



CLIMATE CHANGE: A NEW CHALLENGE FOR LAND RESOURCE ALLOCATION.

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LAND ALLOCATION UNDER CLIMATE CHANGING CONDITIONS

- **Land allocation, a major societal issue:**

 - A factor of production and a spatial resource

(IPCC, 2019; FAO 2021)

 - A natural resource under a rising competition

 - Land markets, a land allocation mechanisms

- **Climate change, a new challenge for land allocation mechanisms:**

 - Importance for enhancing the resilience of societies to climate change**

(FAO, 2011; JRC, 2021)

 - A new driver of land supply and demand**

(Harvey et Pilgrim, 2011)

 - Land availability change; both quantitatively and qualitatively

 - Adaptation and mitigation mechanisms

→ Climate change and land market relationships, a societal issue.

CLIMATE CHANGE IMPACTS ON LAND MARKET : A RESEARCH OBJECT ?

- **Climate change impacts, some implicit assumptions :**

Land quality

(IPCC, 2019)

Agriculture activities and land use change

(Leclère et al., 2014)

Demographic dynamics

(Faist et Schade, 2013)

- **Climate – land markets interactions, partially stressed :**

Institutional works - links between climate change and the land tenure regime

(Durand-Lasserve et al., 2012; Quan and Dyer, 2008)

Ricardian analysis - impact of climate change on land rent

(Mendelsohn et al., 1994)

Anderson et al. (2019) - land market as an effective signals for climate adaptation

(Anderson et al., 2019)

→ Climate change and land market relationships, a needed formalization.

PURPOSE AND CONTRIBUTIONS

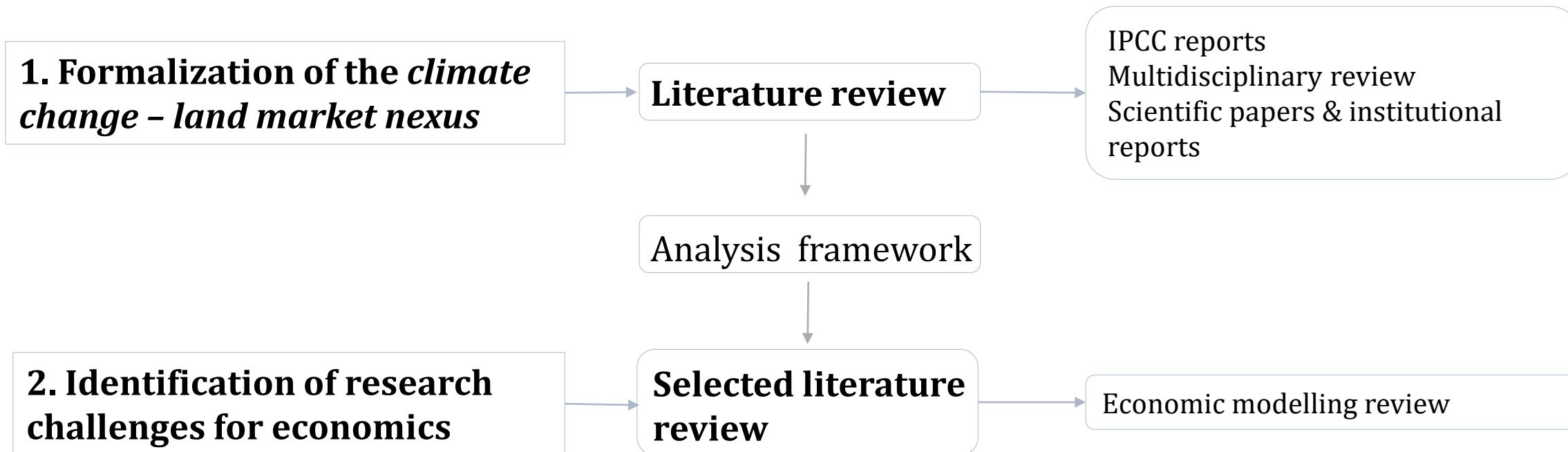
○ PURPOSE

In view of the societal challenges they raise, to what extent should the relationships between climate change and land market be a research object for economic ?

