Regional impacts of climate change, observations and projections

Finnish Pilot study:

North Savo region

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Based on work of MACSUR team:
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FACCE MACSUR Work shop for policy makess
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Total area 20 400 km2

17.5% water bodies

Inhabitants 247 000 (2010)

Agriculture

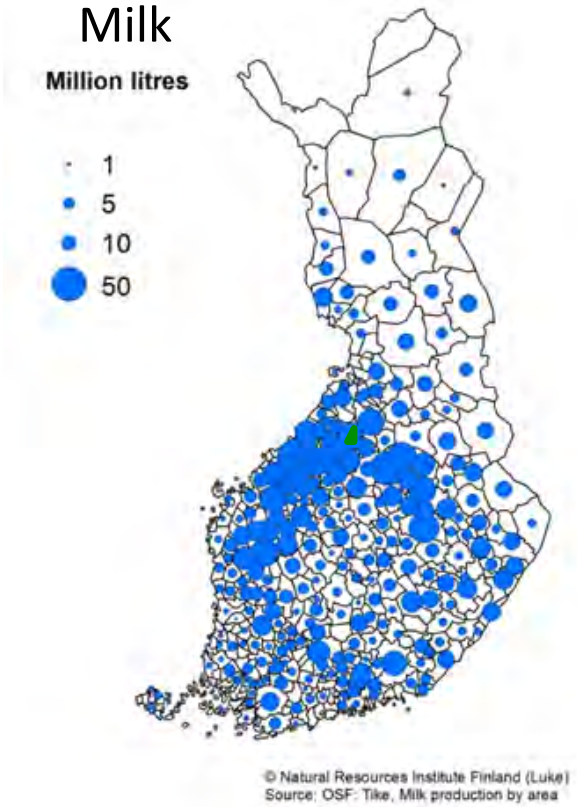
7.3% agricultural land (150 000 ha)

4 200 farms, av. size 36.2 ha

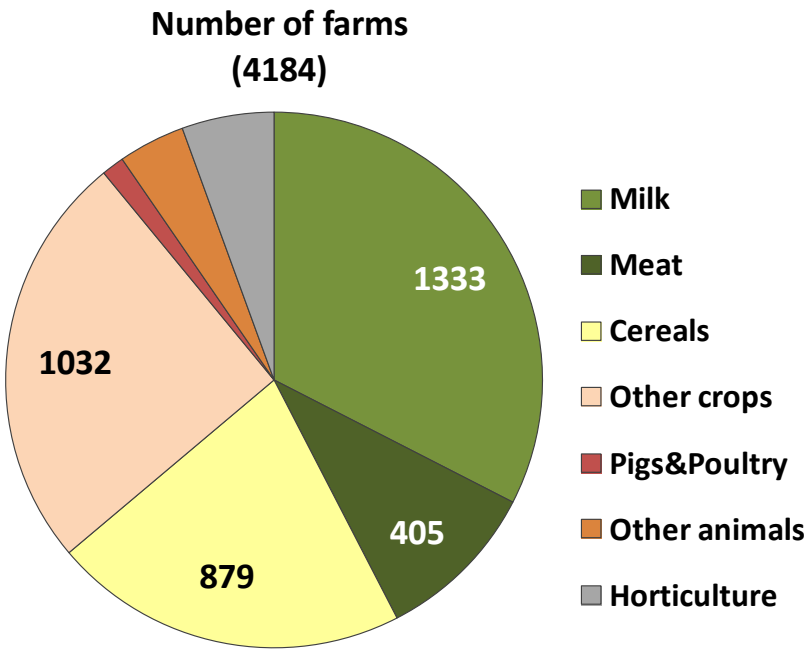
38 000 dairy cows (10% of the total amount)

