIA values 25 years			25 years		30 years	
	GTAP-BIO	GLOBIOM	Default Value	GTAP-BIO with AEZ-EF	GTAP-BIO with CCLUB	GTAP-BIO with AEZ-EF	GTAP-BIO with CCLUB
US Corn ATJ	22.5	21.7	22.1	22.5	14.4	18.7	12.0
US Corn ETJ	24.9	25.3	25.1	24.9	15.6	20.8	13.0
US Soy oil HEFA	20.0	50.4	24.5	20.0	15.0	16.6	12.5

"Biofuels induced land use change emissions: The role of implemented emissions factors in assessing terrestrial carbon fluxes." By: Farzad Taheripour, Steffen Mueller, Isaac Emery, Omid Karami, Ehsanreza Sajedinia, 25th Annual Conference on Global Economic Analysis Accelerating Economic Transformation, Diversification and Job Creation; June 8-10, 2022: Virtual

Low LUC Risk Land (CORSIA)

CORSIA Approved Sustainability Schemes


CORSIA

ISCC

International Sustainability & Carbon Certification

ISCC CORSIA

GUIDANCE FOR LOW LUC RISK CERTIFICATION

Two approaches for Low LUC Risk Feedstock Production

- Yield Increase Approach
- Unused Land Approach

Low LUC Risk SAF: Yield Increase

Yield Increase Approach (Source: ISCC CORSIA Guidance for LOW LUC Risk Certification

"The yield increase approach applies to any situation where feedstock producers are able to increase the amount of available feedstock out of a fixed area of land (i.e. without expanding the surface of the land). An increase in the harvested feedstock may be the result of the following options (non-exhaustive) and shall be documented and described in the low LUC risk report:

- An improvement in agricultural practices (practices that increase yields through means such as increased organic matter content, reduced soil compaction/erosion, decreased pests, etc.);
- Intercropping (i.e. the combination of two or more crops that grow simultaneously, for example as hedges or through an agroforestry system);
- Sequential cropping (i.e. the combination of two or more crops that grow at different periods of the year);
- Improvements in post-harvest losses (i.e. losses that occur at cultivation and transport up to but not including the first conversion unit in the supply chain), including also:
- Mechanical improvements (e.g. using machinery that reduces inputs to enhance output or reduce losses, includes also sowing, precision farming, the introduction of a new harvest machine or new/ faster truck ensuring lower post-harvest losses)
- Non-mechanical inputs (e.g. the introduction of new seed technologies that save chemical and non-chemical inputs or improve crop resistance against climate change and drought)"

Low LUC Risk SAF: Unused Land

Low LUC Requirements under CORSIA

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Assess Potential Use of Reclaimed Coal Lands for "Low LUC Risk" SAF under CORSIA

Developed geospatial tool that

- documents the amount of reclaimed coal lands that can be used for "Low LUC Risk" biofuels.
- documents the persistent yield lag realized by growers farming on reclaimed coal land.
- allows efficient land parcel/owner identification for SAF feedstock sourcing.