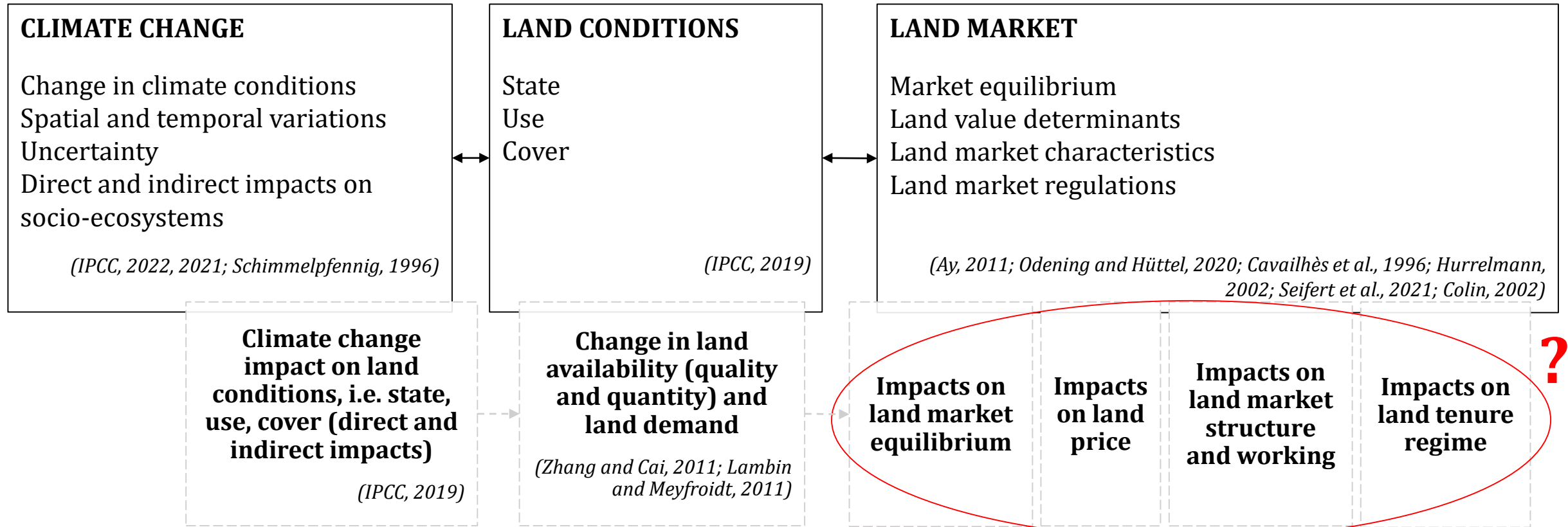
○ CONTRIBUTIONS

- Formalization of the *climate change - land market nexus*
- Identification of research challenges in economics

GENERAL METHODOLOGY



THE “CLIMATE CHANGE – LAND MARKET NEXUS”: A COMPLEX SYSTEM



?

ANALYTICAL FRAMEWORK FOR A SELECTED LITERATURE REVIEW

○ ECONOMIC MODELLING REVIEW

Optimization and equilibrium models - econometric models - single and multi-agent based models

○ ANALYTICAL FRAMEWORK

General modelling requirements → **Key modelling issues**

Thematic requirements

Climate change features

Land market features

Methodological requirements

Microeconomics

Macroeconomics

Spatial dimension

Time dimension

System dynamics

Uncertainty

Land markets dimensions (market equilibrium / land value / market structure / transactions mechanisms / institutional framework)
 Land markets characteristics (land immobility and illiquidity / transaction cost / institution framework)
 Interplay of sales and rental land markets
 Interplay of rural and urban market

Spatial explicitness
 Spatial heterogeneity, aggregation degree
 Articulation of spatial scales

RESULTS OVERVIEW

ECONOMIC MODELS		PAPERS REVIEWED
Optimization and equilibrium models	Land-based product market model	(Nelson et al., 2014) (Palatnik et al., 2011) (Frank et al., 2014) (Gouel and Laborde, 2021) (Hertel et al., 2013) (Lotze-Campen et al., 2008)
	Land market models	(Ciaian and Swinnen, 2006)
Econometrical models	Econometric land-use model	(Mu et al., 2018) (Cho and McCarl, 2017) (Lungarska and Chakir, 2018)
	Regression model	Ricardian analysis (Mendelsohn et al., 1994) (Lippert et al., 2009) (Van Passel et al., 2017) (Moretti et al., 2021) (Vanschoenwinkel et al., 2016) (Timmins 2006) (Arshad et al., 2017) (Severen et al., 2018)
	Other hedonic model	(Deschênes and Greenstone, 2007) (Slaboch and Čechura, 2020) (Dachary-Bernard et al., 2014)
Single and multi-agent based models	Multi-agent models	(Maggiocca et al., 2011) (Mansoori et al., 2021) (Hailegiorgis et al., 2018) (Alam et al., 2014) (Berger 2001) (Filatova and Bin, 2014) (Troost and Berger, 2015) (Bakker et al., 2015) (Happe et al., 2006) (Bert et al. 2015) (Polhill et al., 2001) (Freeman et al. 2009)