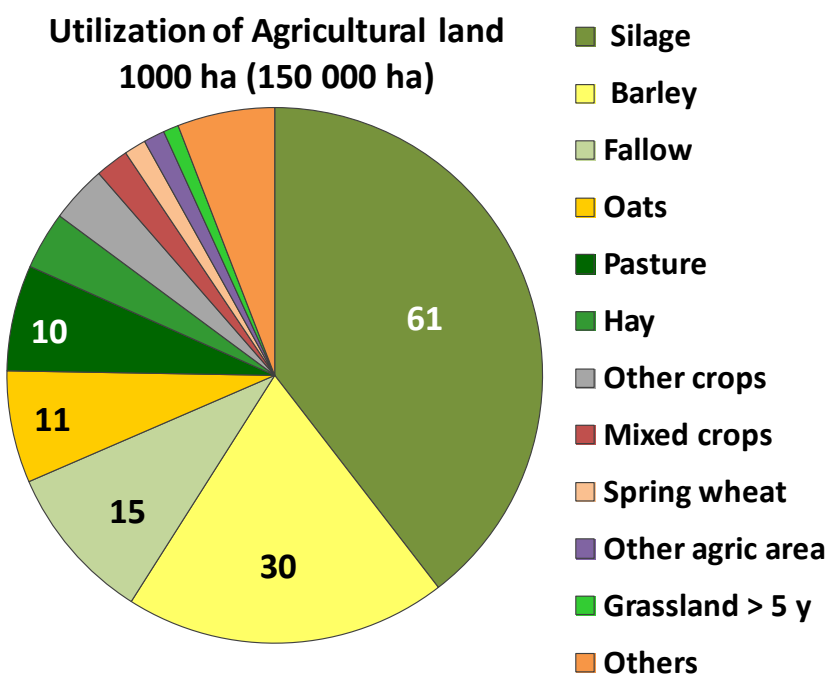
Income/cap: 17 000 eur (av. 18 800 eur, 2010)

http://www.pohjois-savo.fi/fi/pohjois-savo/



Distribution of farms and agricultural area 2012 in North Savo



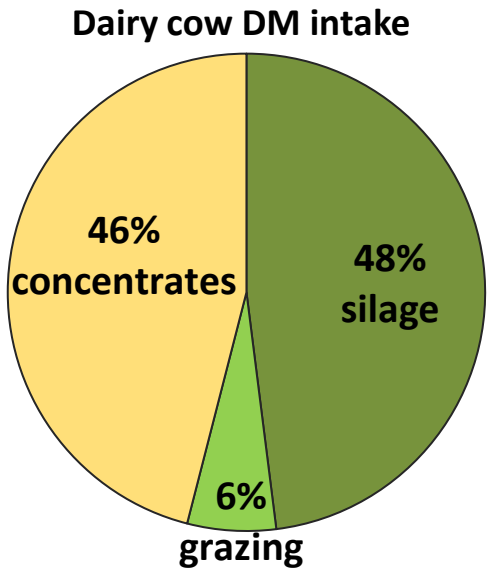


- In North Savo ca. **70% of income comes from milk**
- 56% of cultivated area is covered by grass

Outline of dairy production in North Savo

- High production per cow: 7900 l/cow/ year
- Low number of dairy cows per land area; 0. 59 LU/ha
- Average herd size 33 cows/farm (increasing)
- Relatively high grass production potential 9 -14 tn DM/ha/year,
  - on farms median yield is 5 – 6 tn DM/ha/year
- Rotational ley farming renovation after 3-4 production years

- Important: there is no silage market -> each dairy farm has to succeed each year in silage production
  - Concentrates can be imported
- Challenge: protein source for ruminants
  - No GMO soya
- Short growing season -> <u>Time window for management options is limited</u>
  - risk, cost, D value, soil structure



