

# Do institutions matter in global land use change modelling?

## Taking differences in environmental institutional quality into account

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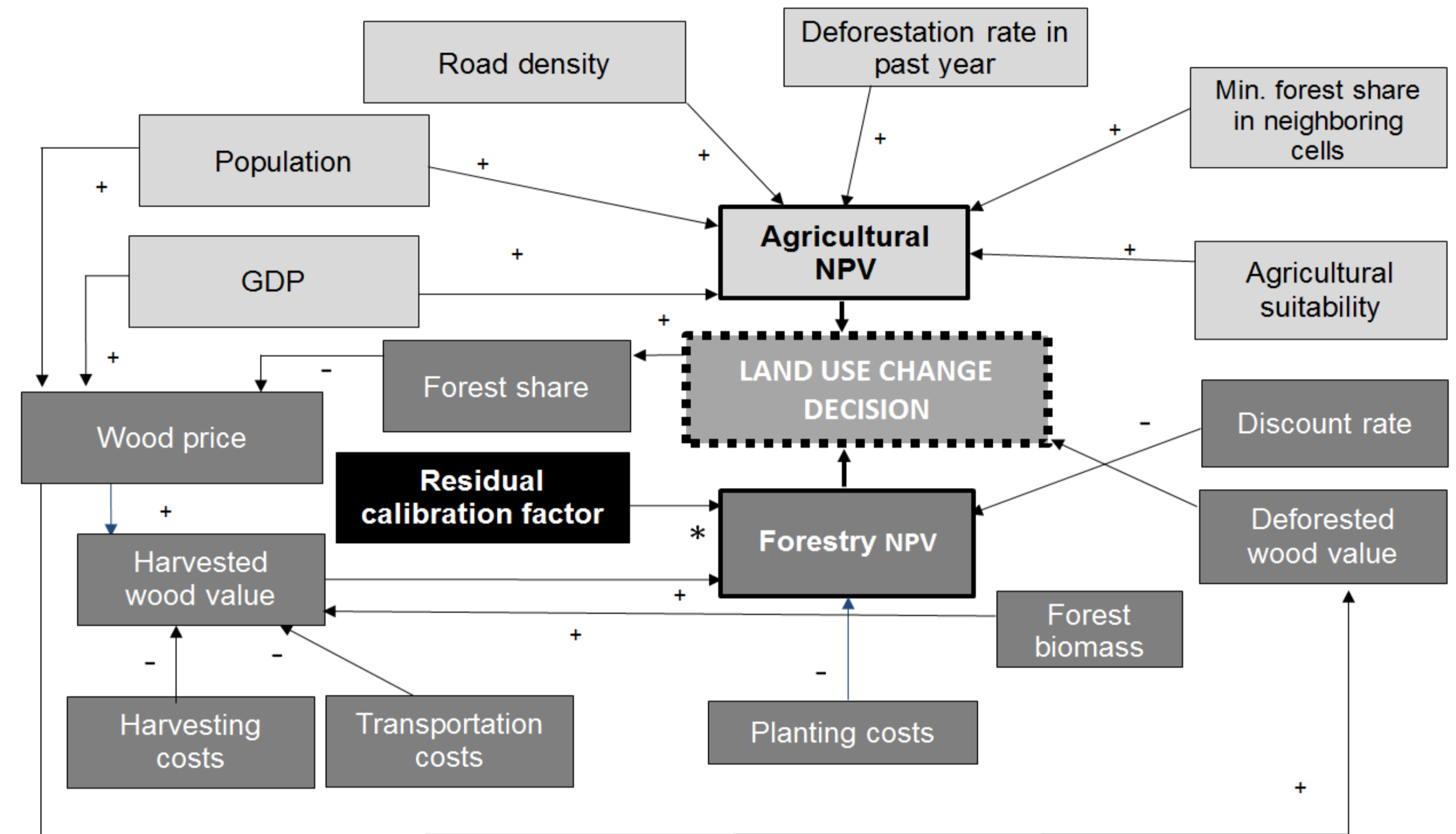
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### 1. Introduction

