

# Uncertainties in LUCC modelling: a contributive review and implications for validation techniques



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Global Land Programme**

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**Session 318R: Uncertainty assessment of land  
system science products**

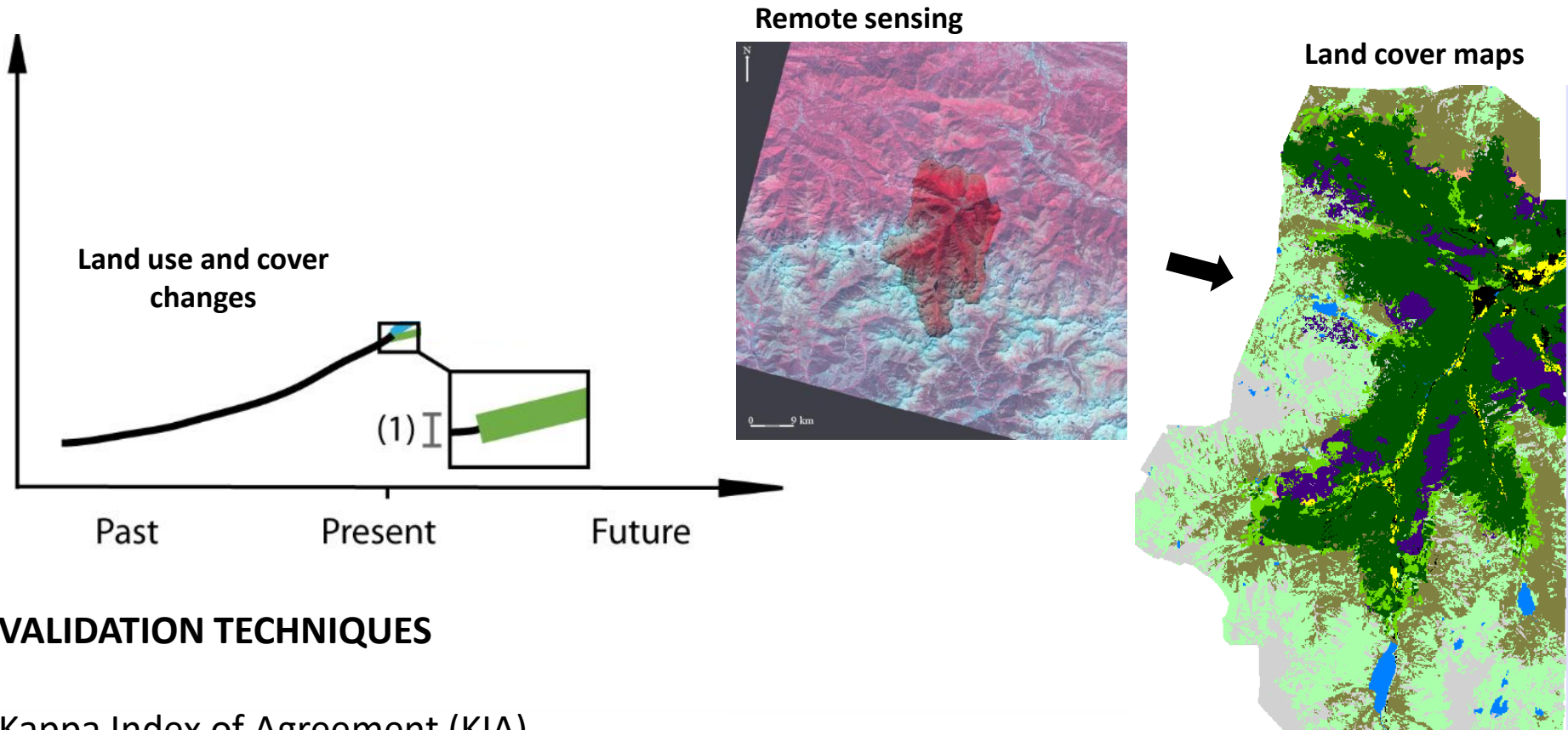


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# FOUR TYPE OF UNCERTAINTIES: (1) MAP ACCURACY