Projected climate change in Finland up to 2100, reference period 1971-2000

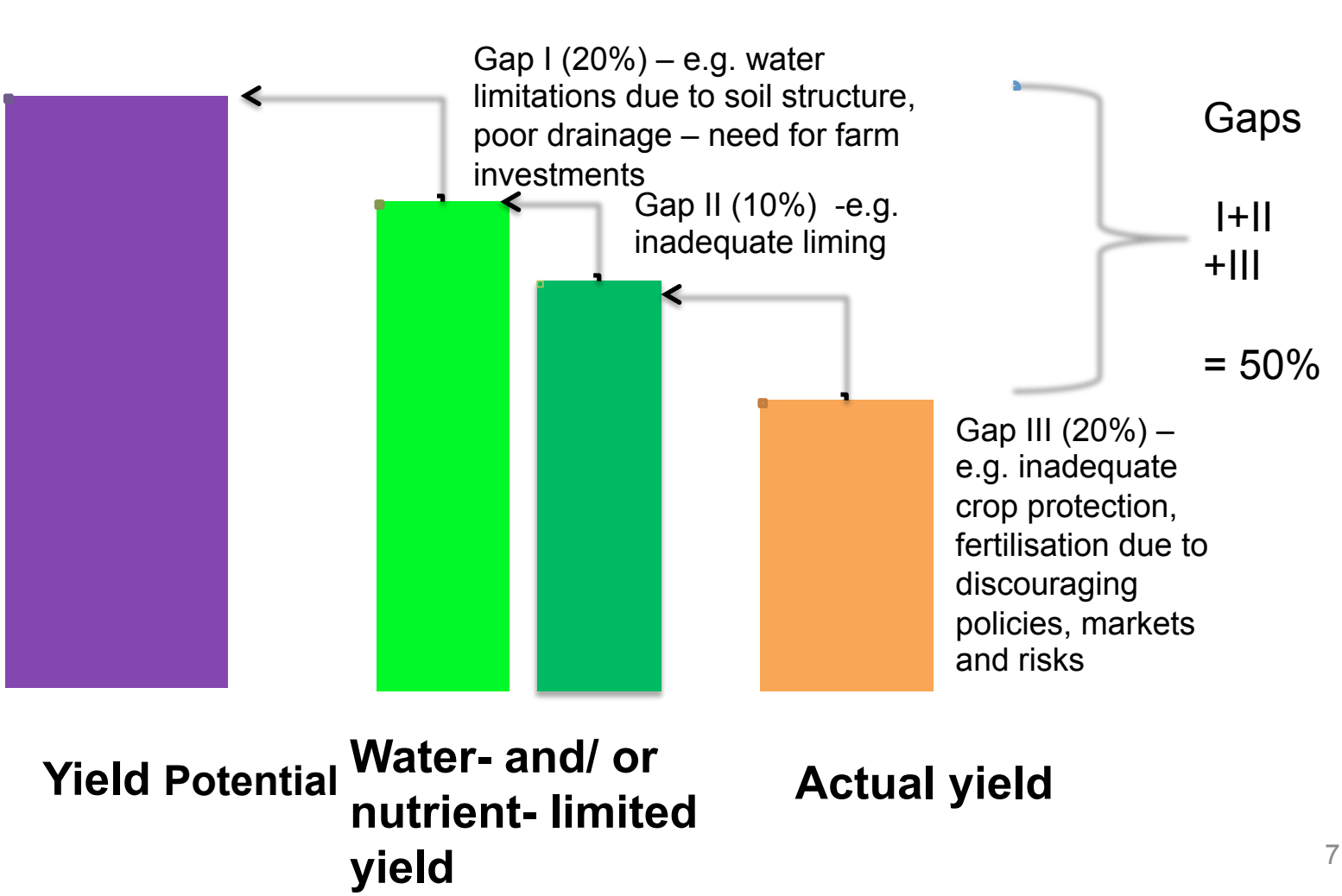
Source: Jylhä et al 2009, Ruosteenoja 2013

- Annual average temperature +2 - + 6 °C
  - **In summer +1-+5 °C**
- Annual precipitation + 12 - 22%
  - **In summer + 0 - 20%**
- Threat of midsummer drought
- Growing season length +30–45 days
- Temperature sum during growing period:
  - **Central Finland 1100 -> 1600 degree days**
- Increasing frequency
  - rainy days, heavy rainfalls, dry spells
- **Reduced snow cover and soil frost**

