



GLOBAL IQ

IMPACT QUANTIFICATION OF GLOBAL CHANGES

Protecting forest & biodiversity

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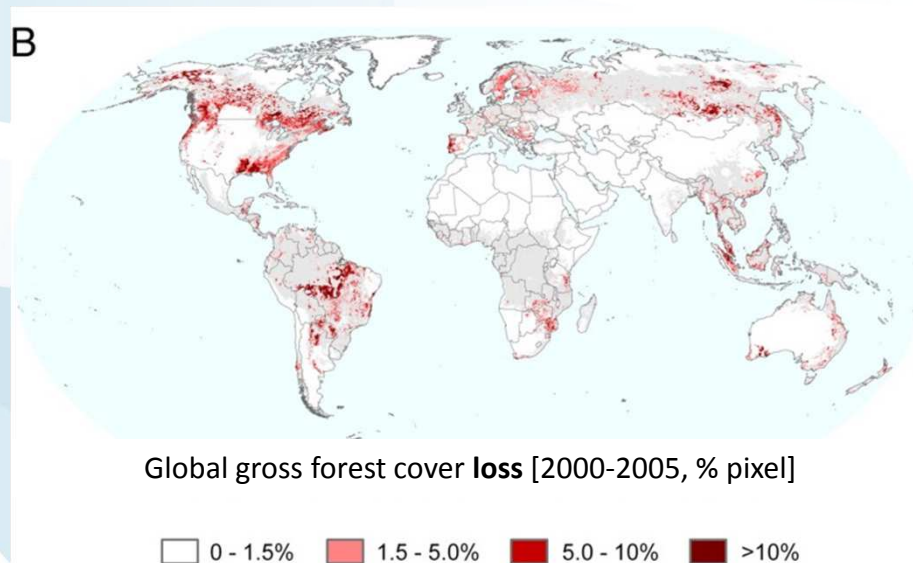


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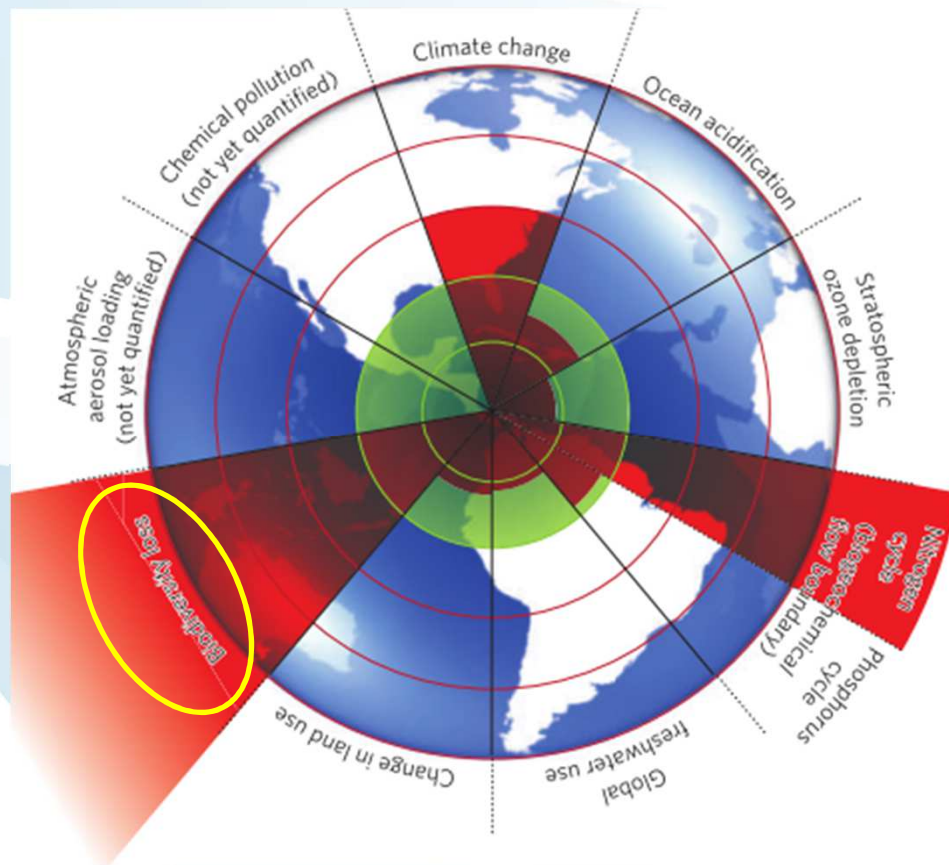
Introduction

- Increasing demand for agricultural products is a significant **threat** to natural areas