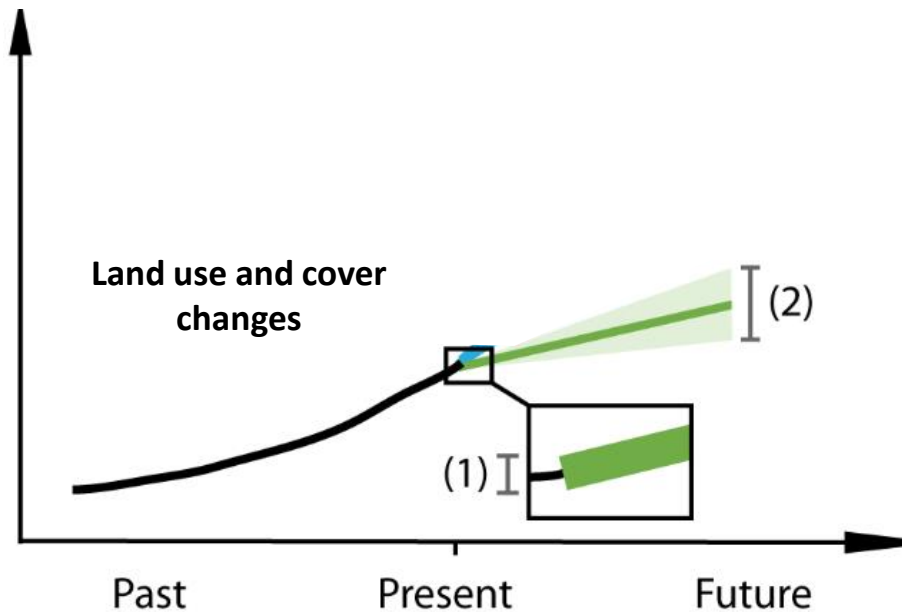
## VALIDATION TECHNIQUES

Kappa Index of Agreement (KIA)  
Overall accuracy  
Producer's / User's accuracies

## IMPLICATIONS FOR LUCC MODELING

LUCC from misclassification can be as large as LUCC in scenarios demonstrating the importance of map accuracy when developing future LUC scenarios / ecological studies (Dedoncker et al, 2007)

# FOUR TYPE OF UNCERTAINTIES: (2) INHERENT MODEL UNCERTAINTY



## Sources of differences in LUCC simulations

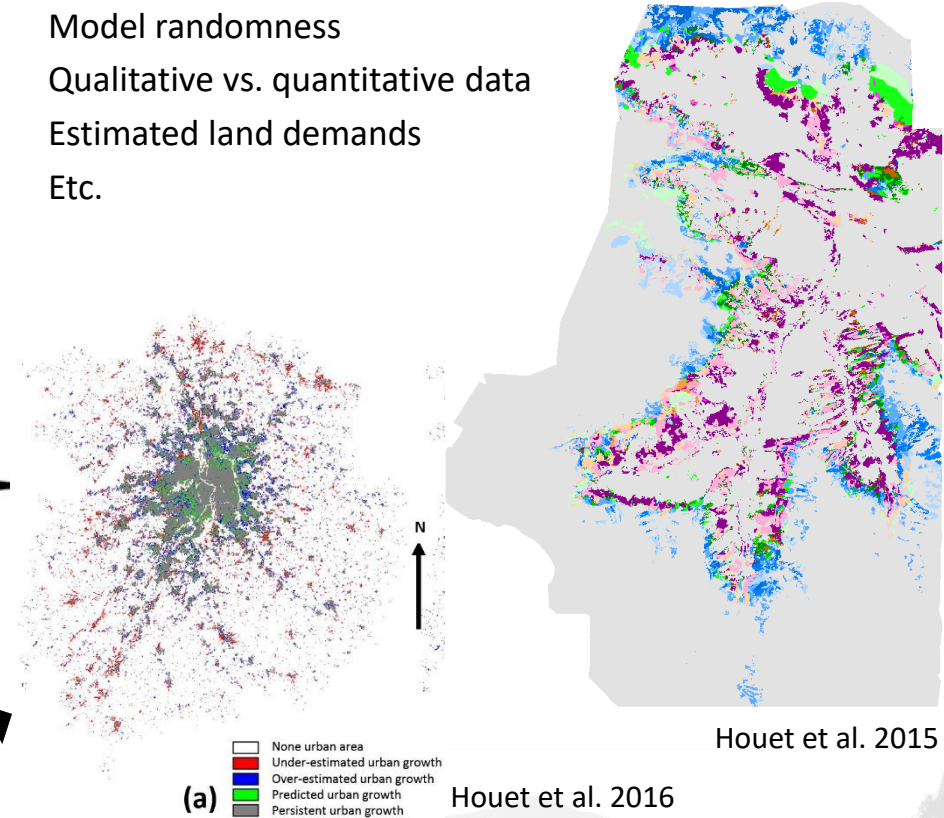
CA competition from location probabilities

