

# Water Scarcity and Agriculture

Risk Analysis and Policy Measures

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K. Wagner, 1



## **Federal Institute of Agricultural Economics, Vienna:**

Research Institute of the Austrian Ministry of Agriculture, Forestry,  
Environment and Water Management

### **Staff:**

14 scientists

### **Departments:**

Agricultural Policy, Regional Research, Agricultural Sociology,  
Business Economics

Market and Food Economics

Methodology

Library

### **Scope:**

National and international projects for the ministry and also other  
institutions, more on [www.awi.bmlfuw.gv.at](http://www.awi.bmlfuw.gv.at)

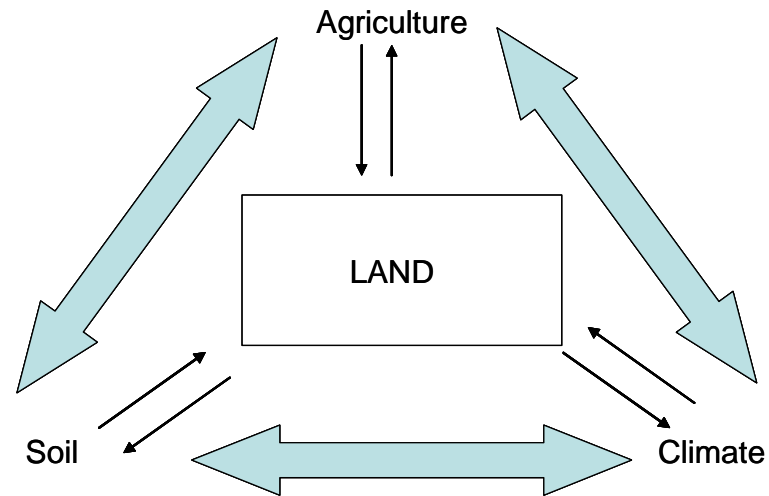
# Content

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

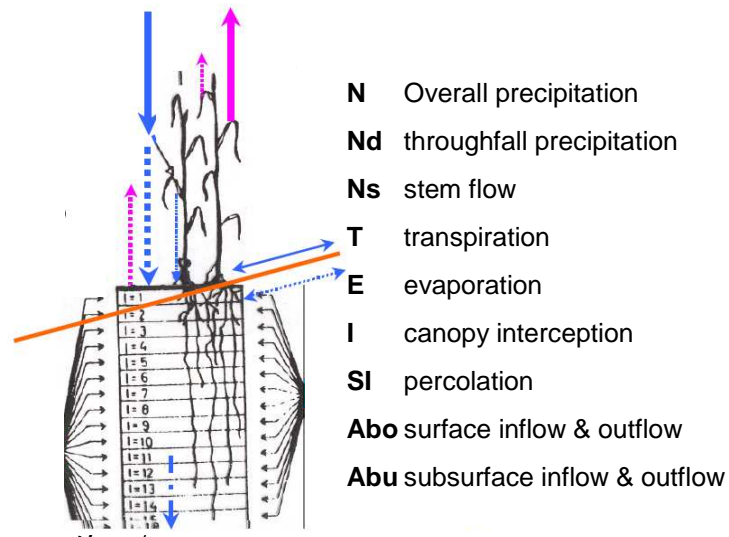
