Water Scarcity and Agriculture

Risk Analysis and Policy Measures

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Scope:
National and international projects for the ministry and also other institutions, more on www.awi.bmlfuw.gv.at
Content

1. Impacts of climate change on agriculture

2. Agricultural risk evaluation in pilot regions

3. Agricultural policy measures and its influence on water quantity

4. Agricultural options for adaptation / mitigation of water scarcity
Objectives

– Agriculture – Water Scarcity – Climate Change

– Risks for agriculture currently and in future concerning water scarcity

– Adapted land use in view of future water scarcity and strategies/options to achieve this
1 Impacts of climate change on agriculture

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

Agricultural Risk Analysis for Water Scarcity Pilot regions - overview

<table>
<thead>
<tr>
<th>Type of Agricultural Area</th>
<th>XXX Agricultural area in ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land</td>
<td>25.156</td>
</tr>
<tr>
<td>Grassland intensive</td>
<td>648</td>
</tr>
<tr>
<td>Grassland low input</td>
<td>1.771</td>
</tr>
<tr>
<td>Orchard</td>
<td>235.570</td>
</tr>
<tr>
<td>Vineyard</td>
<td>236.570</td>
</tr>
</tbody>
</table>

Source: own calculations, national statistic data

National borderline

Alp Water Scarcie Project
Federal Institute of Agricultural Economics Vienna
Klaus Wagner 2009 12

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2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity
Pilot regions - overview

Type of Livestock Units Proportion

- Cattle %
- Pigs %
- Poultry %

XXX Livestock units per ha

Risk Classification
Livestock

Weighted risk points

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Source: own calculations, national statistic data

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2.1 Current Situation
Agricultural Risk Analysis for Water Scarcity
Soil-Risk Classes

<table>
<thead>
<tr>
<th>Risk Classes Proportion</th>
<th>Low risk %</th>
<th>Low - medium risk %</th>
<th>Medium risk %</th>
<th>Medium - high risk %</th>
<th>High risk %</th>
</tr>
</thead>
</table>

Risk Classification
Soil

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

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2.1 Current Situation
Agricultural Risk Analysis for Water Scarcity
Pilot regions - overview

Climate, monthly avg. of last 10 available years

- Temperature
- Precipitation

Risk Classification
Aridity

Pilot region

- Aridity index (avg. year)

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)

Background of the agricultural development

Agricultural outlook mostly short-, middle-term

FAO, G20, EU, national, depending on:

- global food market
- energy market,
- demographic development,
- technical progress,
- policy measures / prices
- climate development ...
2.2 Future Situation (2050)

Development of agriculture

In general: strong need for agricultural products, production has to increase by 70% (in development countries by 100%)

Liberalisation - specialisation scenario: growing market pressure, depending on policy interventions different regional concerns: lower production in disadvantaged, marginal regions, higher, more intensive production in advantaged regions

Conservative scenario: more policy intervention: keeping production in disadvantaged regions (environmental, regional economy concerns), environmental concerns in intensively used regions, development more balanced
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

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

French
Switzerland
Austria
Slovenia
Italy

Source: own calculations, national statistic data

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2.3 Future Risk Patterns Agriculture

Risk Classification of Land Use
Current / Scenario Liberalisation

Water Consumption of Livestock per Hectar
Current / Scenario Liberalisation
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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type</td>
<td>Tendency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decoupled direct payments</td>
<td>Indirect</td>
<td>Positive</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Coupled direct payments</td>
<td>Direct</td>
<td>Positive</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Market regulation measures</td>
<td>Direct / indirect</td>
<td>Positive / indifferent / negative</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rural Development – Competitiveness</td>
<td>Direct</td>
<td>Positive</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rural Development - Environment and Countryside</td>
<td>Direct / indirect</td>
<td>Positive / indifferent</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rural Development - Quality of Life and Diversification</td>
<td>Indirect</td>
<td>Indifferent</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Leader</td>
<td>Indirect</td>
<td>Indifferent</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</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>
</tr>
</thead>
<tbody>
<tr>
<td>Indifferent effects</td>
<td>65</td>
<td>77</td>
<td>46</td>
<td>51</td>
<td>n.a.</td>
</tr>
<tr>
<td>Effects of decreasing water consumption</td>
<td>35</td>
<td>23</td>
<td>54</td>
<td>49</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: A: Lebensministerium 2010, F:, I, S: European Union, Directorate-General for Agriculture and Rural Development 2010; Information of Pilot region project partners, CH: Bundesamt für Landwirtschaft 2010

3 Clusters:

- **Italian regions**: measures concerning water saving in force, highly dependent on irrigation, some regions with high aridity risk
- **North-eastern regions**: grassland farming, water intensive livestock, only a small share of subsidies dedicated to water saving measures
- **South-eastern regions**: relatively low aggregated risk of water scarcity, only special sectors concerned, small share of money in water saving measures

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4 Agricultural options for adaptation to / mitigation of water scarcity

General:
- Land / stable management, soil cultivation
- Intensity / organic farming
- Varieties, species
- Products
- Farm management
- Water management
- Policy, administration
4.1 Regional specific options, depending on risk patterns

**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 Regional specific options, depending on risk patterns:

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.

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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), pays only in case of special products, high producer prices and really dry years, long term sustainability??)
Agriculture:

essential sector of an integrated water management system