Alpine Agriculture – Risks and Options of Future Water Scarcity

Klaus Wagner,
In collaboration with Julia Neuwirth, Hubert Janetschek

Federal Institute of Agricultural Economics
Marxergasse 2, 1030 Vienna
klaus.wagner@awi.bmlfuw.gv.at
www.awi.bmlfuw.gv.at

Innsbruck, Managing Alpine Future II, 2011.11.22
Objectives

– Role of agriculture in an integrated and sustainable water management

– Risks for agriculture currently and in future

– Adapted land use in view of future water scarcity, strategies/options
Content

1. Impacts of climate change on agriculture

2. Agricultural risk evaluation in pilot regions

3. Agricultural policy measures and its influence on water consumption

4. Agricultural options for adaptation / mitigation of water scarcity
1 Impacts of climate change on agriculture

- Examples:
  - Quantity and quality of crops
  - Heat stress
  - Infestation by pests
  - Vegetation period
  - Degradation of land
  - Availability of nutrients

\[ N \quad \text{Overall precipitation} \\
Nd \quad \text{throughfall precipitation} \\
Ns \quad \text{stem flow} \\
T \quad \text{transpiration} \\
E \quad \text{evaporation} \\
I \quad \text{canopy interception} \\
SI \quad \text{percolation} \\
Abo \quad \text{surface inflow & outflow} \\
Abu \quad \text{subsurface inflow & outflow} \]
2 Risk Evaluation

Development of indicators:

Water consumption of agriculture
- Plant cultivation (5 classes, crop coefficient FAO)
- Animal husbandry (3 classes, guidelines for livestock water consumption)
- Irrigation (share of irrigable area)

Soil
- Capacity of available water (3 classes)

Climate
- Aridity index (3 classes, relation of temperature and precipitation)
2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity
Pilot regions - overview

Type of Agricultural Area
- Arable land %
- Grassland intensive %
- Grassland low input %
- Orchard %
- Vineyard %

XXX Agricultural area in ha

Source: own calculations, national statistic data

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2.1 Current Situation

Risk Classification
Standardized

Pilot region

Land use  Livestock  Soil  Aridity  Irrigation

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2.2 Future Situation (2050)

Agricultural Risk Analysis for Water Scarcity
Climate Risk

Seasonal aridity index (3T/P)
difference of scenario 1 to current situation

- Aridity index difference winter
- Aridity index difference spring
- Aridity index difference summer
- Aridity index difference autumn

XXX Aridity index, difference avg. year

National borderline

Alp Water Scarce Project
Federal Institute of Agricultural Economics Vienna
Klaus Wagner 2009 12
Source: own calculations, national statistic data

K. Wagner, 8
### 3 Agricultural policy measures and its influence on water consumption

<table>
<thead>
<tr>
<th>Measure category</th>
<th>Effects related to water scarcity</th>
<th>Austria</th>
<th>France</th>
<th>Italy</th>
<th>Slovenia</th>
<th>Switzerland</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Type &amp; Tendency</td>
<td></td>
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<tr>
<td>Decoupled direct payments</td>
<td>Indirect Positive</td>
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<td>Coupled direct payments</td>
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<td>X</td>
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<tr>
<td>Market regulation measures</td>
<td>Direct / indirect Positive / indifferent / negative</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Rural Development – Competitiveness</td>
<td>Direct Positive</td>
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<td>X</td>
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<tr>
<td>Rural Development - Environment and Countryside</td>
<td>Direct / indirect Positive / indifferent</td>
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<tr>
<td>Rural Development - Quality of Life and Diversification</td>
<td>Indirect Indifferent</td>
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<td>-</td>
<td>X</td>
<td>-</td>
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<tr>
<td>Leader</td>
<td>Indirect Indifferent</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
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</table>

Subsidies in pilot regions

<table>
<thead>
<tr>
<th>Percentage of subsidies with:</th>
<th>Austria</th>
<th>France</th>
<th>Italy</th>
<th>Slovenia</th>
<th>Switzerland</th>
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</thead>
<tbody>
<tr>
<td>Effects of increasing water consumption</td>
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<td>Indifferent effects</td>
<td>65</td>
<td>77</td>
<td>46</td>
<td>51</td>
<td>n.a.</td>
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<td>Effects of decreasing water consumption</td>
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<td>23</td>
<td>54</td>
<td>49</td>
<td>n.a.</td>
</tr>
</tbody>
</table>


3 Clusters:

- **Italian regions**: measures concerning water saving in force, highly dependent on irrigation, some regions with high aridity risk

- **South-eastern regions**: relatively low aggregated risk of water scarcity, only special sectors concerned, small share of money in water saving measures

- **North-eastern regions**: grassland farming, water intensive livestock, only a small share of subsidies dedicated to water saving measures

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4. Agricultural options for adaptation to / mitigation of water scarcity, Regional specific, depending on risk patterns:

4.1 Short-term measures in every case
(positive environmental effects, indifferent economic effects)

- Adapted nutrient, weed, pest management
- Conservational tillage, mulch seeding, landscaping measures
- Adapted crop calendar, plant density, grazing / stable systems
- Efficient irrigation technology

Risk management (insurance systems to minimise risk of crop losses for farmers, multiple risks, hail, frost, public support in some member states, special funds for flooding or droughts)
4.2 Long-term measures to change structures and systems

(negative economic effects, indifferent effects on production, landscape, regional economy)

- Change from intensively used grassland to low input systems (focus in Steirisches Randgebirge, Koralpe, Karawanken, Julian Alps, Noce, Tarentaise)

- Adapted crops (winter / spring, reduction of field forage crops..., focus in Steirisches Randgebirge, Koralpe, Karawanken, Pohorske, Dravsko-Ptujsko Polje, Scrivia)

- Reduction of livestock intensity, Change of livestock systems (focus in Steirisches Randgebirge, Koralpe, Jauntal, Unteres Gurktal, Sterisches Becken, Noce, Pohorske, Dravsko-Ptujsko Polje)

- Extension of irrigation only under certain conditions.
4.3 Economic effects: advantages, disadvantages for farm enterprises, examples for Austria:

- **Land management, soil cultivation** (additional expenditure for autumn mulch seed in planting: 109€/ha, saving of expenditure in case of direct seeding in winter planting: 31€/ha)

- **Crop rotation** (important in Austria: maize ear silage, change to maize whole plant silage which makes better use of winter humidity means 1,359.- €/ha disadvantage for farmers per year)

- **Irrigation** (to reduce climate-induced yield variations, but most expensive investment in agriculture, also high operative costs, (400 - 1,900 €/ha per year), does pay only in case of special products, high producer prices and really dry years, long term sustainability??)