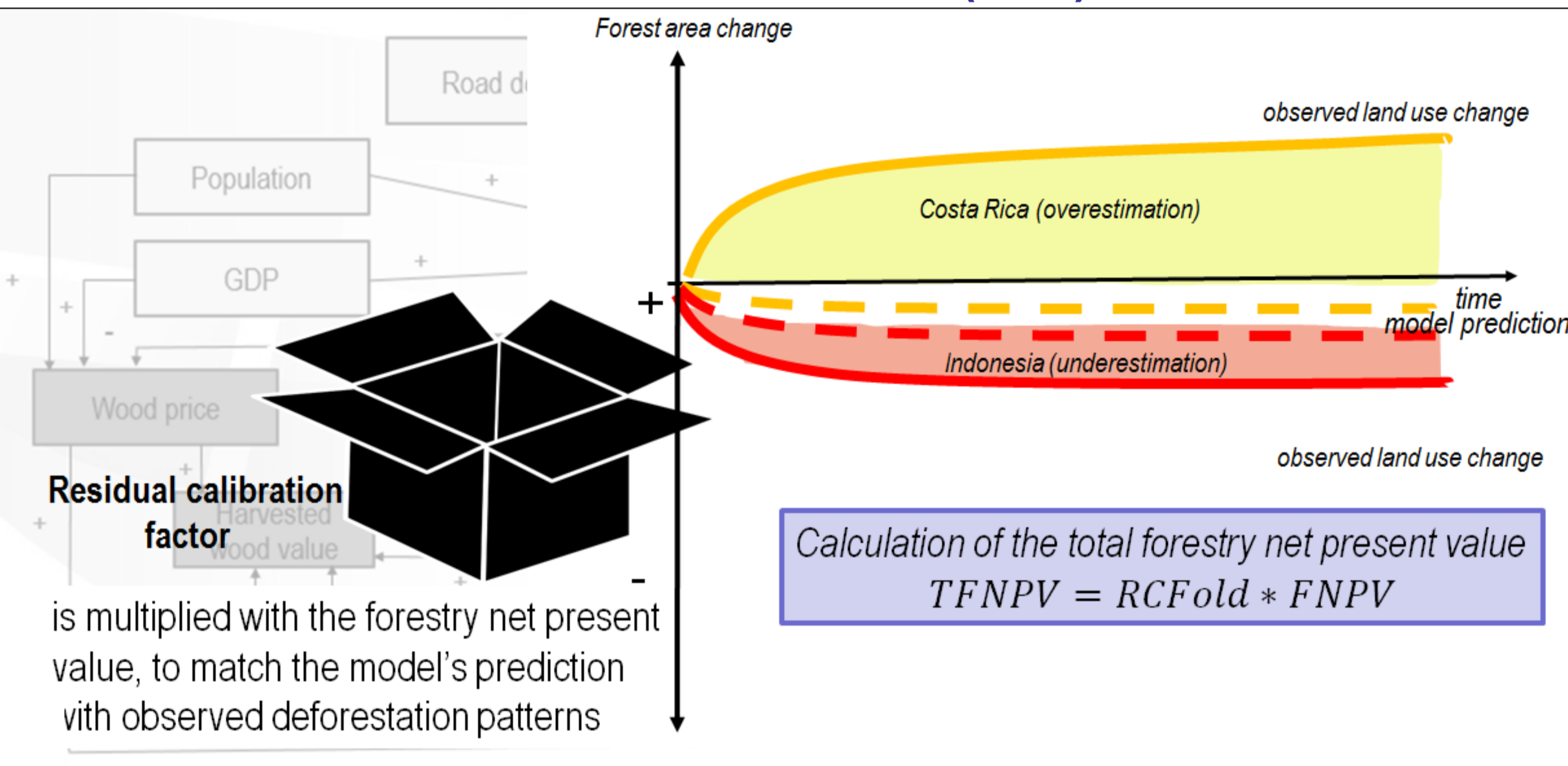
Land use/land cover change models are commonly used to inform integrated assessments and to provide advice on climate change mitigation, securing food supply, conserving ecosystems services and other policy objectives. As an example, IIASA's Global Forest Model (G4M) has a biophysical and an economic component. Precisely, it compares the net present value of agriculture and forestry and makes a land use change decision based on this comparison.

Moving beyond biophysical processes and economic tradeoffs, we here aim at understanding in how far integrating differences in environmental institutional quality can improve the representation of forest cover change processes of the model.

