



International Institute for
Applied Systems Analysis
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science for global insight

Global Outlook: Agriculture and food research as seen from a global perspective

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Ecosystem Services and Management Program

IIASA

EUAGRI Conference 2012

Bio-economy and its context – the role of Agriculture

Tuesday, October 2, 2012

Ministry of Agriculture, Vienna



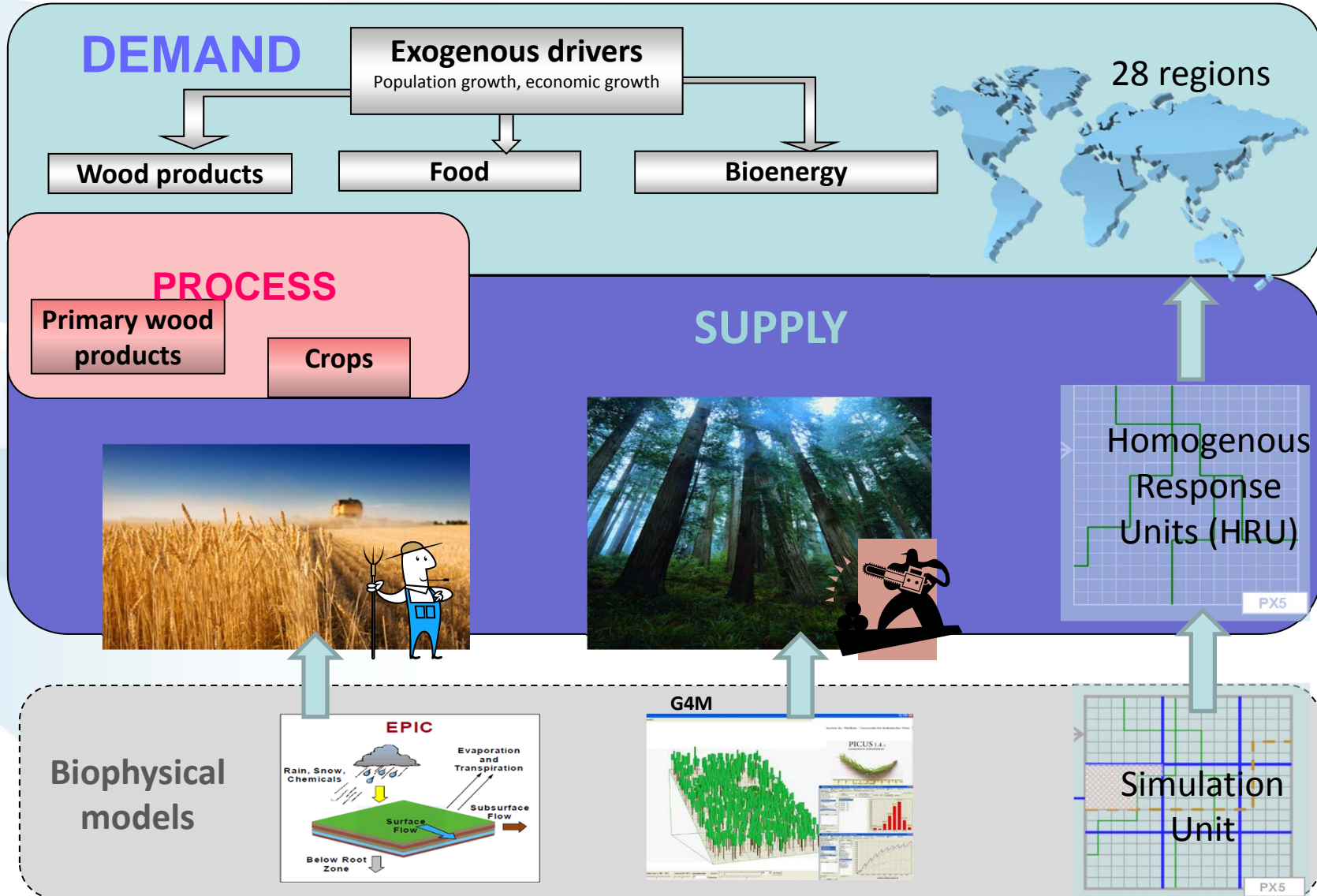
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Issues

- Every AG-research problem is unique
- Global consistency of local actions
- Long-term consistency of today's action
- Sectorial consistency
- Robust decision making uncertainty
 - Environmental
 - Technological
 - Market
 - Policy

How do we generate an integrated view on the Global Agricultural sector?