Model randomness

Qualitative vs. quantitative data

Estimated land demands

Etc.



## VALIDATION TECHNIQUES

Comparison of location / quantity of LUCC

Occurrences of simulated LUCC

Relative Operating Characteristic (ROC)

Error analysis (patterns, allocation, etc.)

Calibration / learning rates

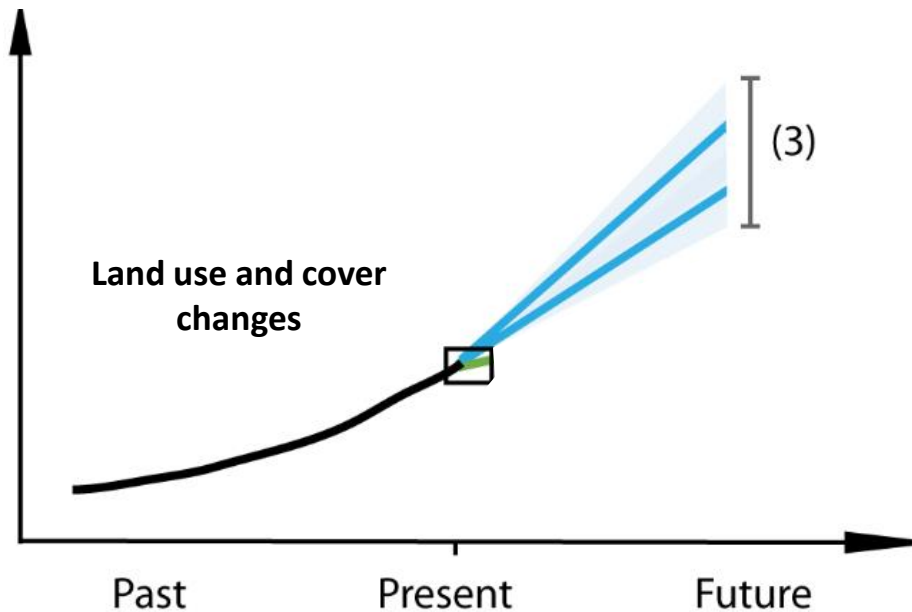
Etc.

## IMPLICATIONS FOR LUCC MODELING

Evaluate the predictive power of LUCC models

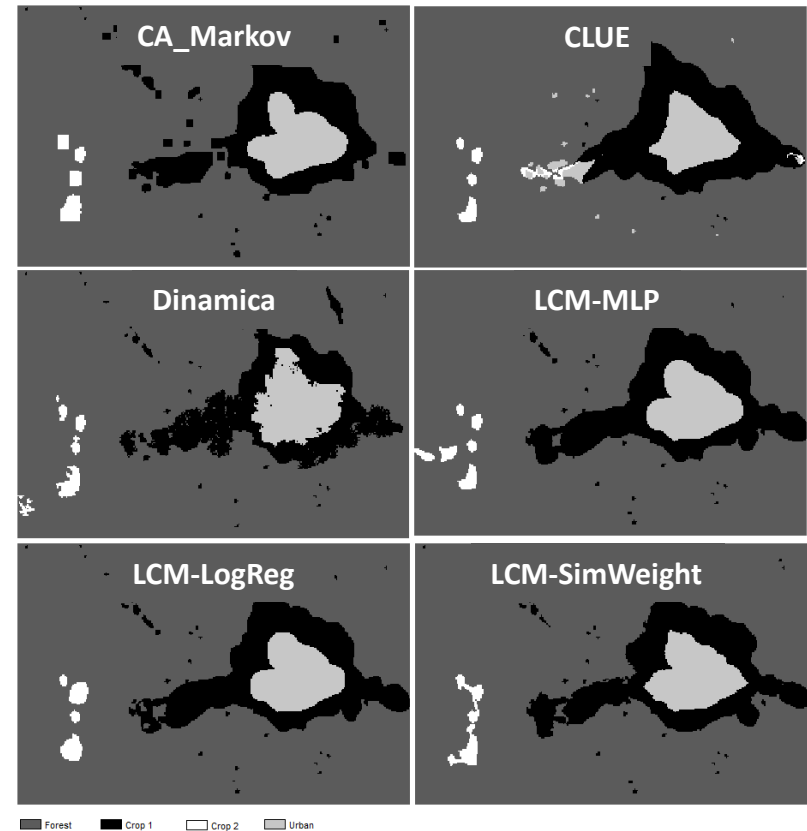
Assume the system to be stationary in the future