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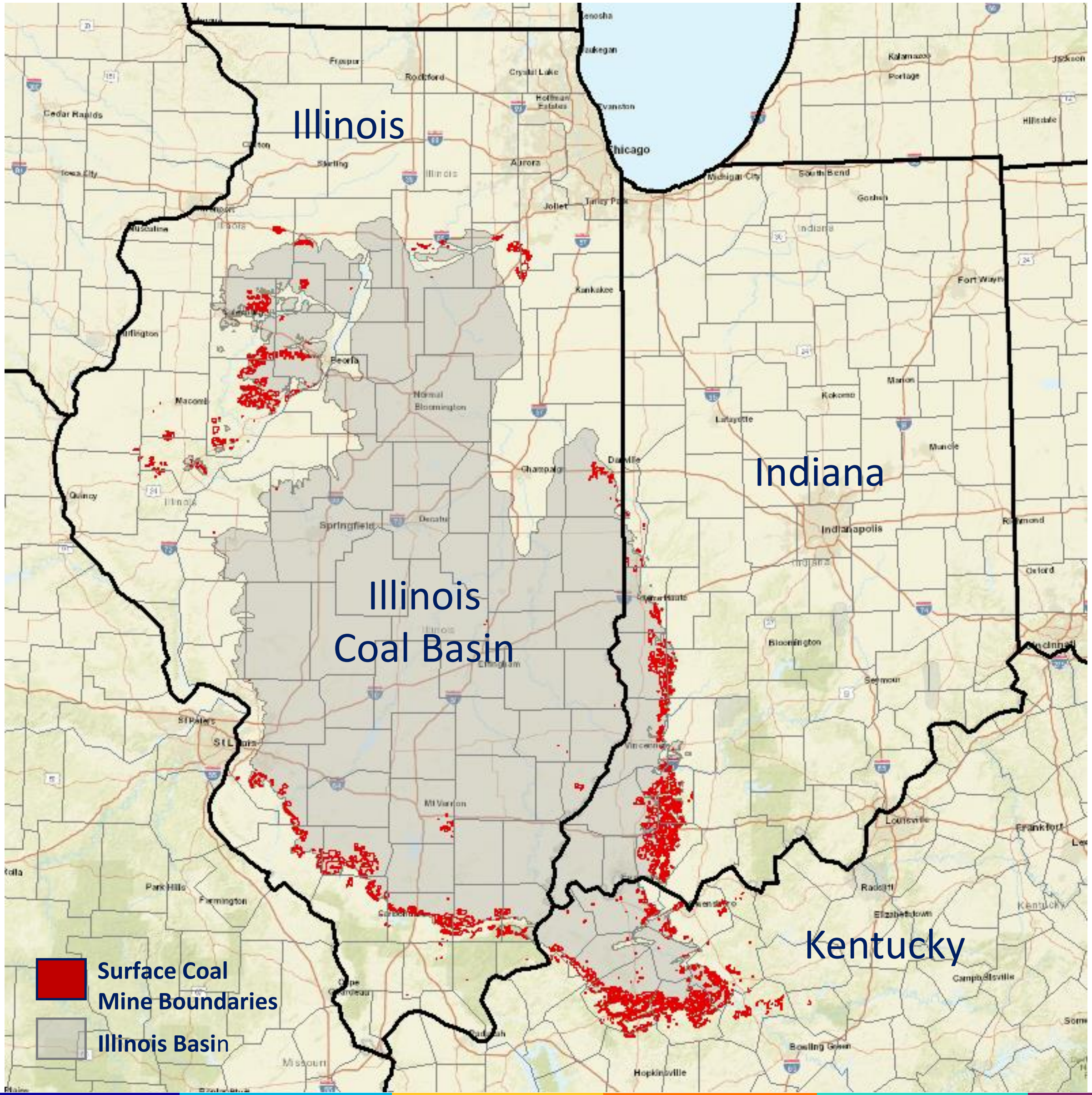
Results from Illinois Coal Basin Mapping Analysis



Total area of surface mines in the Illinois Basin is approximately 250,000 hectares.

The following is a list of hectares that met the criteria (on or after January 1, 2016) for this project's objective:

- ***203,000 to 210,000*** ha of reclaimed surface mine lands that have never been in agricultural production between 2011-2019.
- Between 28,000 to 32,000 ha were in agricultural production between 2011-2019.
- ***4,000 to 9,000*** ha were not in agricultural production prior to 2016, but moved into agricultural production sometime after this date.
- Between 1,000 to 7,000 ha were agricultural lands prior to 2016, but reverted to non-agricultural lands sometime after this date.