Hansen et al., PNAS (2010)

Introduction

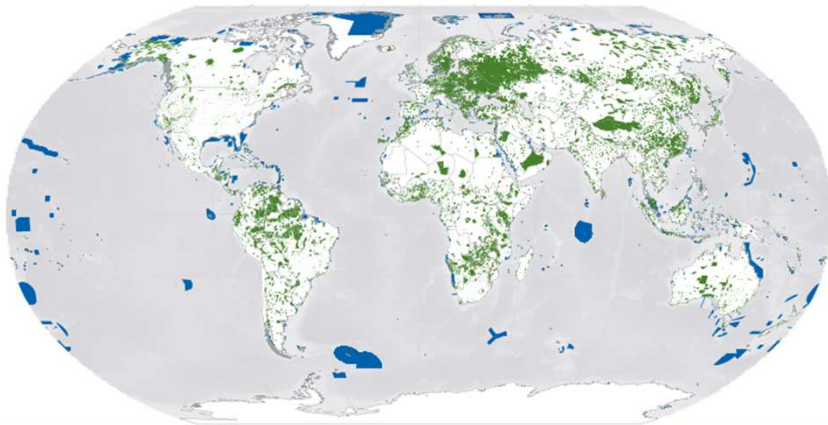


Rockström et al., Nature (2009)

- Increasing demand for agricultural products is a significant **threat** to natural areas
- Biodiversity loss is (one of) the largest anthropogenic impact on environment
species extinction rate
~ >100 x natural rate

Introduction

Figure 2.1 Spatial distribution of 177,547 nationally designated protected areas around the world. Protected areas with a marine component are shown in blue, solely terrestrial protected areas are shown in green.
Source: WDPA 2012



Bertzky et al. (2012)

- Increasing demand for agricultural products is a significant **threat** to natural areas
- Biodiversity loss is (one of) the largest anthropogenic impact on environment
- On the international agenda since 1992's Earth summit in Rio
- About 13% of Earth land is now protected

Outline

How to protect biodiversity in the reference scenario?

What consequences for global food security? for Europe?

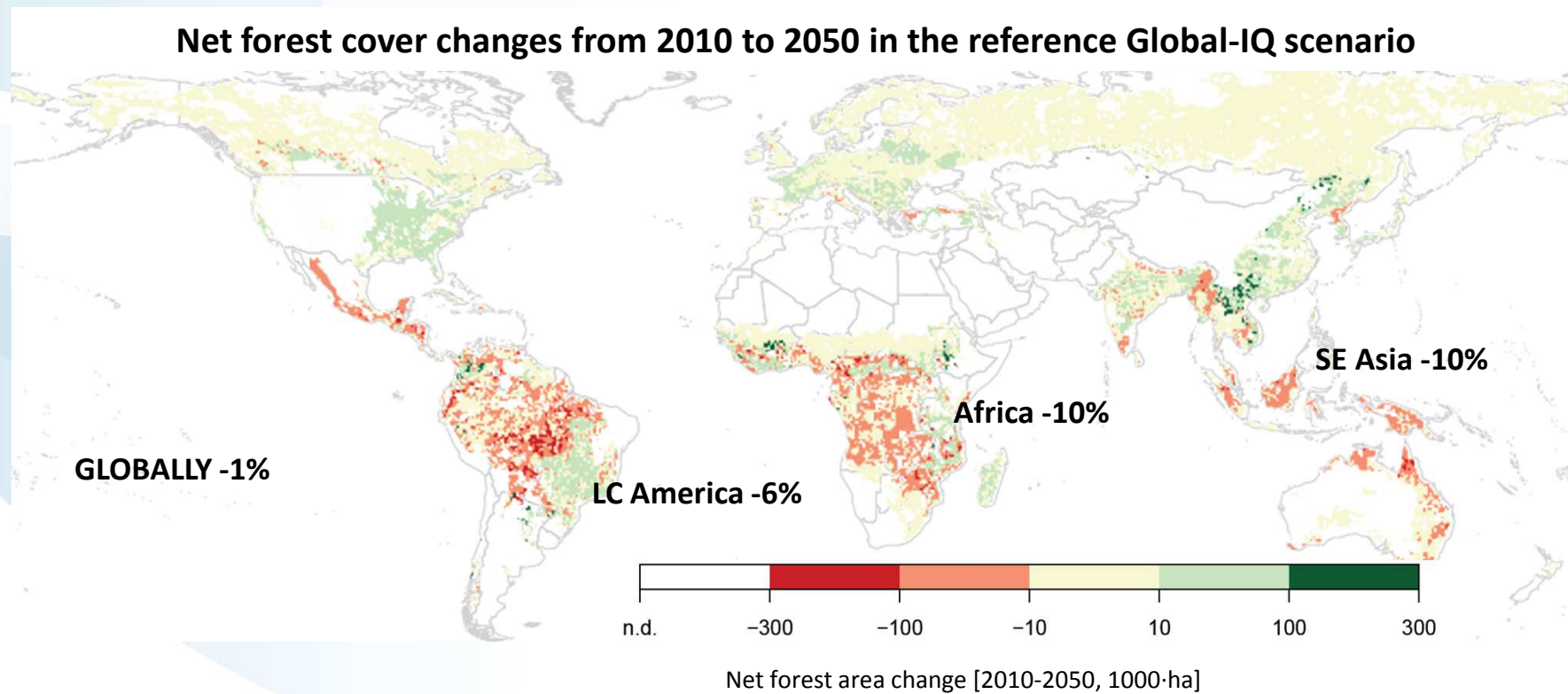
➔ Exploring policy options and trade-offs

