

Global Carbon Markets & Local Impacts

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Societal impacts matter for participation in global carbon markets & enhancing climate ambition

- Mitigation links to other national priorities – social well being, environmental protection, economic prosperity
- Local implications on the basic F-E-W nexus and international implications on ambition & participation
- For many regions, societal and climate goals are inextricably linked
- Ambition affected by distributional effects being synergistic or antagonistic
- Important for framing international agreements
- Need for a structured analysis

Research Question

What are the local distribution implications of global carbon markets along the F-E-W nexus?

Pathways: (a) Global Net Zero CO₂ attained in 2050

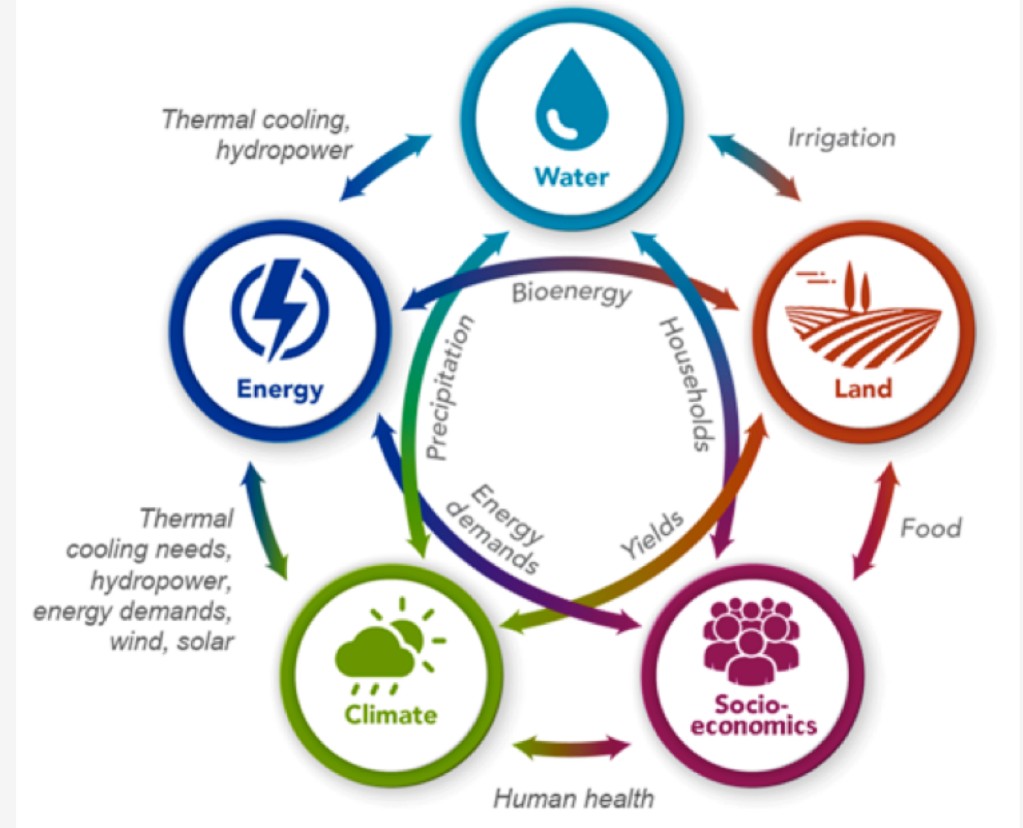
(b) Equity-based net zero CO₂ attainment

- **Effect of design**
 - Inclusion of nature-based mitigation options?
- **Effect of equity-oriented pathways**
 - Varying regional net zero year
- **Short vs long term impacts**
 - 2030 & 2050

All impacts are shown relative to regional carbon market case

IAMs are well-suited for F-E-W analysis

- IAMs capture many interlinkages, cross-sector implications
- GCAM: Global Change Analysis Model
 - Hector climate model, v2.5
 - 32 global energy-economy regions
 - 384 land regions
 - 235 water basins



Calvin et al. 2019

Effect of Market Design: Varying levels of nature-based mitigation options

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									

Strong tradeoff Strong co-benefit

Effect of Market Design: Excluding nature-based mitigation options

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									

Effects with equity-oriented net zero pathways

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									
	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	Total water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									

Strong tradeoff

Neutral

Strong co-benefit

Short- & Long-Term Impacts: Net zero in 2050 pathways

2030

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
IND									
MEX									
SAF									
USA									

2050

	FOOD			WATER		ENERGY			
	Food price/cap	Wheat price	Beef price	water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
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EU12									
EU15									
IND									
MEX									
SAF									
USA									

Short- & Long-Term Impacts: Equity-oriented pathways

	FOOD			WATER		ENERGY			
2030	Food price/cap	Wheat price	Beef price	Total water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
AFR EAST									
AFR SOU									
AFR WEST									
AUS NZ									
BRZ									
CHN									
EU12									
EU15									
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MEX									
SAF									
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	FOOD			WATER		ENERGY			
2050	Food price/cap	Wheat price	Beef price	Total water consumption	Water use for biomass	Resid. electricity price	Share of RE	Share of traditional biomass	Resid. electrification
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Summary

- Effect of market design:
 - LUC pricing dampens cobenefits & tradeoffs
 - Shifting of mitigation from land to energy sector
- Effect of equity-based pathways: Generally, more beneficial to vulnerable regions
- Short term vs long term: Long term impacts are dampened based on stringency of target
- Complex interactions and priorities for different regions
 - Implications for global cooperation
 - Implications for market design
- Does not include climate impacts

Policy Implications

- Local impacts & global market design:
 - (a) actively promote attainment
 - (b) avoid/minimize/mitigate negative SD effects
- Choice for countries as winners/losers: innovate to maximize SD synergies and minimize tradeoffs, redistribution of benefits from trade
- Net effects will depend on pace of transition, magnitude of mitigation effort, **management of change**
- Opens options for premium carbon pricing by project impact

Questions & comments welcome

Thank you