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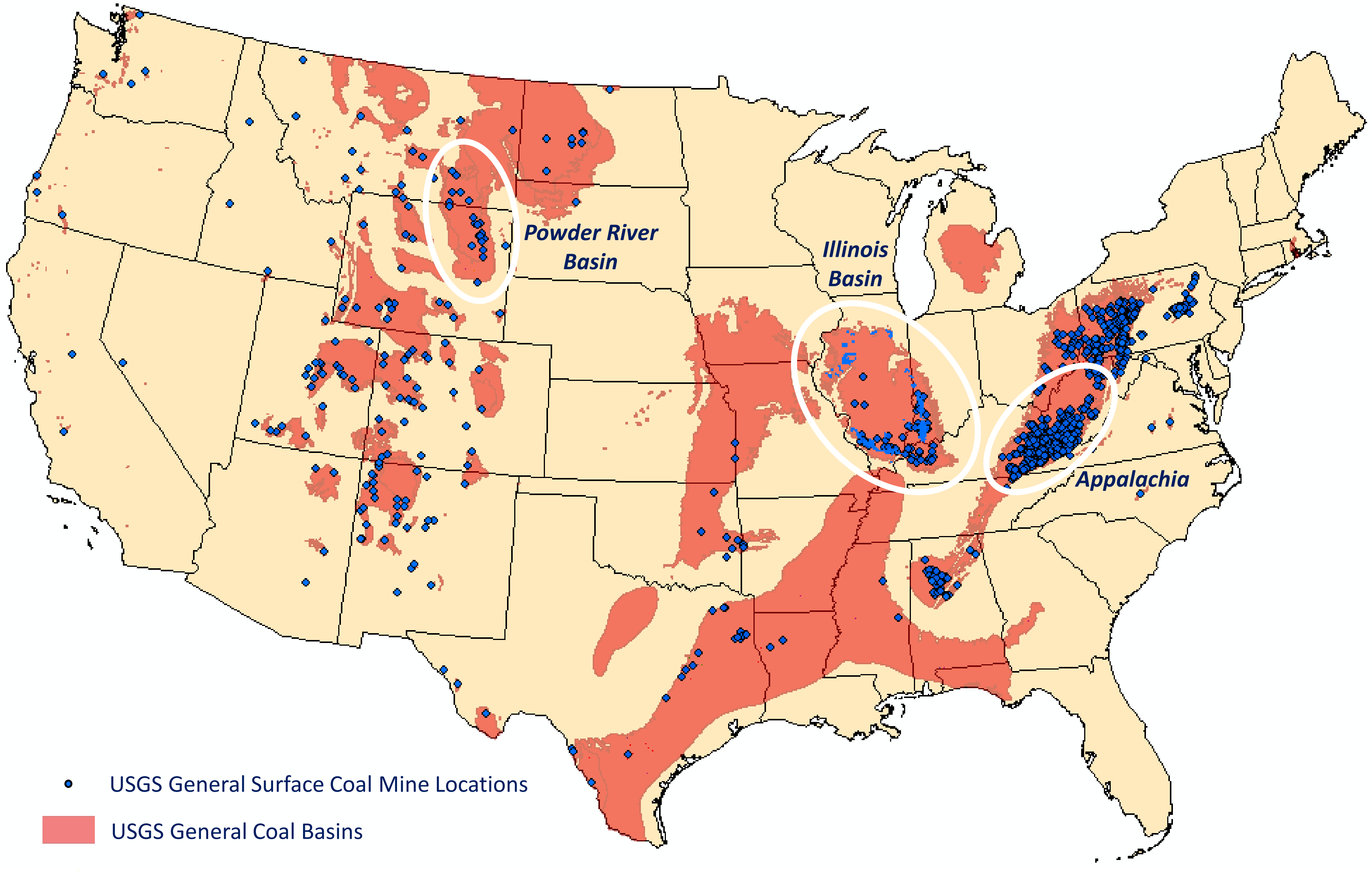
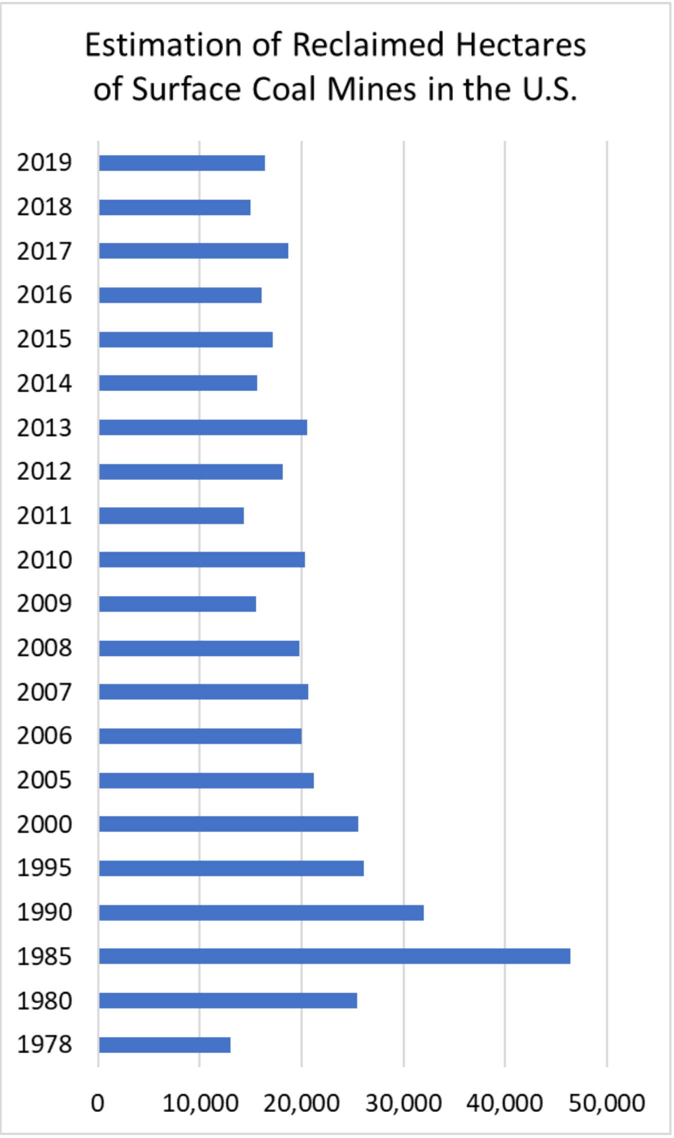
General Surface Coal Mining Locations and Basins in the U.S.





Sources: Garside 2020; OSMRE 2020; USEIA 2018; USGS 2013

1. Since 1978 there has been a total of just over 430,000 hectares of reclaimed coal mine lands in the U.S.
2. Since 2006 there has been an annual average of nearly 18,000 hectares of reclaimed coal mine lands in the U.S.

Main Conclusions

- Impact of carbon accounting model on SAF pathways is significant. Updated carbon accounting models reduce SAF ILUC.
- Impact of amortization period is significant.
    - The standard amortization period in the United States for biofuels modeling is 30 years.
    - Applying 30 year amortization period significantly reduces SAF ILUC
- “Unused Land” approach under CORSIA may provide opportunity for corn/soy SAF pathways. Eligible lands may exist in larger quantifies in the United States.