### 2. The Global Forest Model (G4M)



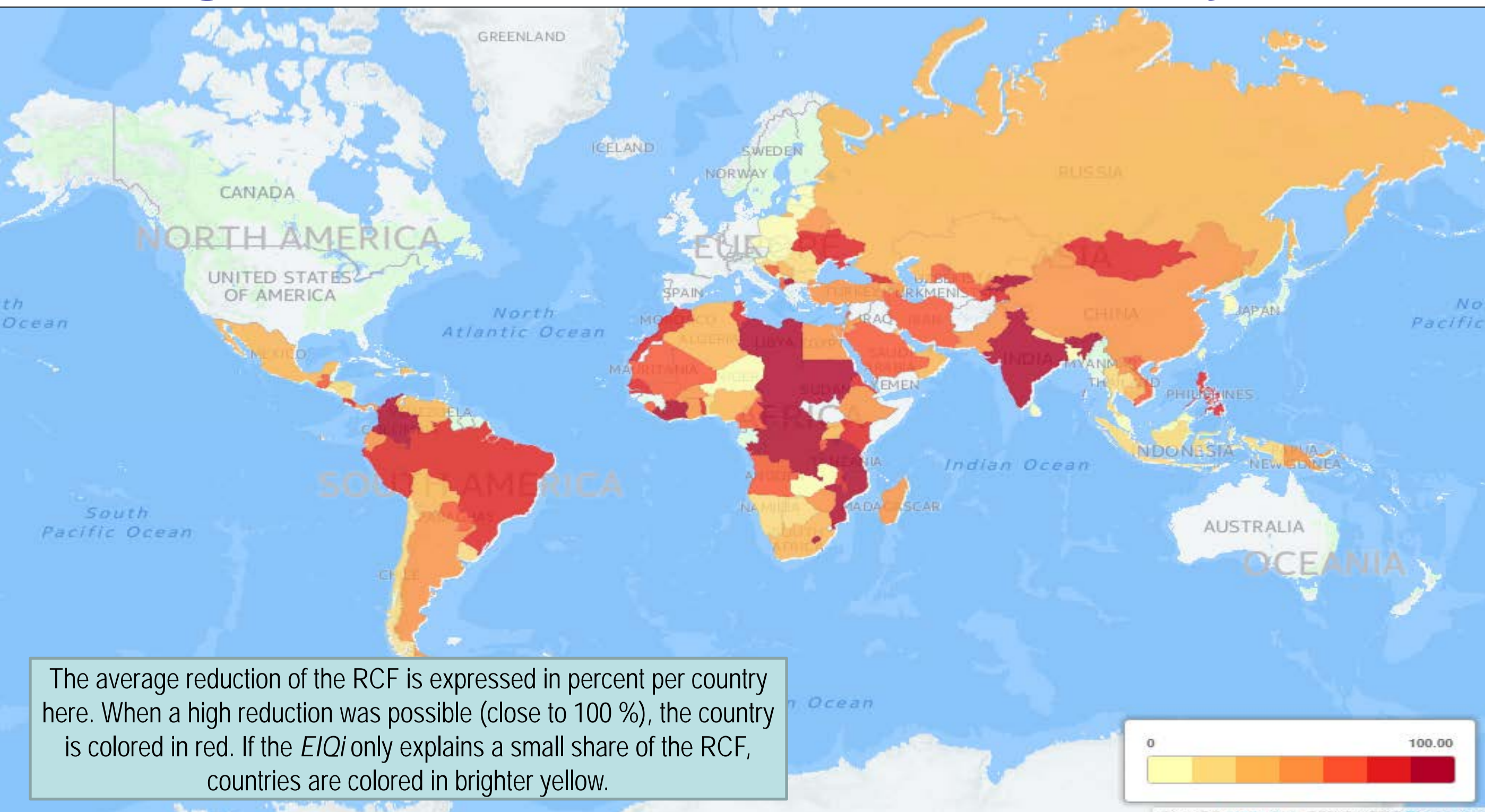
### 3. The model's residual calibration factor (RCF)



New calculation of the total forestry net present value, taking differences in EIQ into account:

$$TFNPV = RCF_{new}^{\frac{1}{EIQ}} * FNPV$$

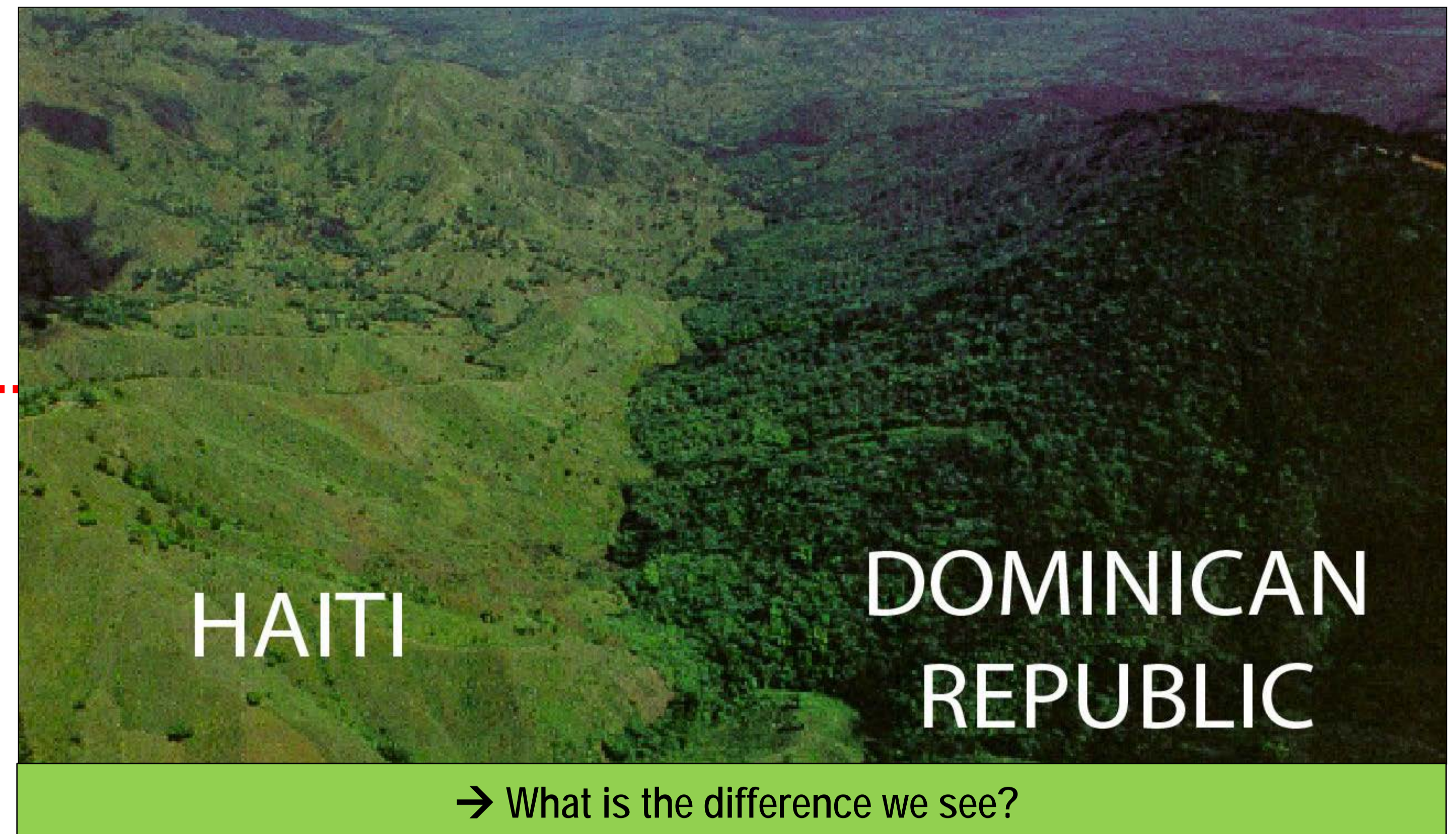
### 6. Average reduction of the residual calibration factor by 44.95 %



The average reduction of the RCF is expressed in percent per country here. When a high reduction was possible (close to 100 %), the country is colored in red. If the EIQ only explains a small share of the RCF, countries are colored in brighter yellow.