# FOUR TYPE OF UNCERTAINTIES: (3) ENSEMBLE MODEL UNCERTAINTY



## VALIDATION TECHNIQUES

Same as previous ones  
+ comparisons of models outcomes  
+ occurrences of models outcomes



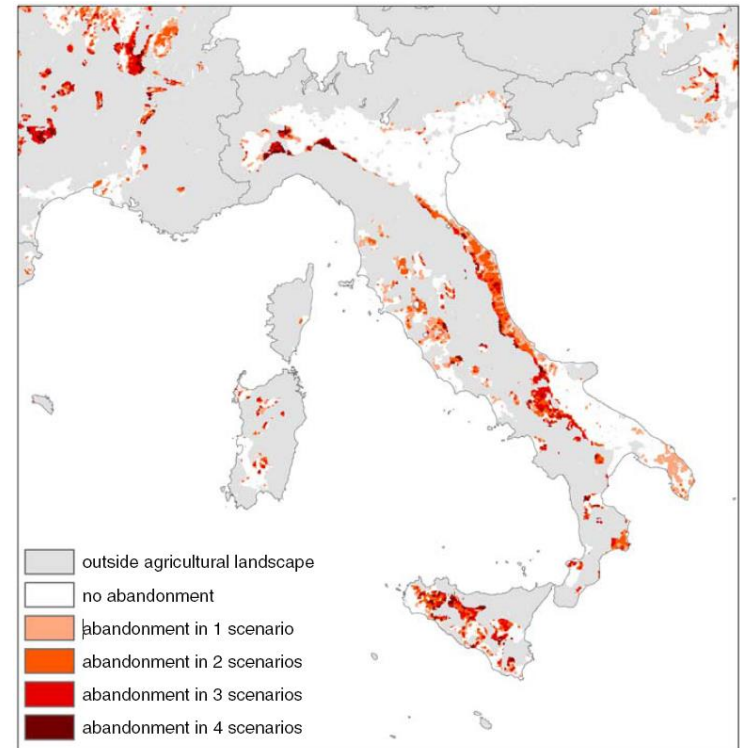
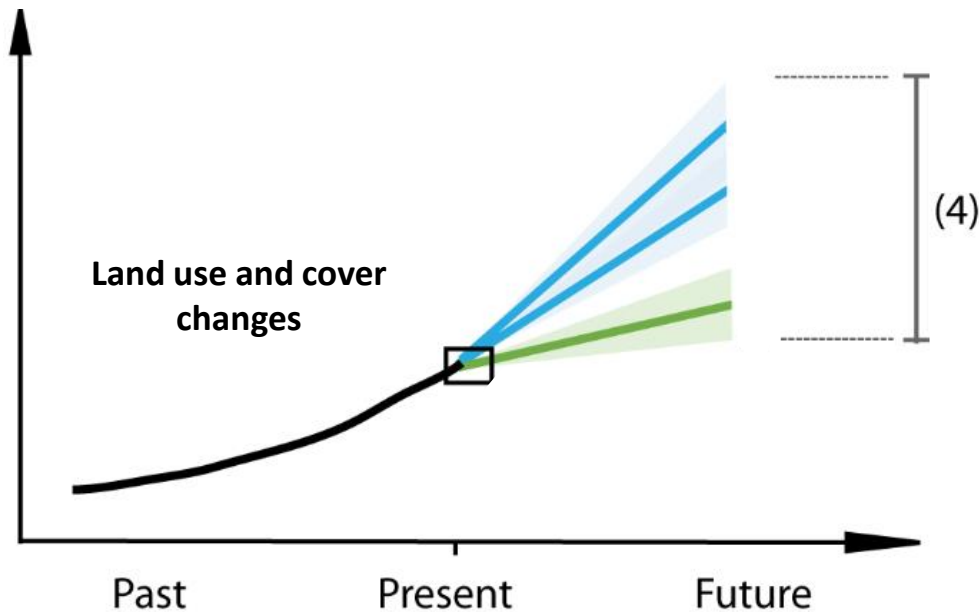
Mas et al, 2011