Climate related problems

- Variability of crop yields
- Feed quality losses (forage, cereals)
- Drought/heat spells more frequent
- Winter time damages
- Soil compaction, wet conditions
- Plant pests becoming more frequent

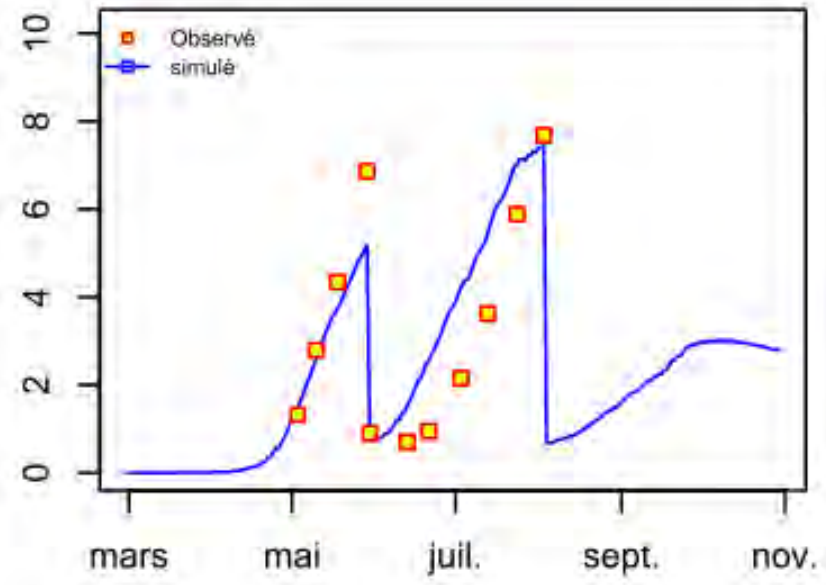
Yield gaps and their drivers



Modeling grassland

- Currently we are able to model DM yield of grassland BUT there is clear lack in modelling quality (digestibility) of grass
  - High digestibility is crucial with high yielding cows
  - Heat waves especially together with variable weather condition (exceptionally low and exceptionally high temperatures) leads to lower digestibility (solution: earlier cut leading to decreased yield

STICS **Saerheim (NO)**



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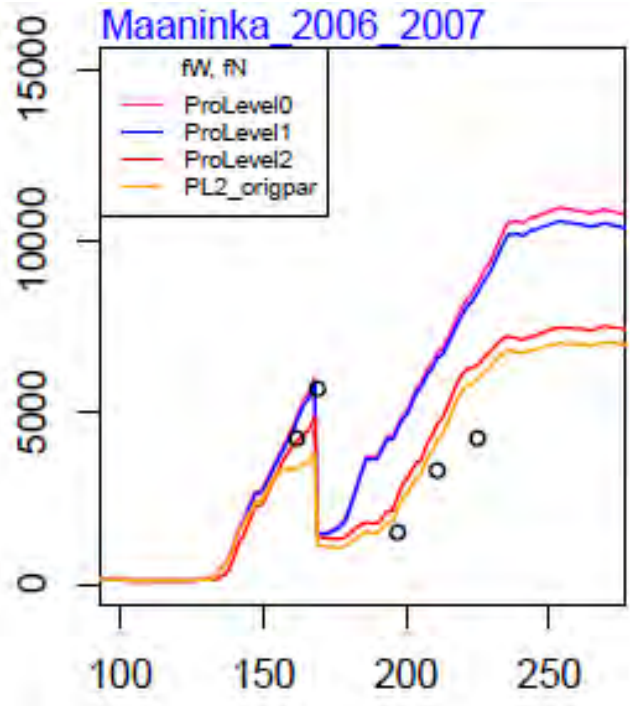