### Acknowledgements

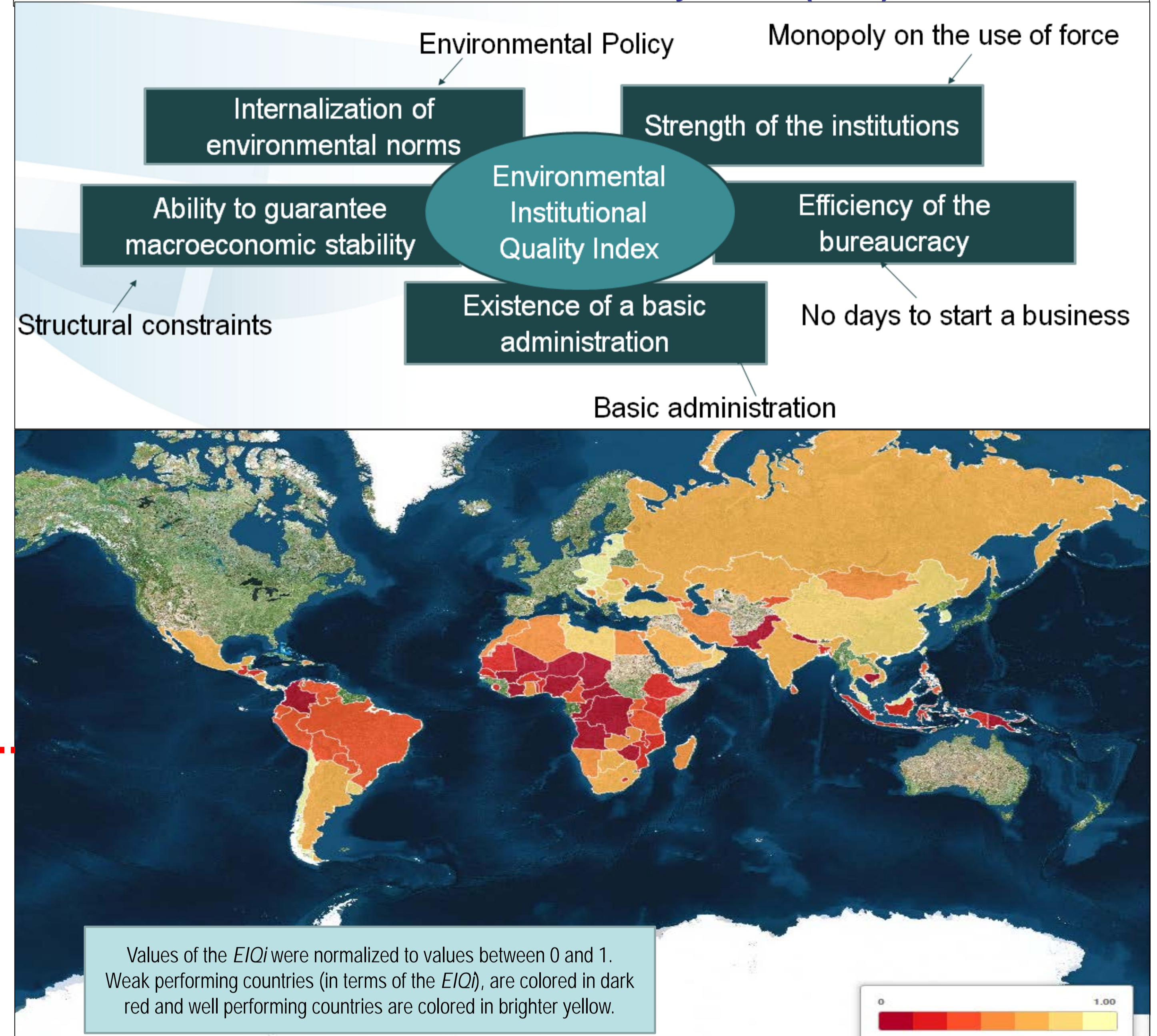
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### 4. Sources for indicators on environmental institutional quality

Name	Source	Availability	Indicators
Worldwide Governance Indicators (WGI)	Kaufmann et al. (2010)	2000 - 2010 <sup>a</sup>	6
Country Policy and Institutional Assessment (CPIA)	The World Bank Group (2014)	2005 - 2010	10
Global Competitiveness Index (GCI) <sup>b</sup>	Porter et al. (2000); Porter et al. (2008)	2006 - 2010	41
Bertelsmann Transformation Index (BTI) <sup>c</sup>	Donner and Hartmann (2008)	2003/2006-2010	29
Index of Economic Freedom (Heritage Foundation (HT))	Johnson and Sheehy (1995) <sup>d</sup>	2000 - 2010	7
Economic Freedom of the World Index (Fraser Institute (FI))	Gwartney et al., (1996) <sup>e</sup>	2000/2005 - 2010	21
Doing Business (DB) - Economy Rankings (World Bank (WB))	The World Bank Group (2015)	2004 - 2010	22
Freedom in the World Index (Freedom House (FH))	Gastil (1990); Messick (1996) <sup>f</sup>	2000 - 2010	1

### 5. The Environmental Institutional Quality Index (EIQ)



### 7. Conclusion & Outlook

The implementation of the EIQ index into the G4M model allowed to significantly reduce the RCF and thus to improve the model's ability to reflect the complexity of land use change processes. Next to more regional and country specific applications, in future research, it would be interesting to explore, in how far this approach could be translated to other resource use and overuse models, such as for example fishers, hydrological or mammal distribution models.

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