GLOal BIOSphere Management Model



Issues of basic input data for biophysical modeling







Geospatial Land Cover Validation at geo-wiki - Mozilla Firefox

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http://geo-wiki.org/#

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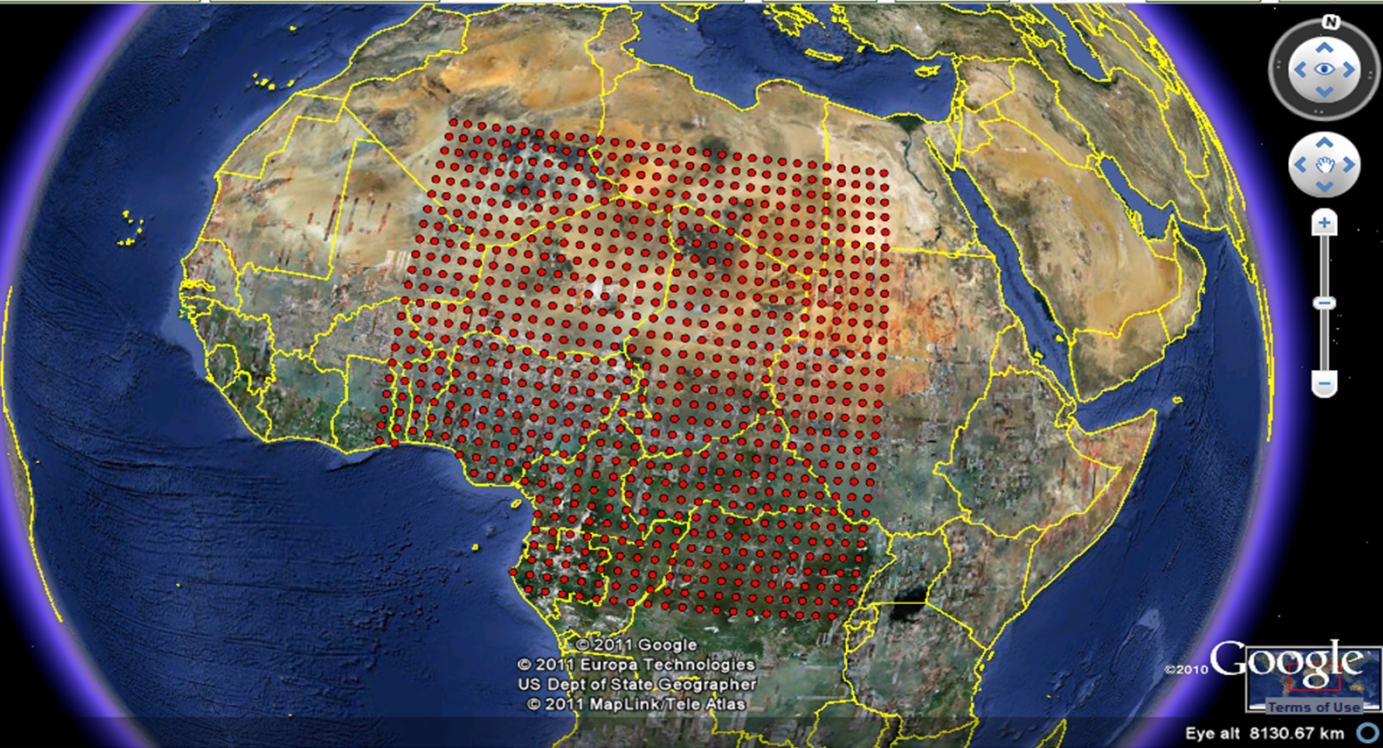







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Toolbar

 Normal mode

Quick Start
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Transparency: 30
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[Land Cover Data](#)
 MODIS details
 GlobCover details
 GLC-2000 details
[Disagreement](#)
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 Spin the Earth



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 Eye alt 8130.67 km

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Done

IIASA



Toolbar

Pixel validation

Quick Start

Validate random points

Validate my custom area

Transparency: 8

Show none

Land Cover Data

- MODIS details
- GlobCover details
- GLC-2000 details

Disagreement

- Combined Disagreement Map
- Cropland Disagreement Maps:**
 - Show GlobCover - GLC-2000
 - Show GlobCover - MODIS
 - Show MODIS - GLC-2000

Forest Disagreement Maps:

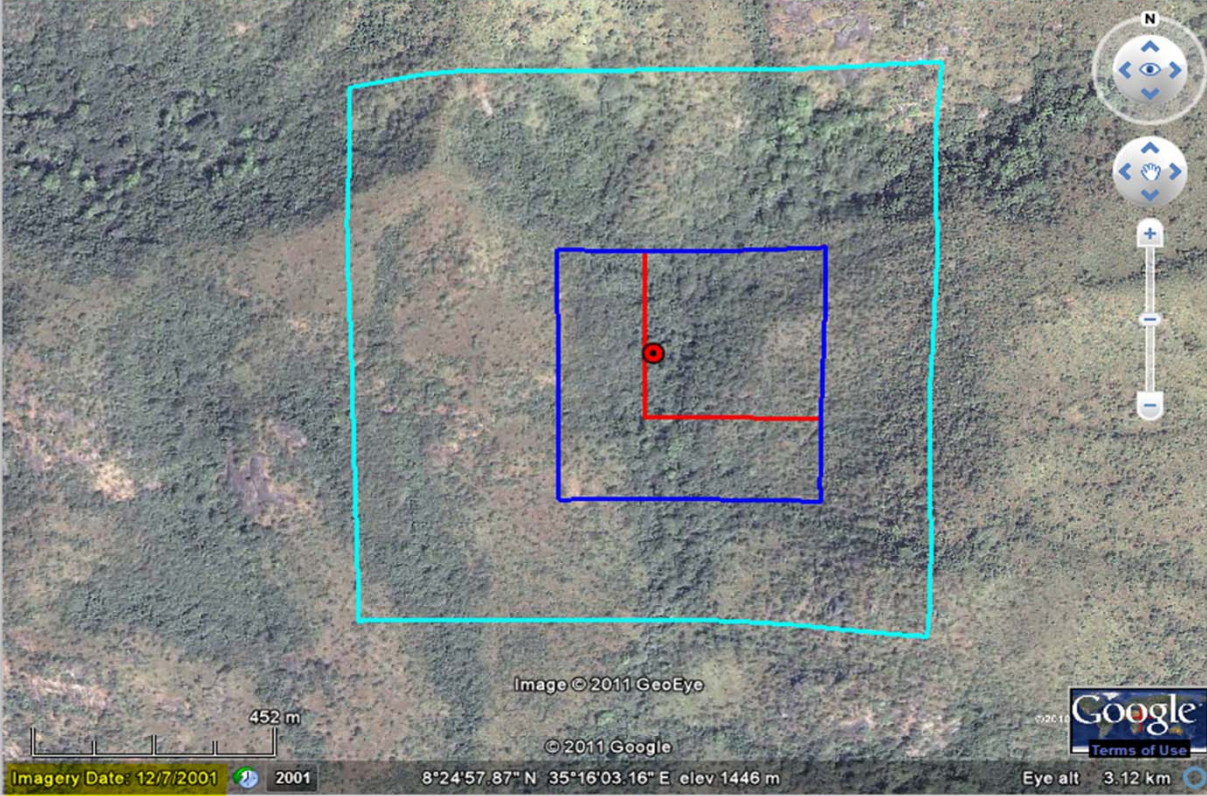
- Show GlobCover - GLC-2000
- Show GlobCover - MODIS
- Show MODIS - GLC-2000

Validation

Additional Data

Geocoding

Spin the Earth



Validate the landcover of the polygons:
Show instructions

good not sure bad

MODIS: Woody Savannahs

GlobCover: Mosaic grass or shrub or forest/Cropland

GLC-2000: Cultivated and managed areas

Correct class:
Tree cover

Provide picture URLs (ending with .jpg/.png) if available:
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More information about validation:
Google Image Date:

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Toolbar

Info button

Quick Start

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Transparency: 30

Show none

Land Cover Data

Show MODIS details

Show GlobCover details

Show GLC-2000 details

Disagreement

Show Combined Disagreement Map

Cropland Disagreement Maps:

Show GlobCover - GLC-2000

Show GlobCover - MODIS

Show MODIS - GLC-2000

Forest Disagreement Maps:

Show GlobCover - GLC-2000

Show GlobCover - MODIS

Show MODIS - GLC-2000

Validation

Already Validated Areas:

Show validated Areas

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[Geocoding](#)

Spin the Earth

MODIS:	Non-Woody Savannahs
GlobCover:	Closed-open mixed broadleaved-needleleaved forest
GLC-2000:	Cultivated and managed areas

409

North:

South:

© 2008 Google

Eye alt 8.71 km

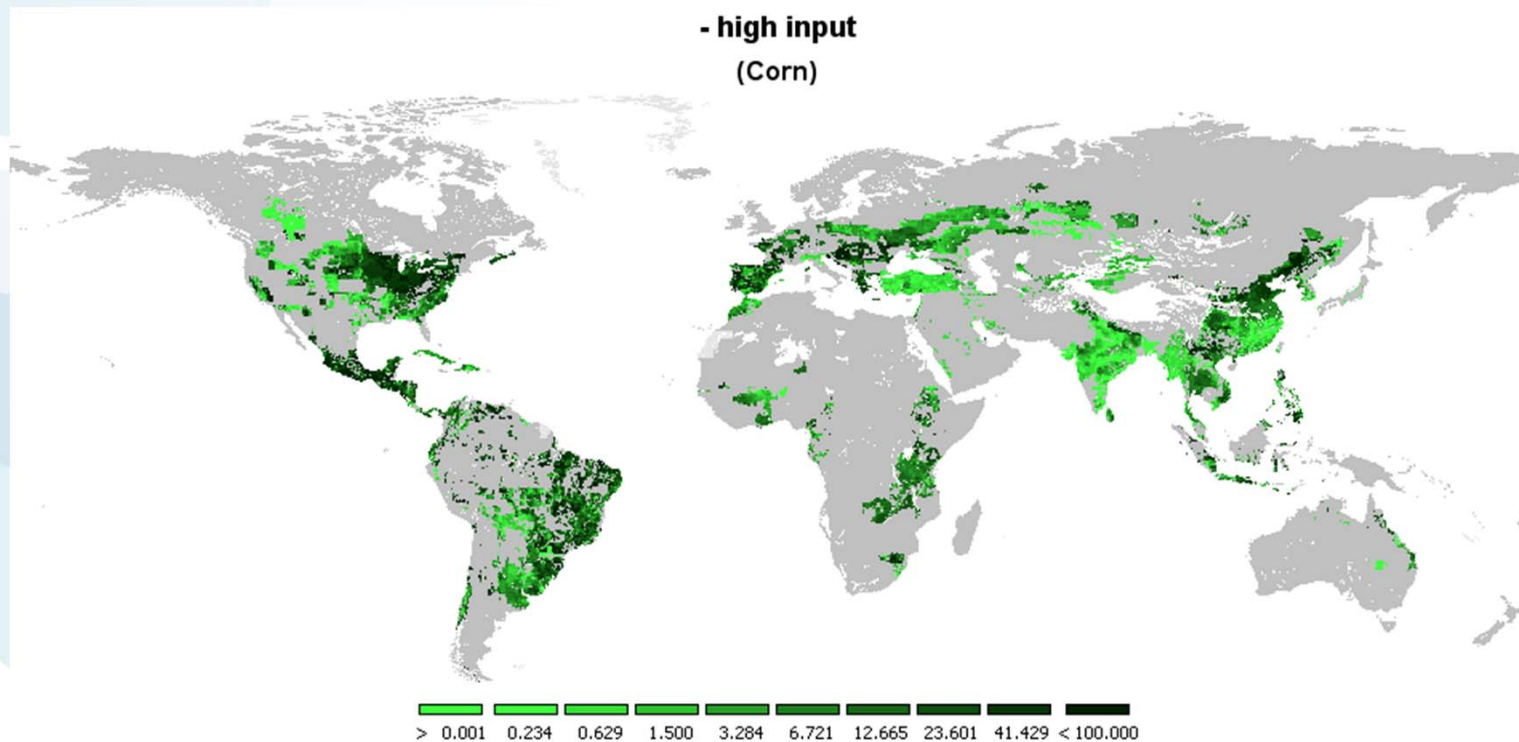
www.geo-wiki.org

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Initial crop areas distribution