- Methodology
- Main results
- Conclusions

Methodology

Methodology

- The  global dynamic land use model



Methodology

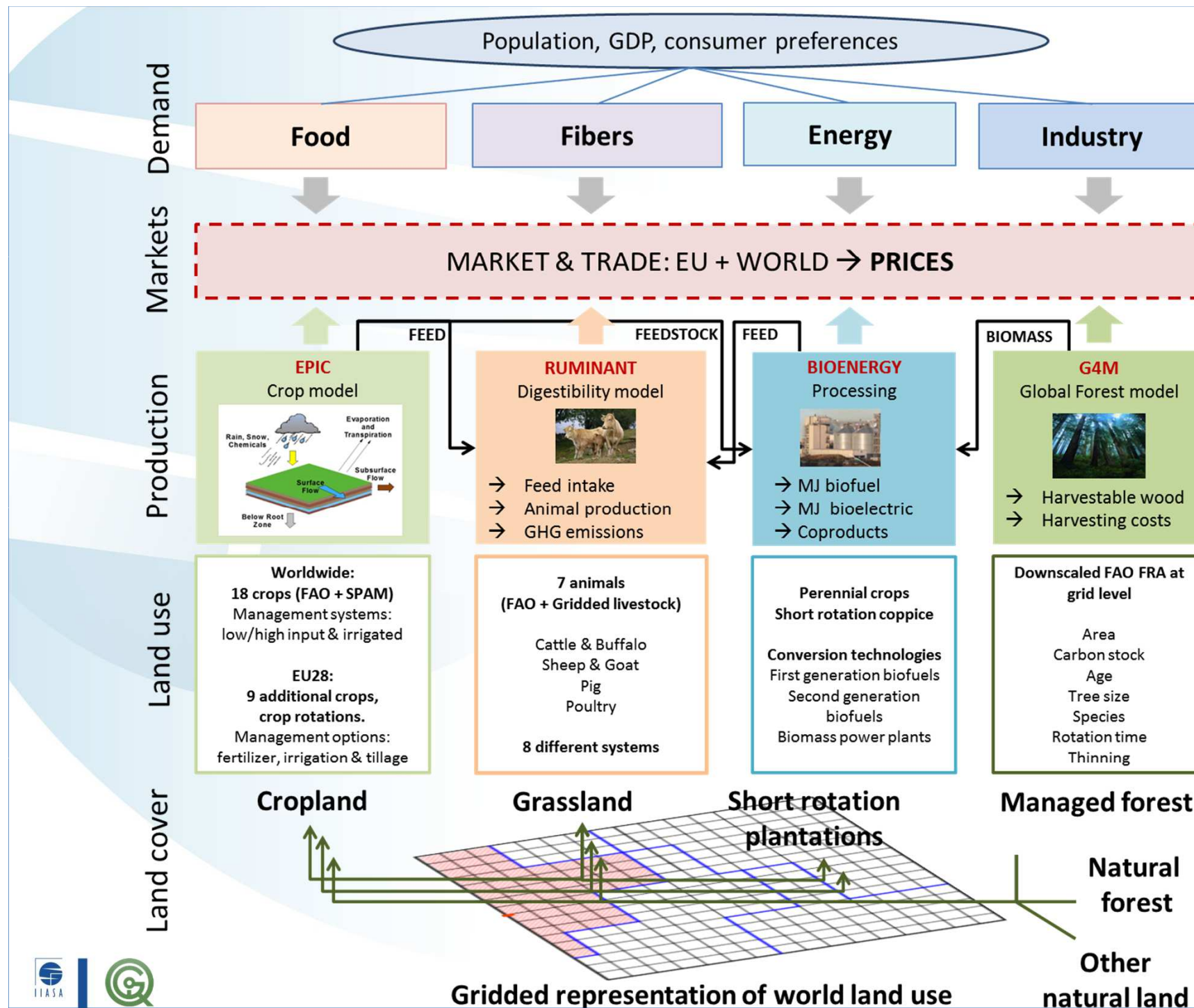
Havlík et al. Energy Policy (2011); Havlík et al. PNAS (2014)