## IMPLICATIONS FOR LUCC MODELING

Estimate the spatial uncertainties from various models (as in climate change modelling)  
Assume the system to be stationary in the future



# FOUR TYPE OF UNCERTAINTIES: (4) ENSEMBLE FUTURE UNCERTAINTY



Verburg et al, 2010

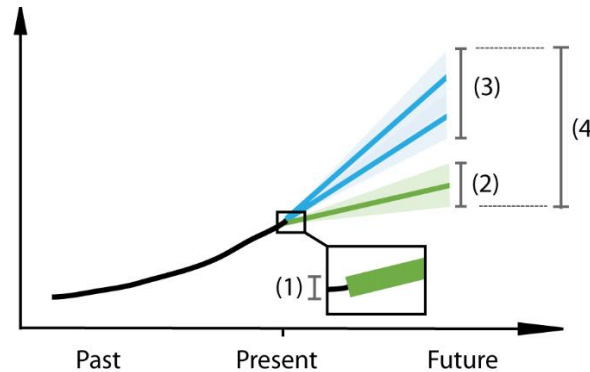
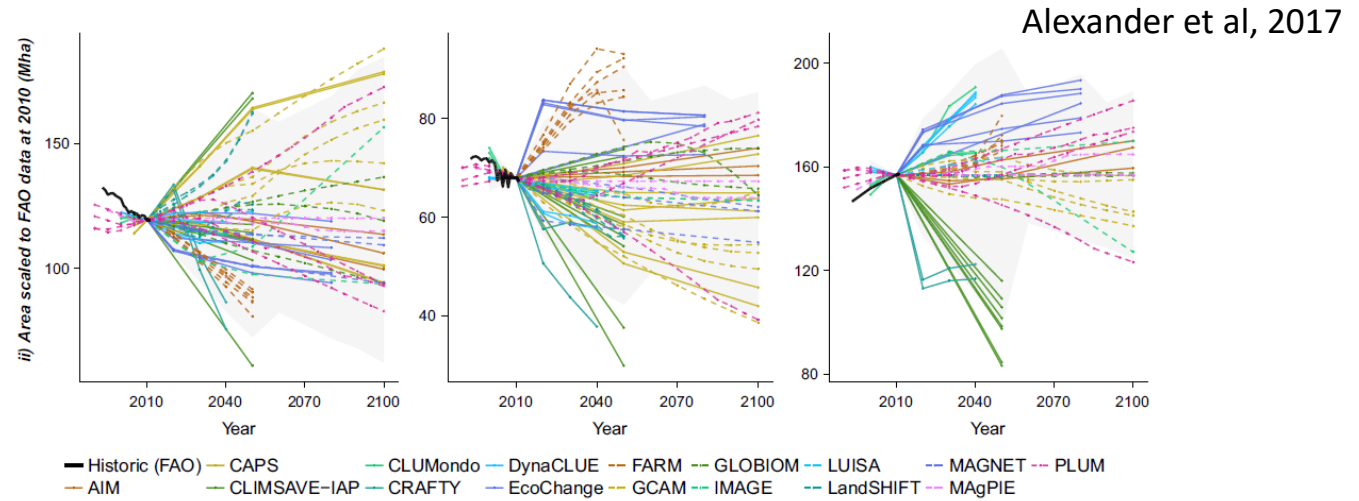
## VALIDATION TECHNIQUES