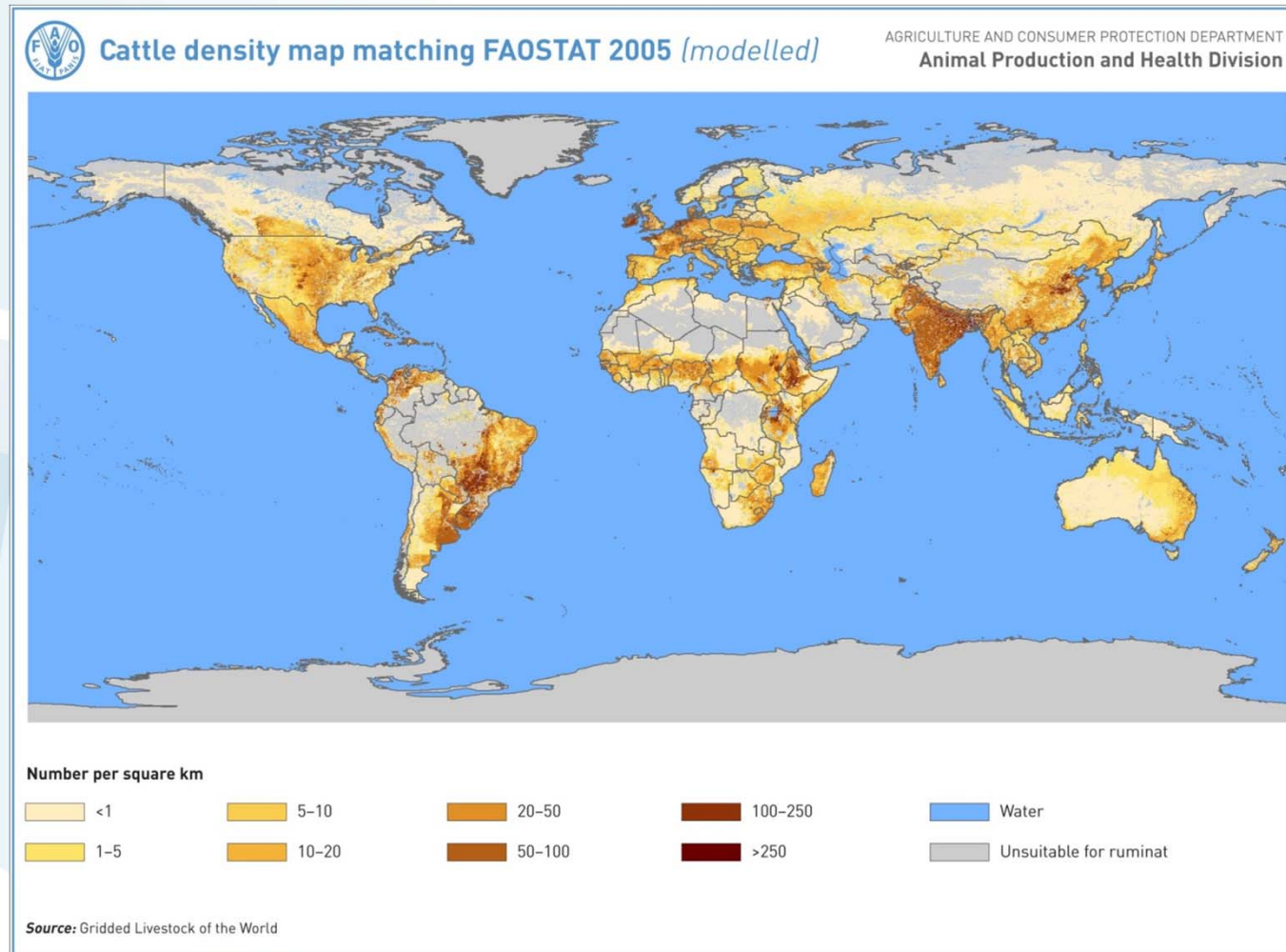
Spatial Production Allocation Model (SPAM) by You et al. (IFPRI)

- provides harvested area and physical area for 20 crops and 3 input systems



Initial livestock numbers distribution

Gridded Livestock of the World – Robinson et al. (2011)

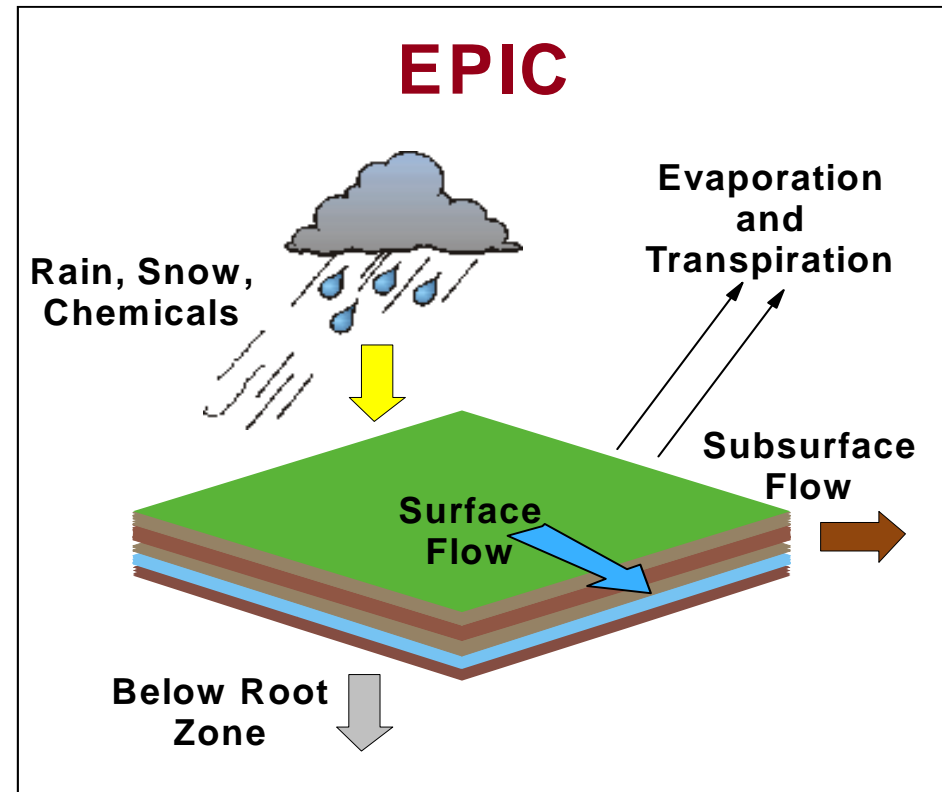


Biophysical Modeling

Physiological targeting by integrating modeling and Plant breeding

Processes

- Weather
- Hydrology
- Erosion
- [Crop Scheduling – google fq](#)
- Carbon sequestration
- Crop growth
- Crop rotations
- Fertilization
- Tillage
- Irrigation
- Drainage
- Pesticide
- Grazing
- Manure



Major outputs:

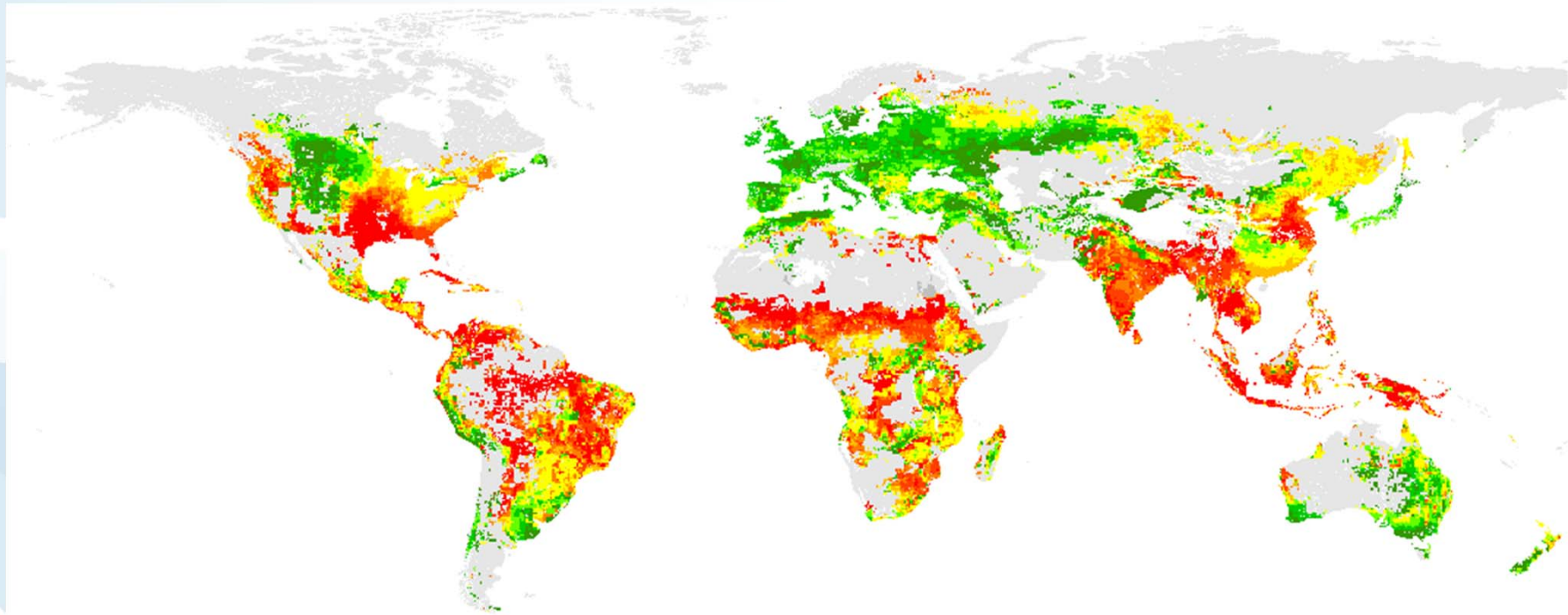
Crop yields, Environmental effects (e.g. soil carbon, nitrogen leaching)

20 crops (>75% of harvested area)

4 management systems: High input, Low input, Irrigated, Subsistence

Climate change impacts

Relative Difference in Means (2050/2100) in Wheat Yields
[Data: Tyndall, Afi Scenario, simulation model: EPIC]