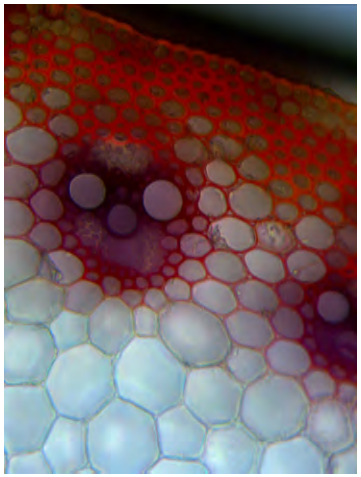
The cost of managing farm level grass yield risk

- Excess silage grass area (ca. 20%) is kept to hedge against silage deficit
- The mean yield of grass is gradually increasing from the baseline period up to middle-century
- Little change in the variation of grass yields in North Savo
  - The average standard deviation of harvested yield decreases considerably in A1B, as well as the share of years of silage deficit
- => Easier to retain buffer stocks filled in the climate scenario than in the baseline - except under consecutive dry years
- The cost of risk remains significant – farmers need to keep sufficient grassland area and buffer stocks

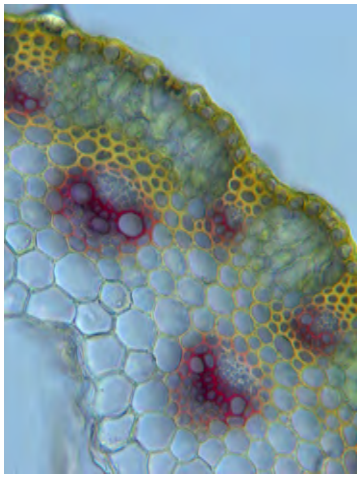
Source: Kässi, P., Känkänen, H., Niskanen O., Lehtonen, H. & Höglind, M. 2014 Farm level approach to manage grass yield variation under climate change in Finland and North-Western Russia (submitted)

Adaptation solutions, grass

- **Increasing the number of cuts**
- **Earlier cuts**
  - To maintain high digestibility
- **New grassland species and cultivars**
  - More resistant to heat stress and drought
  - Better nutritive value
  - Sufficient winter hardiness
- **Adjusted fertilisation levels**
  - Proper timing, according to developmental phases
  - According to yield potential of different crops and cultivars
  - Restricted by nitrate directive and agri-environmental legislation
- **Prevention of soil compaction**
  - Drainage, sufficient
  - Development of machinery/use of machinery