→ **33 reviewed papers**

THEMATIC REQUIREMENTS

ECONOMIC MODELS	OPTIMIZATION AND EQUILIBRIUM MODELS		ECONOMETRICAL MODELS			SINGLE AND MULTI-AGENT BASED MODELS
	Land market models	Land-based product market models	Econometric land-use models	Ricardian analysis	Regression models Other hedonic models	Multi-agent models
CLIMATE CHANGE FEATURES	-	yield shocks mitigation strategy = shock on supply and demand of crops agricultural adaptation = land reallocation	meteorological fluctuations mitigation strategy adaptation strategy = land reallocation	adaptation mechanisms	environmental risk	yield shock, natural hazard frequency adaptive expectation of agents, risk assessment mitigation strategy
LAND MARKET FEATURES	land market equilibrium accounting for land transactions cost and imperfections	future land demand	future land demand land price		land price	land market equilibrium, land price, market imperfection, transaction mechanisms, agents heterogeneity sub-land market inclusion

THEMATIC REQUIREMENTS

ECONOMIC MODELS	OPTIMIZATION AND EQUILIBRIUM MODELS		ECONOMETRICAL MODELS			SINGLE AND MULTI-AGENT BASED MODELS
	Land market models	Land-based product market models	Econometric land-use models	Ricardian analysis	Regression models Other hedonic models	Multi-agent models
CLIMATE CHANGE FEATURES	Direct impacts – exogenous Indirect impacts – exogenous or endogenous					
LAND MARKET FEATURES	Segmented approaches:					
	Land market equilibrium	future land demand		land price		market mechanisms

METHODOLOGICAL REQUIREMENTS

ECONOMIC MODELS	OPTIMIZATION AND EQUILIBRIUM MODELS		ECONOMETRICAL MODELS			SINGLE AND MULTI-AGENT BASED MODELS
	Land market models	Land-based product market models	Econometric land-use models	Ricardian analysis	Other hedonic model	Multi-agent models
MICRO ECONOMICS	+ (farmer optimization function)	-	+ (farmer optimization function, adaptive reaction)			++ (agent heterogeneity, microeconomic behavior)
MACRO ECONOMICS		++ (demographic, policies and economic drivers)	+ (idem)	-		++ (idem)
SPATIAL DIMENSIONS	regional spatial-explicit	global aggregated level : high (spatial explicit)	global/regional aggregated level: variable (spatial explicit)	regional/local aggregated level: low (depend of scale data level) spatial-explicit		variable scale aggregated level: variable spatial explicit
TIME DIMENSIONS	short-term	long-term	long/short-term	long-term		long/short-term
SYSTEM DYNAMICS	x	land use change - economic adjustments	agents adaptation - land use change - economic adjustments	x		agents adaptation - land use change - agricultural structural change - economic adjustments
UNCERTAINTY	x	climate and GHG emission scenario		randomization of selected variables risk assessment setting		probabilistic element risk assessment setting climate and GHG emission scenarios

METHODOLOGICAL REQUIREMENTS

ECONOMIC MODELS	OPTIMIZATION AND EQUILIBRIUM MODELS		ECONOMETRICAL MODELS			SINGLE AND MULTI-AGENT BASED MODELS
	Land market models	Land-based product market models	Econometric land-use models	Ricardian analysis	Other hedonic model	Multi-agent models
MICRO ECONOMICS	Analytical level attached to the modelling approach					
MACRO ECONOMICS						
SPATIAL DIMENSIONS	Complex consideration of the spatial dimensions of the land market. Global approach vs. fine consideration of spatial heterogeneity.					
TIME DIMENSIONS	short-term	long-term	long/short-term	long-term		long/short-term
SYSTEM DYNAMICS	x	macro & micro		x		macro & micro
UNCERTAINTY	x	scenario		data		probability, scenario, data

ECONOMICS RESEARCH PERSPECTIVES

○ Remaining research issues related to socio-ecosystems

System dynamics - Micro and macroeconomics levels - Time and uncertainty dimensions - Detailed applied model vs. theoretical comprehensive model - Verification and validation

○ Identified research gaps specific to CC-LM nexus

Thematic issues

- Porosity of the agricultural and urban land markets
- Interplay of rental and sales land markets
- Market stakeholders heterogeneity
- Consequences on land ownership and land use structure

Methodological issues

- Spatialization of land supply and demand functions
- Combination of theoretical and empirical approaches

ECONOMICS RESEARCH PERSPECTIVES

- **Remaining research issues related to socio-ecosystems**

Challenge 0 Socio-ecosystem related issues

- **Identified research gaps specific to CC-LM nexus**

Challenge 1 Complexity of land markets and interactions multiplicity.

Challenge 2 Climate change modelling: from direct to indirect impacts.

Challenge 3 Agent heterogeneity: nature of stakeholders and microeconomics behaviours.

Challenge 4 Importance of the spatial dimension: heterogeneity and explicitness.

Challenge 5 Land allocation, as a societal issue.

CONCLUSION

The climate change – land markets nexus:

- a complex socio-ecosystem,
- a research object in its own rights,
- explored by multiple economic modelling approaches
- which still challenges research.

THANK YOU FOR YOUR ATTENTION

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