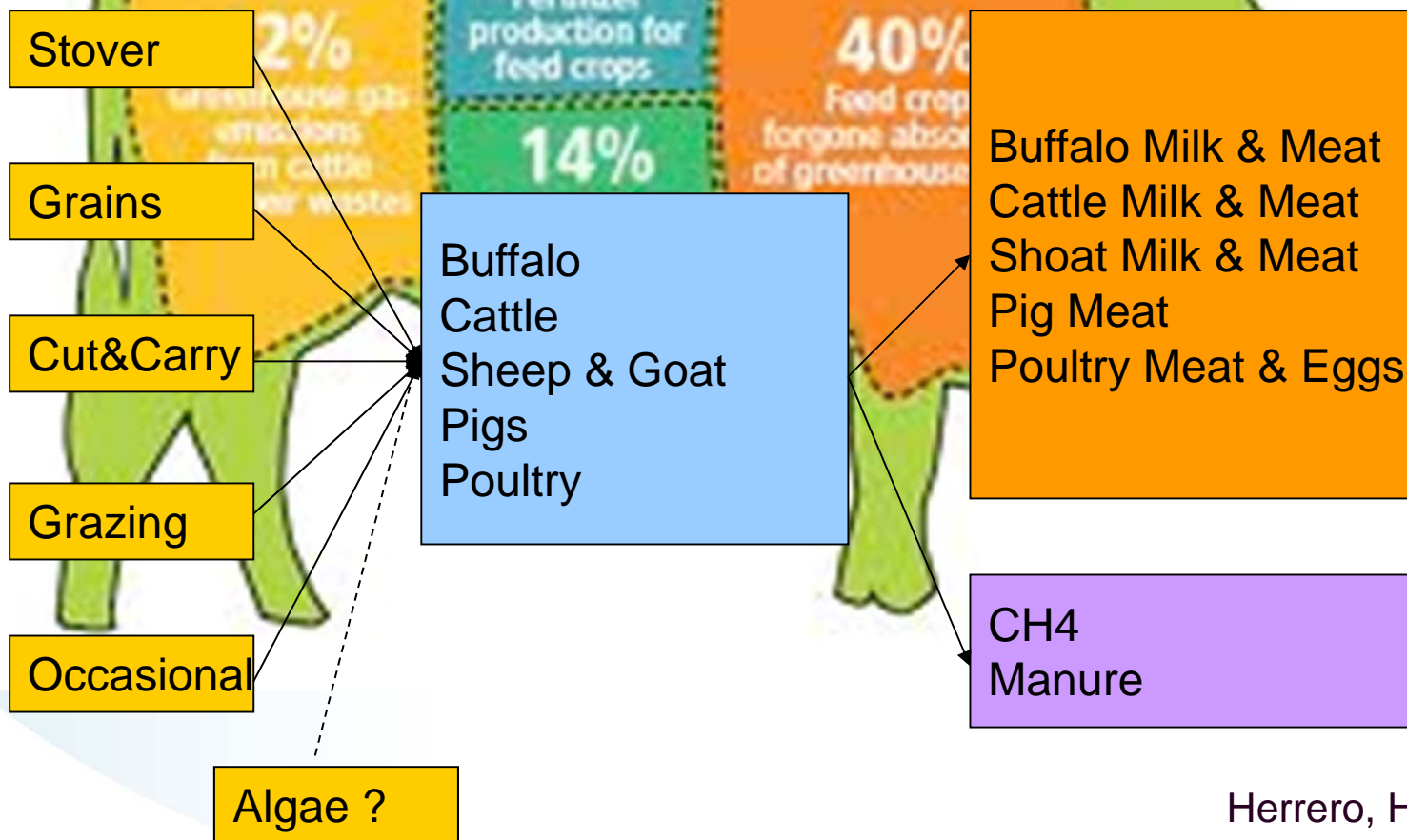


Livestock production parameterization

- by region and system

Input parameters

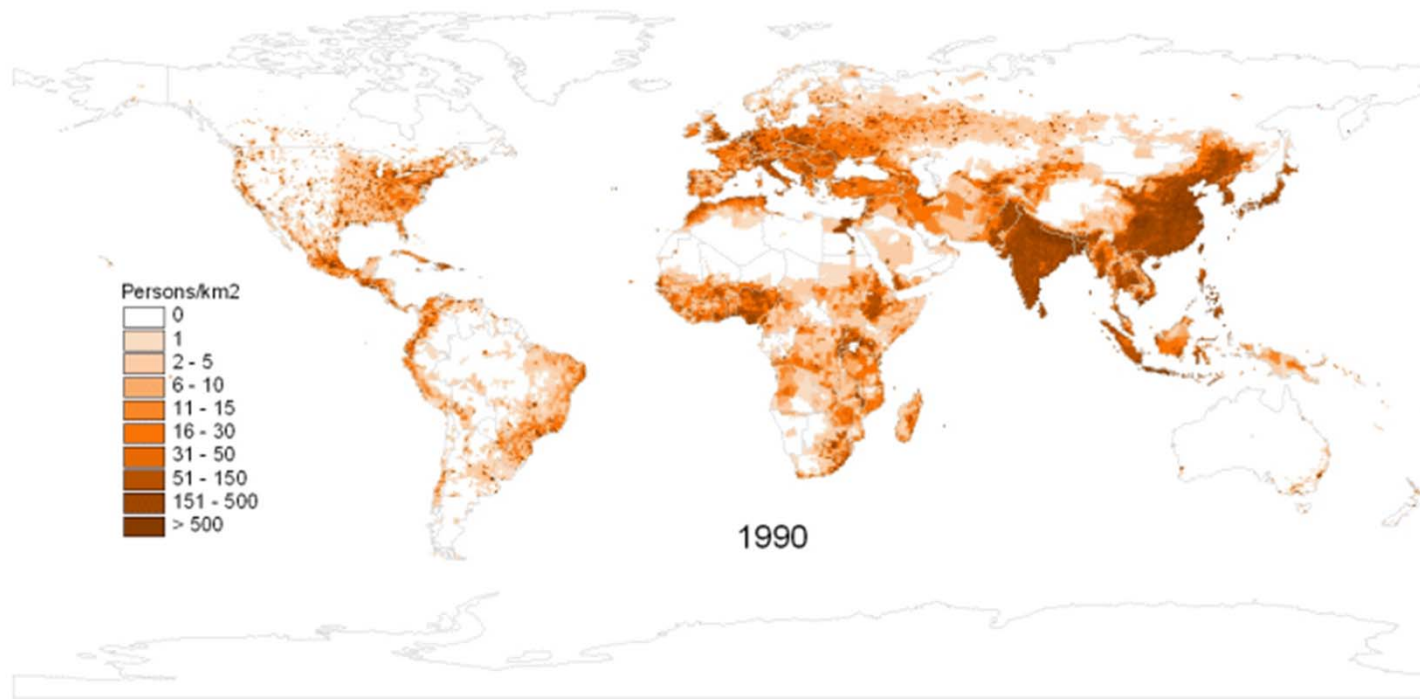
Output parameters



Herrero, Havlik et al
(PNAS forthcoming)

Policy experiments

Population density dynamics 2010-2100, B1



Food for a Week, Darfur Refugees, Chad

© 2007 PETER MENZEL PHOTOGRAPHY

Pour ses cinq enfants, O jma réfugié mitorine du nord au sud, le régime de la famine et la violence et la violence de tous les côtés.



TCHAD 230 000 réfugiés de guerre soudanais vivent dans les camps de l'Onu. Chacun a droit à 2100 Cal par jour: céréales, sucre, sel, huile, légumes secs et farine vitaminée.

Food for a Week, Germany

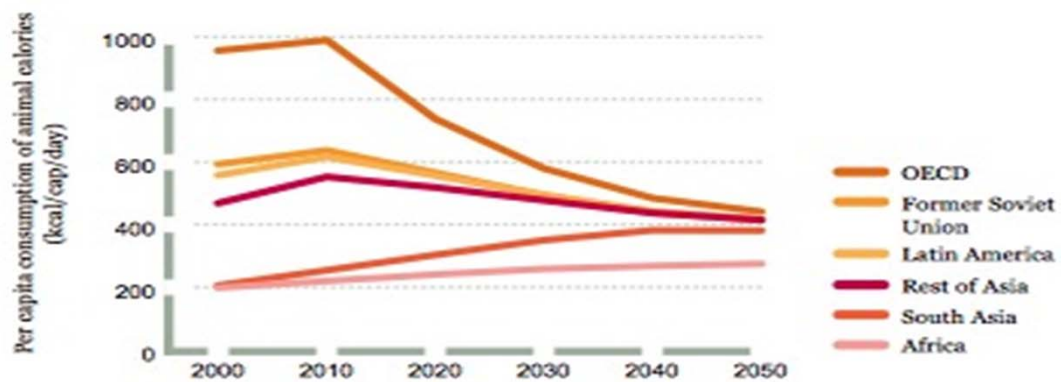
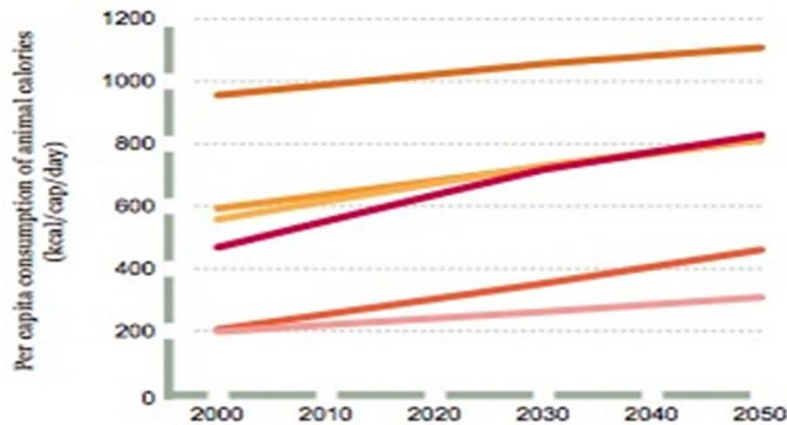
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ALLEMAGNE 1500 sortes de saucisses, 1200 restaurants McDonald's, 750 millions de kebabs avalés chaque année... Plus de la moitié des Allemands sont en surpoids ou obèses.