- The  global dynamic land use model

A **bottom-up** dynamic spatially explicit global model of the agricultural, forestry and bioenergy sectors

Represents, at a **10 year** time step:

- **producers' behavior** at high resolution (> 10 k spatial units)
- **consumers' behavior** and **bilateral trade** at regional scale (30 regions)
- **market interactions** between consumers and producers of various regions



Methodology

Havlík et al. Energy Policy (2011); Havlík et al. PNAS (2014)

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A **bottom-up** dynamic spatially explicit global model of the agricultural, forestry and bioenergy sectors


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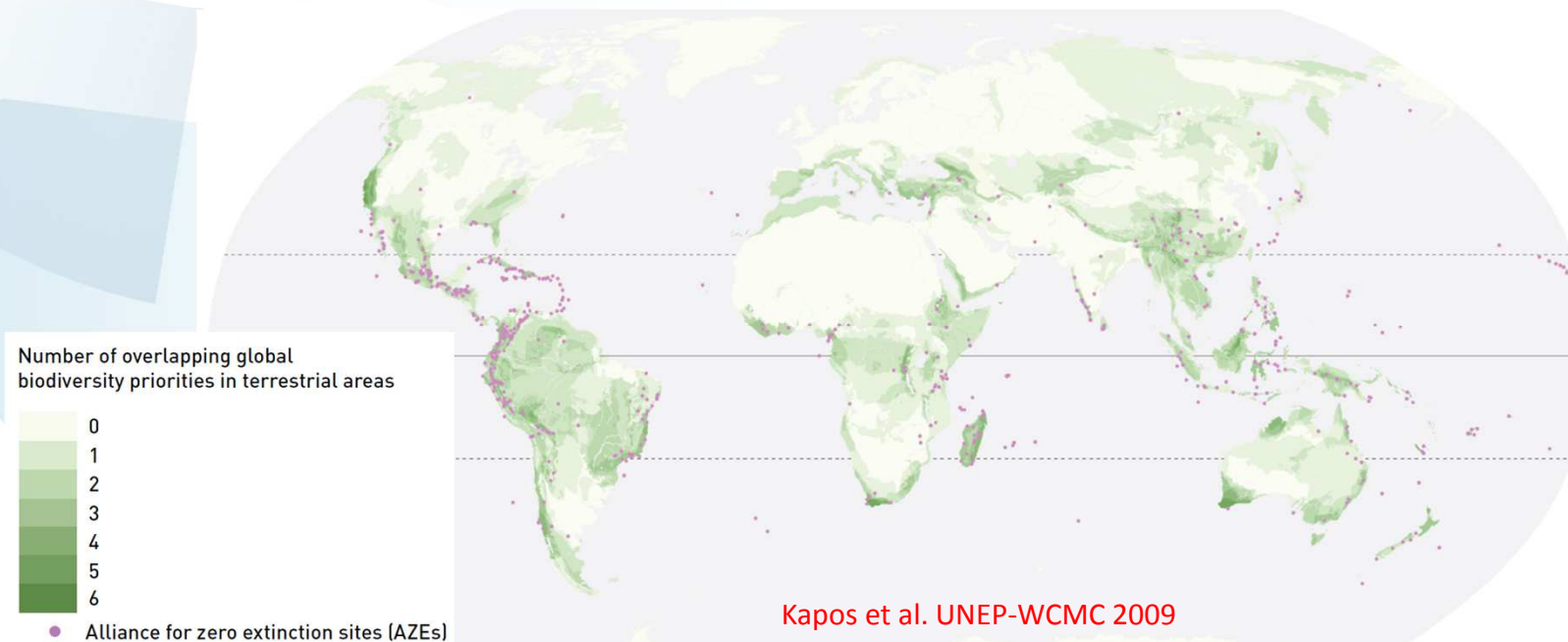
- **producers' behavior** at high resolution (> 10 k spatial units)
- **consumers' behavior** and **bilateral trade** at regional scale (30 regions)
- **market interactions** between consumers and producers of various regions

➔ **Well suited to test:**

- The implementation of conservation policies
- Its consequences on the global food system & policy alternatives

Methodology

- The  global dynamic land use model
- A global spatially explicit dataset on biodiversity richness
 - 6 different indicators of biodiversity UNEP-WCMC