Strong lignification, low digestibility

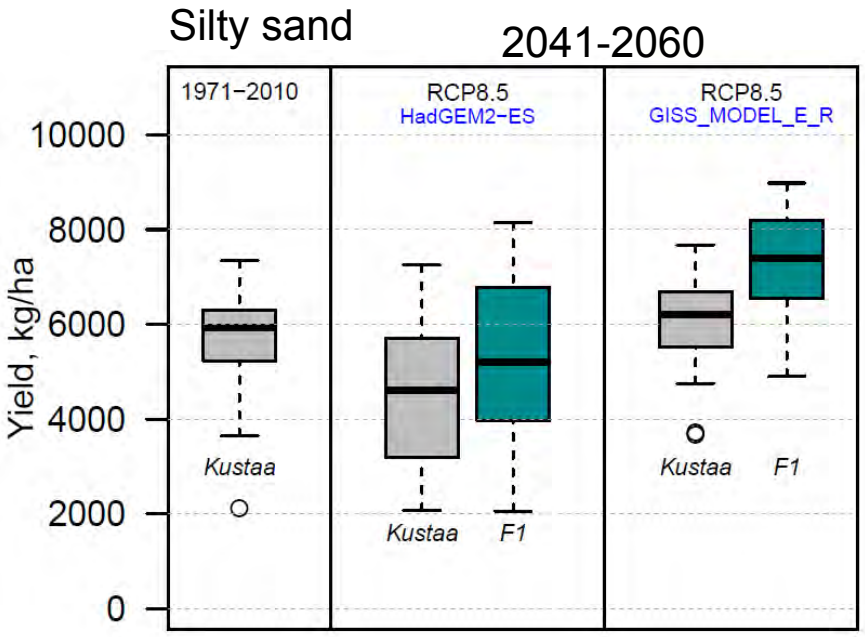


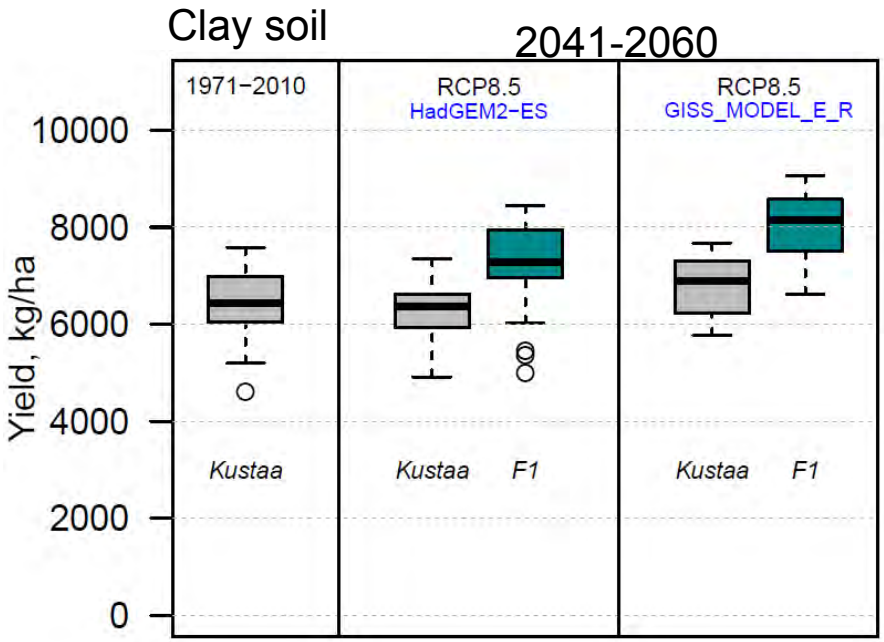
Weak lignification, high digestibility

Future rainfed potential yields of barley in North Savo

Water-limited yields simulated with model WOFOST (World Food Studies) using different emission scenario (RCP8.5) / climate model combinations for Kuopio (10 x 10 km grid)

- Current cultivar, Kustaa
- Possible future cultivar, ”F1” (only thermal requirement changed)





Adaptation solutions, cereals

- **New cultivars**
  - Adapted to longer growing season
  - Decrease vulnerability to (early summer) drought
  - More tolerant of heat stress
- **Earlier sowing times**
- **Improved crop protection**
  - Currently no/little fungicide use => can be increased
  - More diverse crop rotations may relieve disease pressure
- **Adjusted fertilisation levels and timing**
  - Split applications according to development phases
  - According to yield potential of different crops and cultivars
- **Improved soil structure, soil pH, drainage**

=> resilience, extra costs…

Issues related to agricultural policy

- Regional adjustment of regulation is important (eg. water protection)
  - Due to expected growing yield potential fertilisation restrictions need adjustment
  - Nitrate directive restricts efficient and sustainable grass production
  - Greening practices have only slight – and partly negative - impact on ruminant production (permanent grassland not suitable for northern conditions)
- Inefficient markets for agricultural land cause difficulties for farms that are increasing their production
  - Capitalisation of area payments to land prices + incentives for extensification (e.g. nature management and other set aside schemes under pillar 2) fit better part-time crop farms, not full-time livestock farms – they express frustration on weak land supply
- Production based support for suckler cows and (dairy originated) beef production is vital for producers
  - No significant increase in production expected, budgetary limits of coupled supports

Kiitos!
Thank you!

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For further information
http://macsur.eu/index.php/regional-case-studies/