Policy Interventions



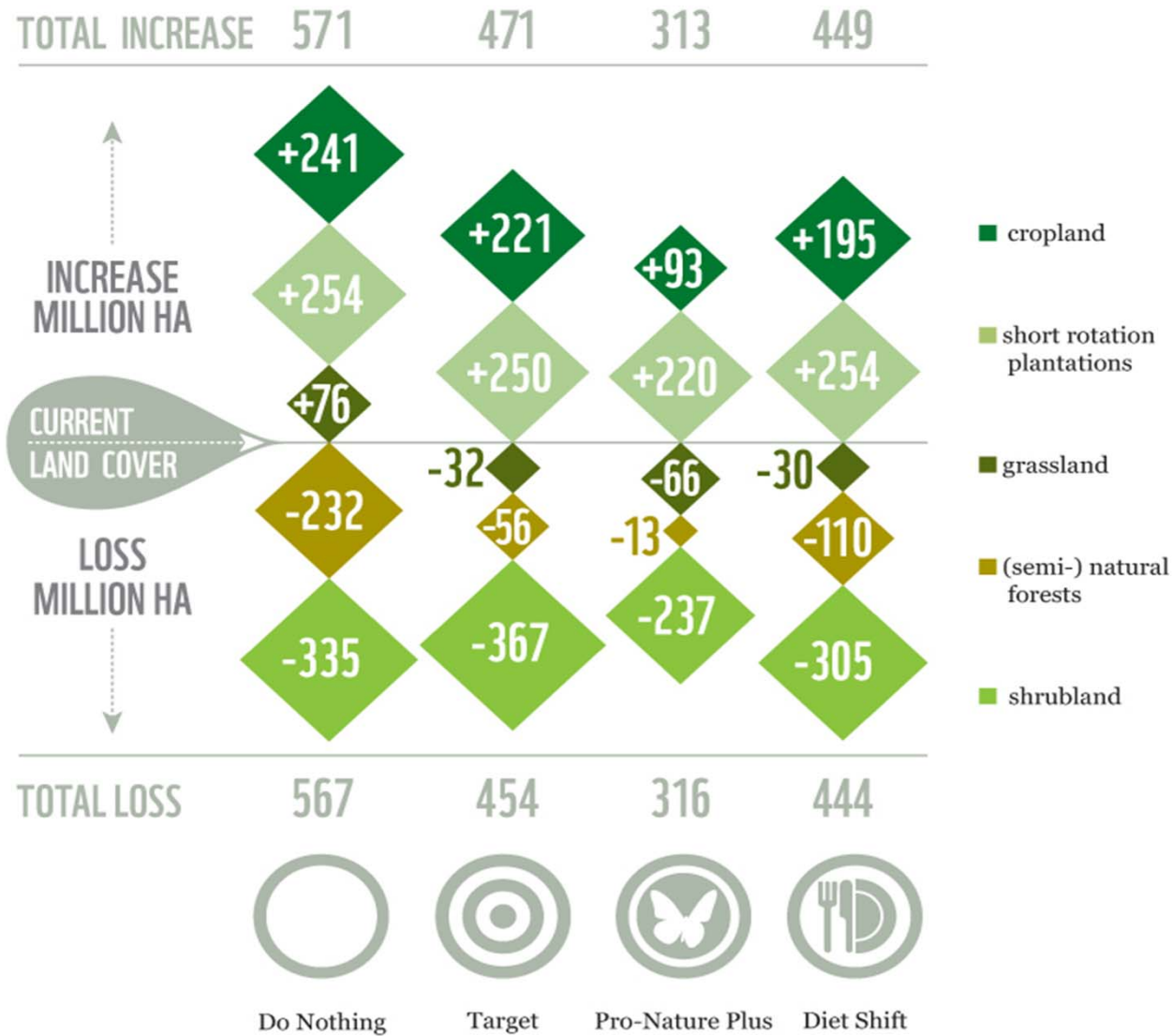


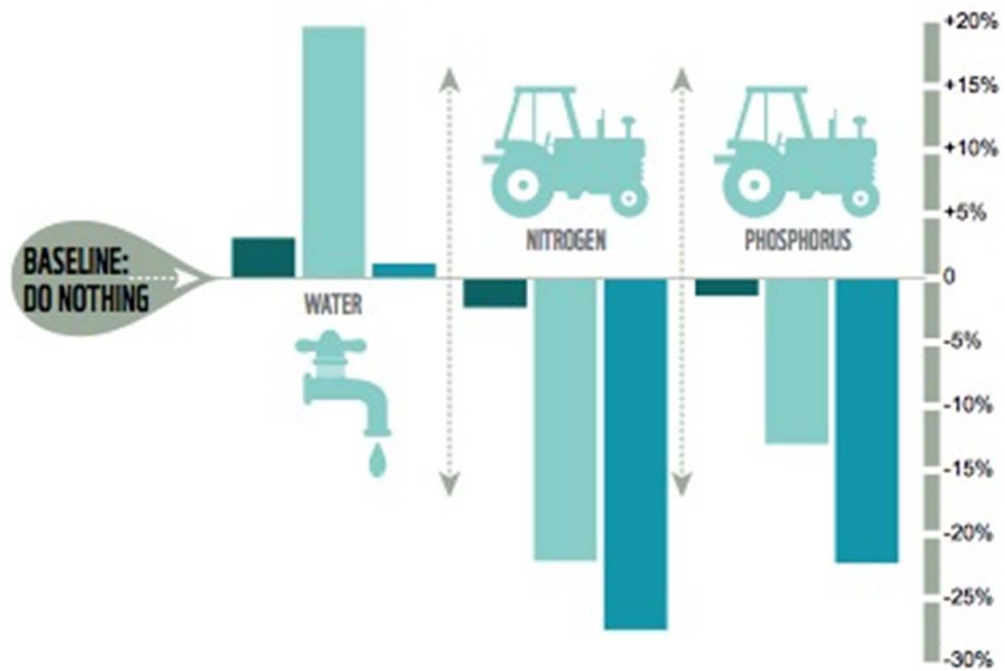
Projected animal calorie consumption per day between now and 2050 in different regions under the Do Nothing Scenario (top graph), where per capita consumption continues to follow the current path predicted by the FAO and the Diet Shift Scenario (bottom graph), where in OECD countries a gradual reduction is achieved through dietary changes and waste reduction, while allowing per capita consumption in other regions, such as South Asia and Sub-Saharan Africa, to increase.