Methodology

WWF (2011) Forest for a living planet

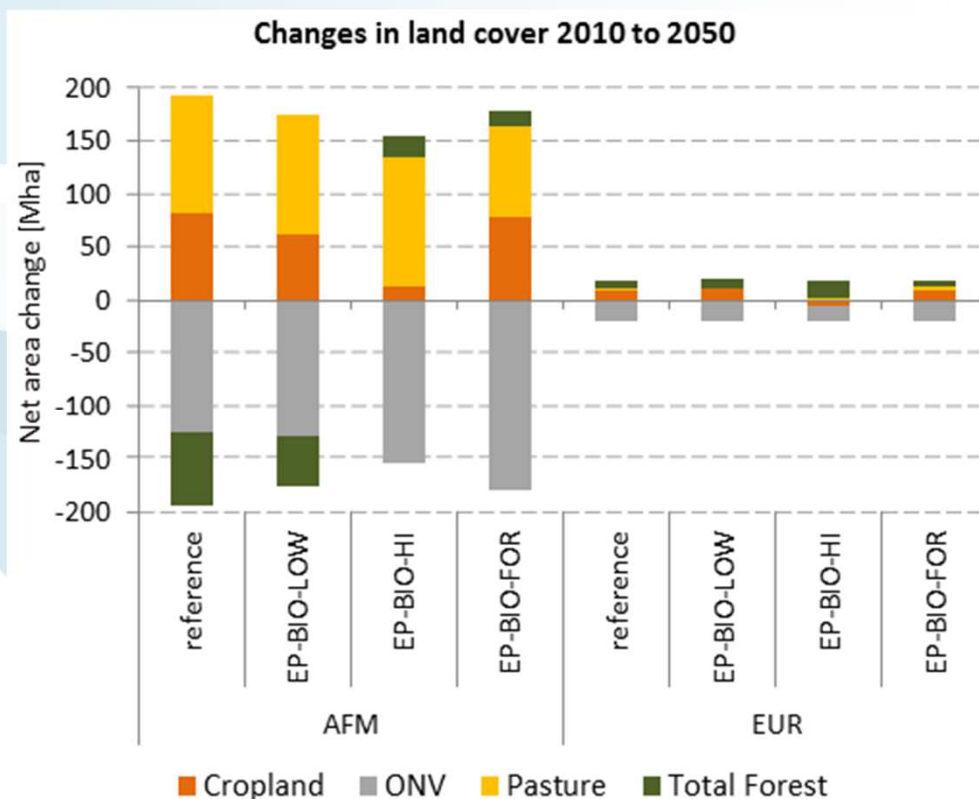
- In addition to the reference Global-IQ scenario, we implemented three different conservation scenarios:
 - **FOR** Zero net deforestation
(no specific biodiversity data)
 - **BIO-LOW** Protecting only biodiversity hotspots
(at least 3 biodiversity indicators) ~ 14% of global land cover
 - **BIO-HI** Protecting all biodiversity rich areas
(at least one biodiversity indicator) ~ 50% of global land cover
- In these areas, possible land conversions are restricted:
 - **FOR** Net deforestation forbidden
 - **BIO-HI/LOW** (grassland, other natural vegetation) -> (cropland) **also** forbidden

Main results

Main results

- Conservation policies would:

- Efficiently protect forests



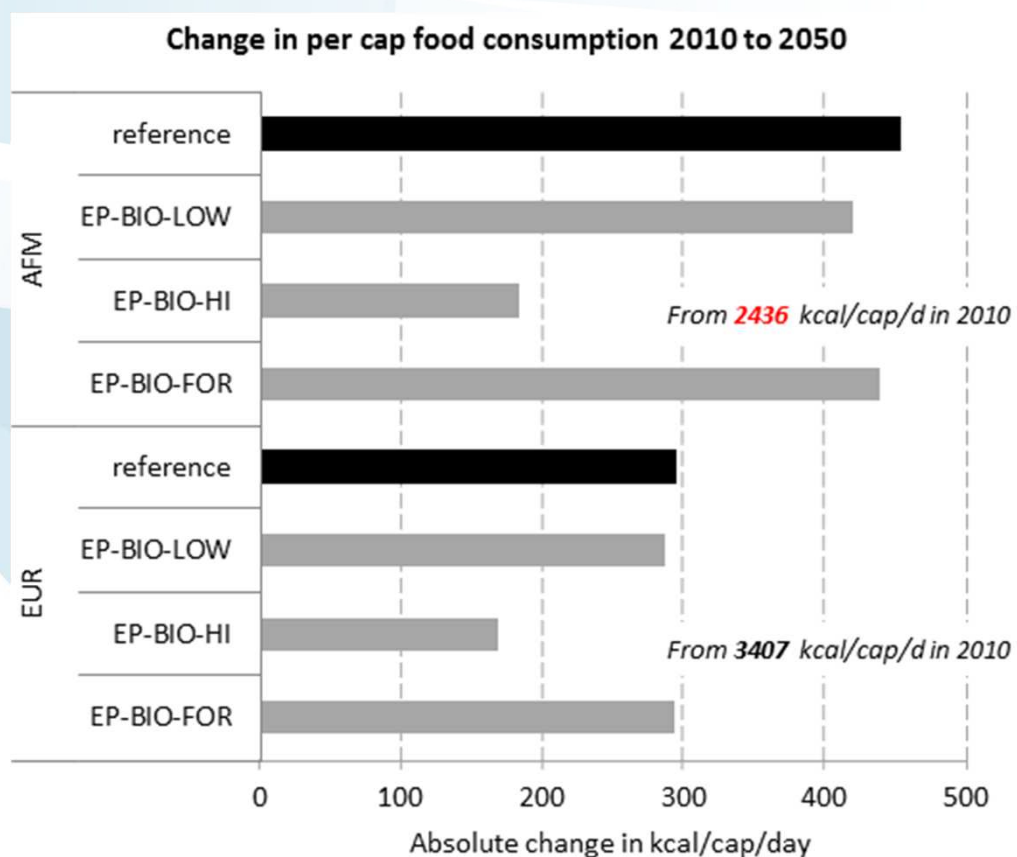
forest area [2010 to 2050]:
globally up to +5% instead of -1% in
reference scenario

- Move (extend) other natural vegetation losses to areas with:
 - Lower biodiversity richness
 - But lower potential productivity

Other nat. veg. area [2010-2050]:
globally up to -18% instead of -14%
in reference scenario [2010 to 2050]

Main results

- But could impact consumers



- with potentially large food security impacts in developing countries

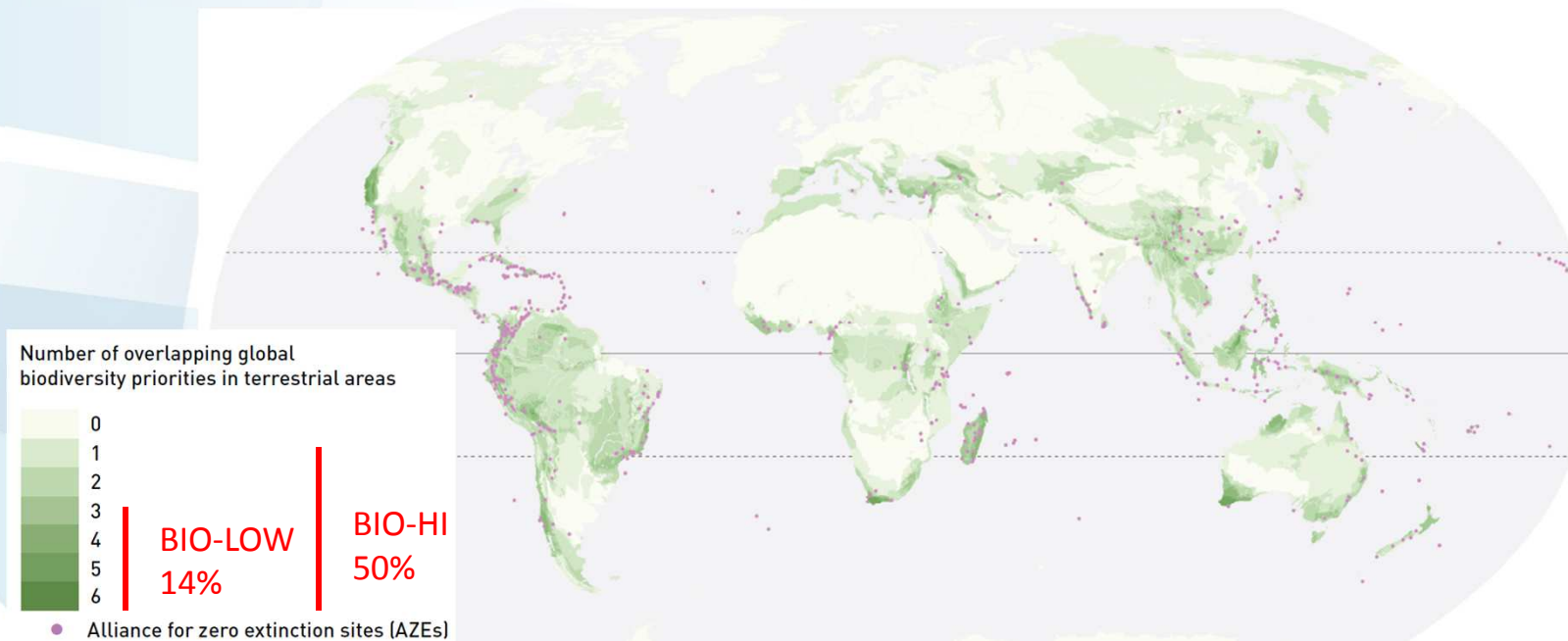
*per cap. food cons. in **Africa** [2010-2050]:*
+8% instead of +18% for reference scenario