Occurrences of simulated LUCC from various scenarios / models

## IMPLICATIONS FOR LUCC MODELING

Estimate the envelope of potential future LUCC  
Account for contrasted / non-stationary scenarios

# To SUM UP



- (1) Map accuracy
- (2) Inherent model uncertainty
- (3) Ensemble model uncertainty
- (4) Future ensemble uncertainty

Two opposite paradigms... using common techniques

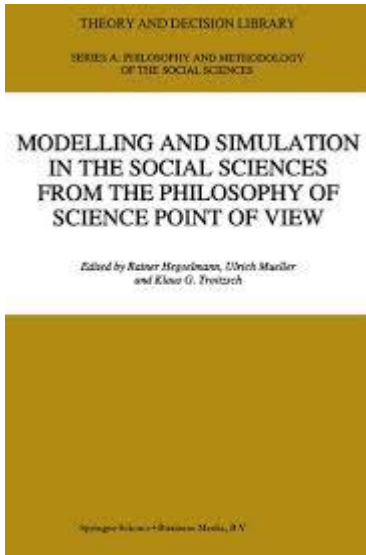
## Modelling

Improving / assesing the  
predictive power

## Future studies

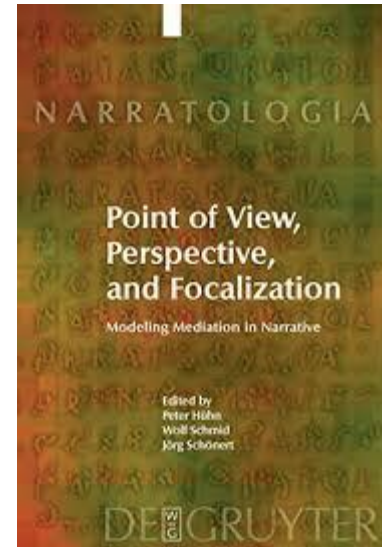
Severals possible futures  
≠ prediction

# PROSPECTS

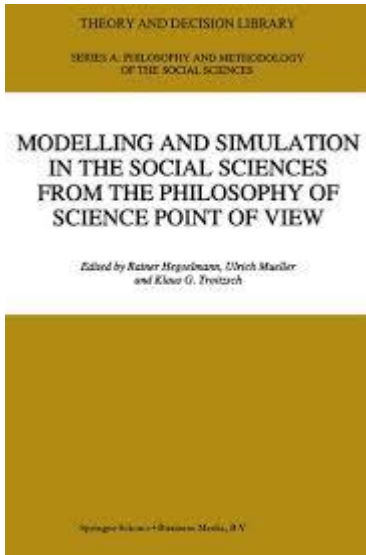


→ The long term future can't be validated

The aim is to increase the confidence end-users can have in models outcomes ←

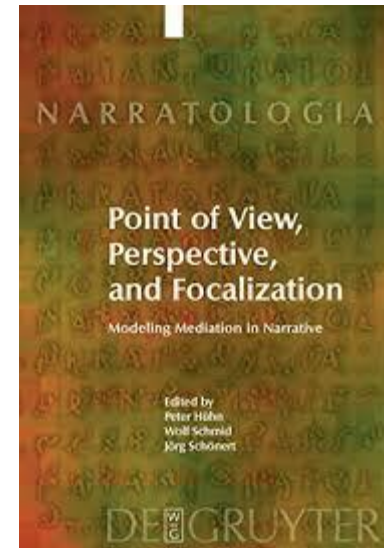


# PROSPECTS



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If a model is able to...

- ... simulate what narratives expect (new transitions, new land uses or land covers, various land demands, etc.)
- ... simulate what participants have designed
- ... simulate LUCC over a past period
- ... be described transparently (avoiding 'black-box')

Creativity

Legitimacy

Consistency

Transparency

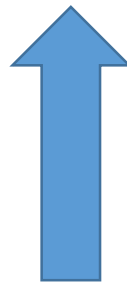


# PROSPECTS

## Validation of simulated LUCC for contrasted scenarios ?

*Plausibility ?*

**Respect of Future Studies principles**



**Validation of scenarios coherency and consistency**

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