Options Disappear

	feasibility in 2030	feasibility in 2030 if agriculture stagnates	feasibility in 2050	feasibility in 2050 if food commodity index increases capped at 10%	
target	✓	✗	✓	✓	🎯
target with pro-nature	✓	✗	✓	✗	🎯 🦋
target with pro-nature plus	✓	✗	✗	✗	🎯 🦋
target with bioenergy plus	✓	✗	✓	✓	🎯 🌱
target with diet shift	✓	✓	✓	✓	🎯 🍴
target with diet shift and pro-nature	✓	✓	✓	✓	🎯 🍴 🦋
target with diet shift and pro-nature plus	✓	✓	✓	✓	🎯 🍴 🦋

Land use change – Leakage into Shrub-lands





Target



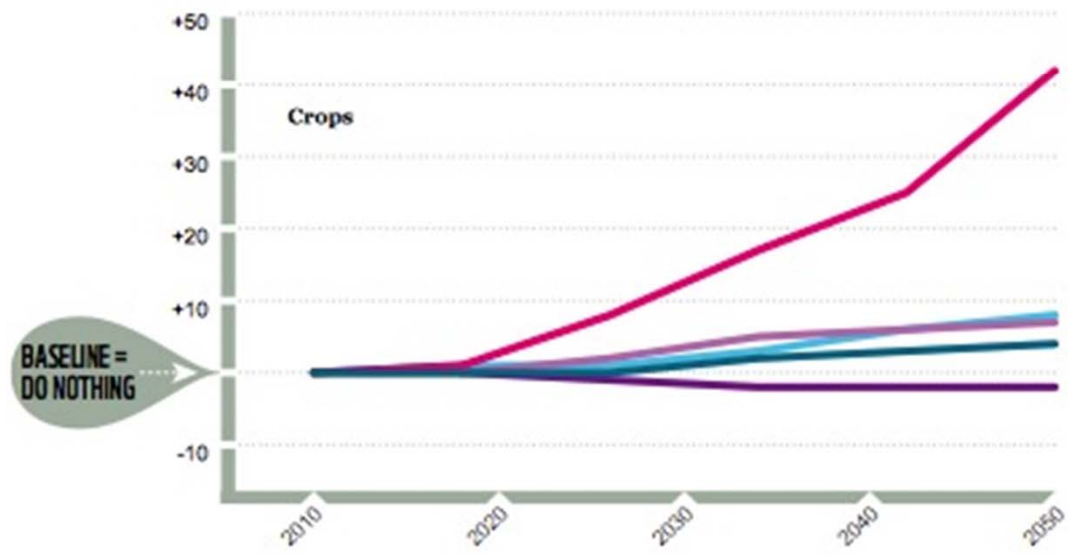
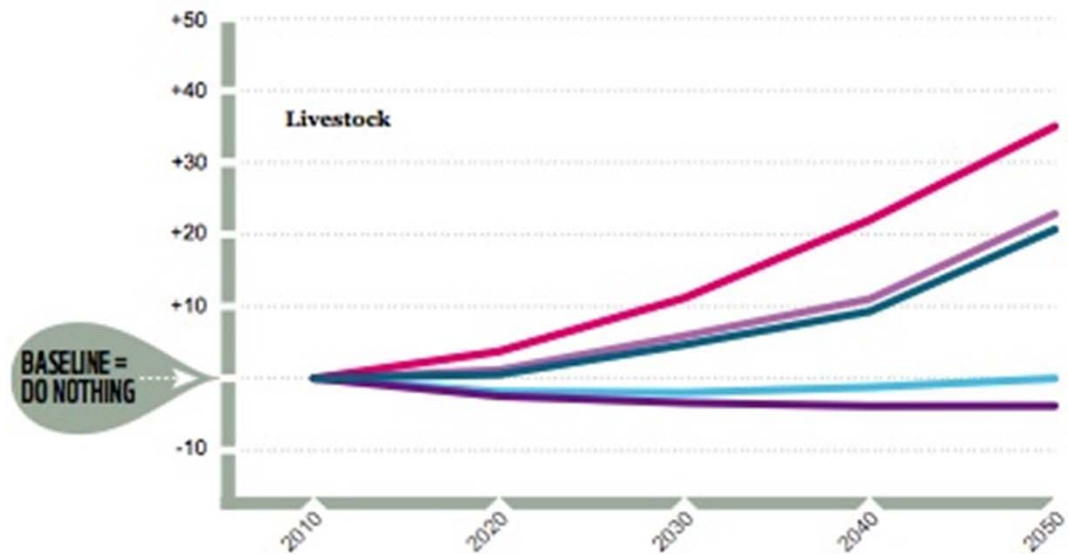
Pro-Nature Plus



Target & Dietshift



Transmission Mechanisms largely unknown









Target Pro-Nature Plus Target & Pro-Nature Target & Dietshift Target & Pro-NaturePlus & Dietshift

Outlook: Towards a systematic strategic research agenda

- Data, data, data – Vol studies
- R&D – VoR studies
- Policy foresight – VogP studies