- but also in Europe through increased pressure on global markets

global price index [2010-2050]:
+36% instead of -2% for reference scenario

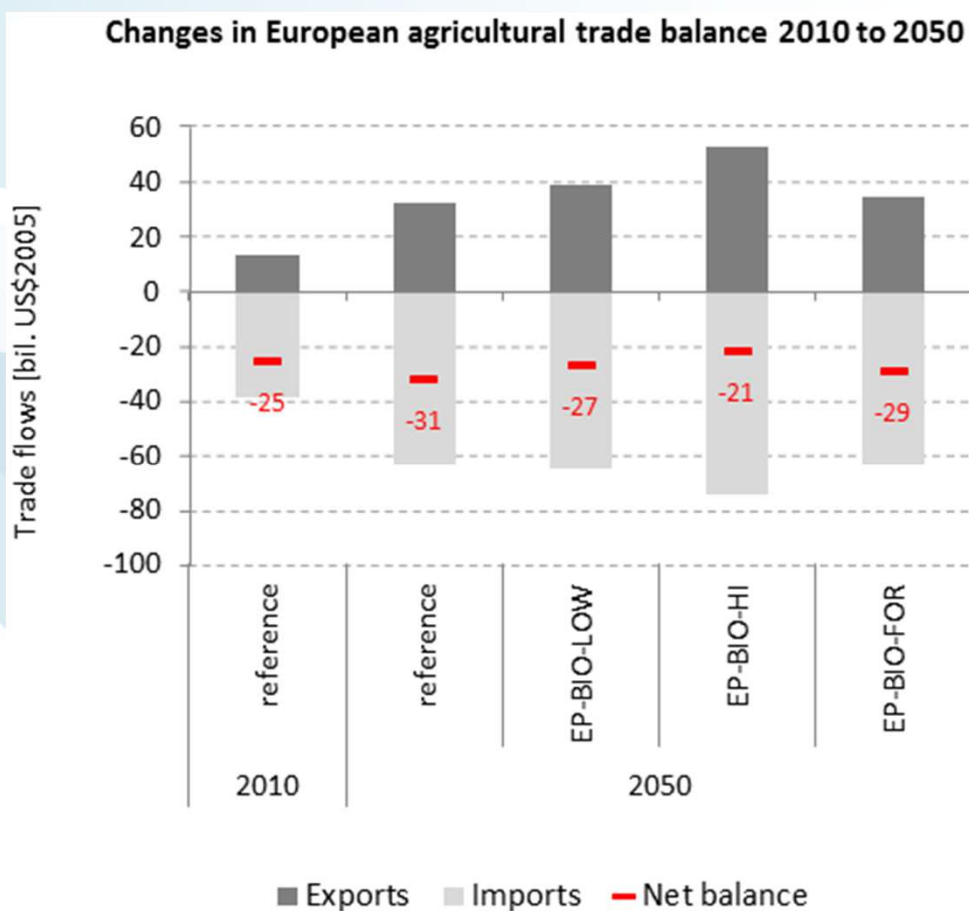
Main results

- But could impact consumers



Main results

- And favour EUR producers



- value of exports could largely increase

EUR Exports [2010-2050]:

up to 53 billion US\$2005 compared to 32 billion US\$ in reference scenario

- European agriculture trade deficit could be reduced

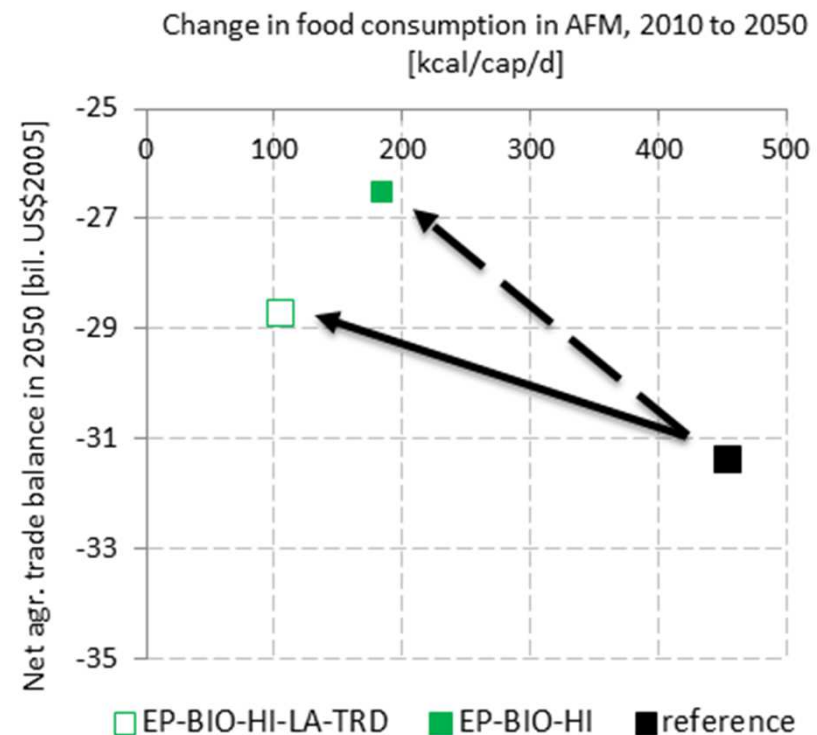
EUR net agr. trade balance [2010-2050]:

up to -21 billion US\$2005 compared to -31 billion US\$2005 in reference scenario [2010-2050]

To go further

- If trade adjustments were limited:
 - the trade-off with food security is enhanced
 - the gains for EUR producers is reduced

Effect of limited trade on conservation policy effect



To go further

- If trade adjustments were limited:
 - the trade-off with food security is enhanced
 - the gains for EUR producers is reduced
- Partial protection in SSA do not induce leakage effects
- Higher (but realistic) technological progress is not enough
- Transition towards more sustainable diets could largely reduce pressure on biodiversity

Dumollard et al., in prep

Conclusions

Conclusions

- Zero net deforestation does not threaten food security ...
 - ... in contrary to ambitious biodiversity protection targets
 - Conservation policies could however favour European producers and reduce the European agricultural trade deficit
 - Some mitigation options exists (more sustainable diets, high yield improvements), but also aggravating factors (trade restrictions)
- ➔ Achieving an ambitious biodiversity protection policy is a challenge
- ➔ Approaches beyond land sparing must be further investigated



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Thank you !

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Domenico Rossetti Di Valdalbero - European Commission Officer (EC)



EUROPEAN COMMISSION
European Research Area



22, date

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Leclère et al., GIQ Final Conference, 17th June 2014

References

- Bertzky, B., Corrigan, C., Kemsey, S., Ravilious, C., Besacon, C., & Burgess, N. (2012). *Protected Planet Report 2012: Tracking progress towards global targets for protected areas*. IUCN, Gland, Switzerland & UNEP-WCMC, Cambridge, UK.
- Hansen, M. C., Stehman, S. V, & Potapov, P. V. (2010). Quantification of global gross forest cover loss. *Proceedings of the National Academy of Sciences of the United States of America*, 107(19), 8650–5. doi:10.1073/pnas.0912668107
- Dumollard, G., Havlík, P. (in prep), *The biodiversity protection vs. food production dilemma, a land-use modeling approach*
- Havlík, P., Schneider, U. a., Schmid, E., Böttcher, H., Fritz, S., Skalský, R., ... Obersteiner, M. (2011). Global land-use implications of first and second generation biofuel targets. *Energy Policy*, 39(10), 5690–5702. doi:10.1016/j.enpol.2010.03.030
- Havlík, P., Valin, H., Herrero, M., Obersteiner, M., Schmid, E., Rufino, M. C., ... Notenbaert, A. (2014). Climate change mitigation through livestock system transitions. *Proceedings of the National Academy of Sciences of the United States of America*, 111(10), 3709–14. doi:10.1073/pnas.1308044111
- Kapos V, Ravilious C, Campbell A, Dickson B, Gibbs H, Hansen M, Lysenko I, Miles L, Price J, Scharlemann JPW, Trumper K (2009) Carbon and biodiversity: a demonstration atlas. UNEP-WCMC, Cambridge, UK.
- Rockström, J., Steffen, W., & Noone, K. (2009). A safe operating space for humanity. *Nature*, 461. Retrieved from <http://www.nature.com/nature/journal/v461/n7263/full/461472a.html>
- WWF (2011) WWF living forests report: Chapter 1, Forests for a living planet. ISBN 978-2-940443-32-1