# Objectives

- 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

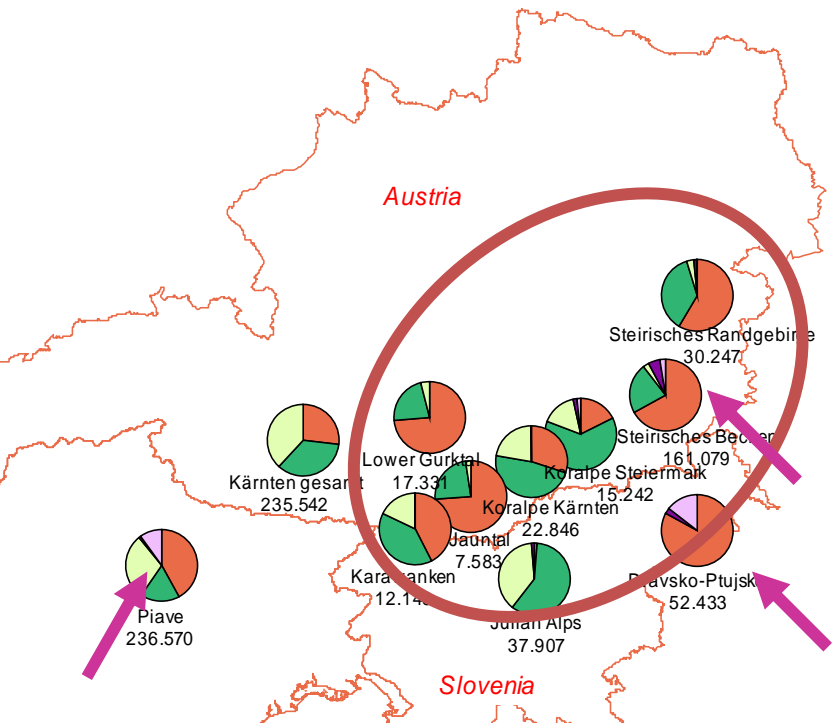
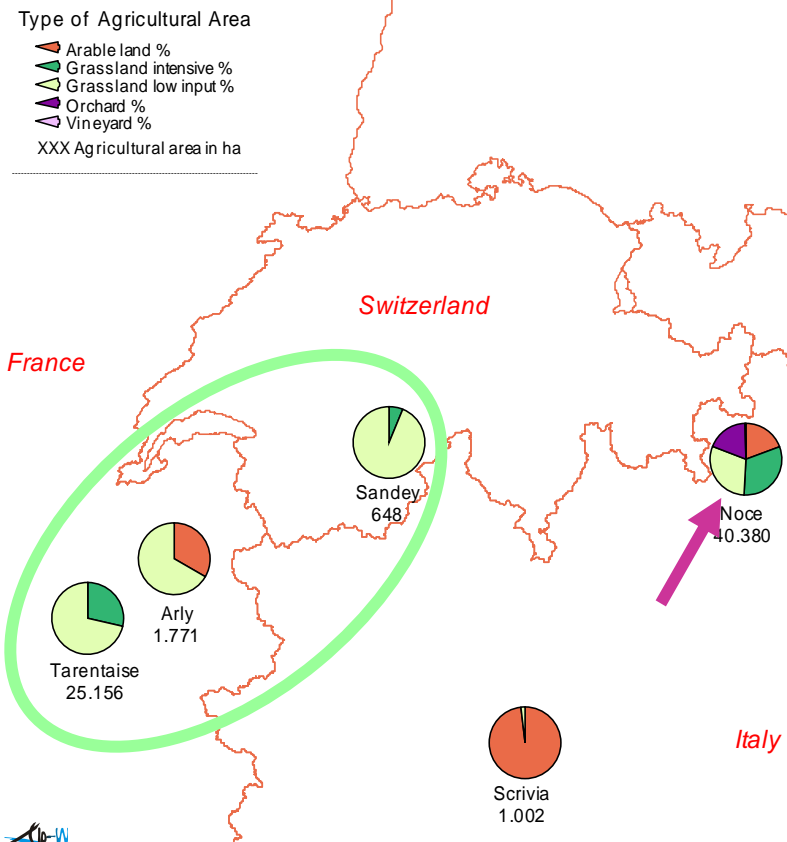
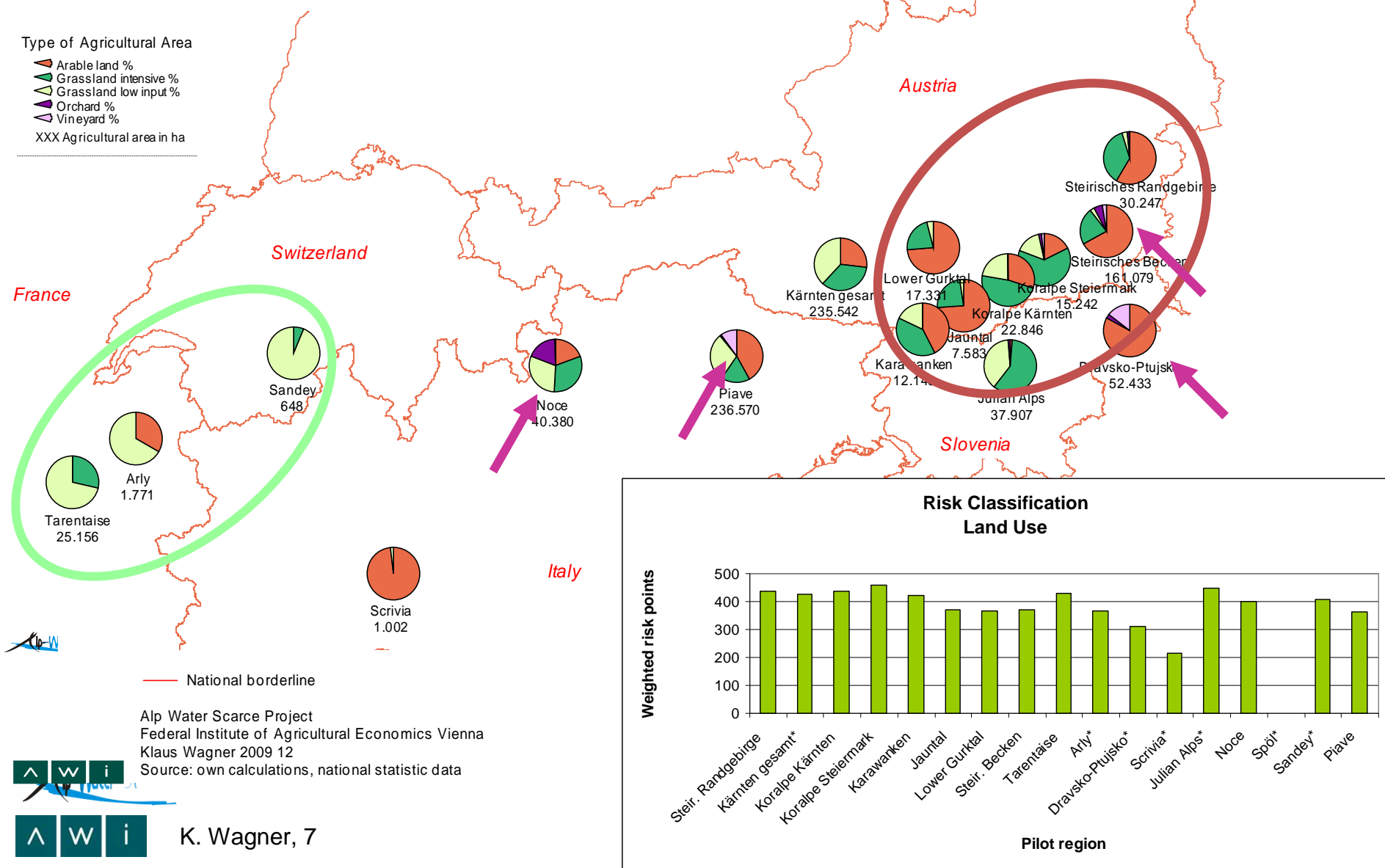
- **Capacity of available water** (3 classes)

#### Climate

- **Aridity index** (3 classes, relation of temperature and precipitation)

# 2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity  
Pilot regions - overview

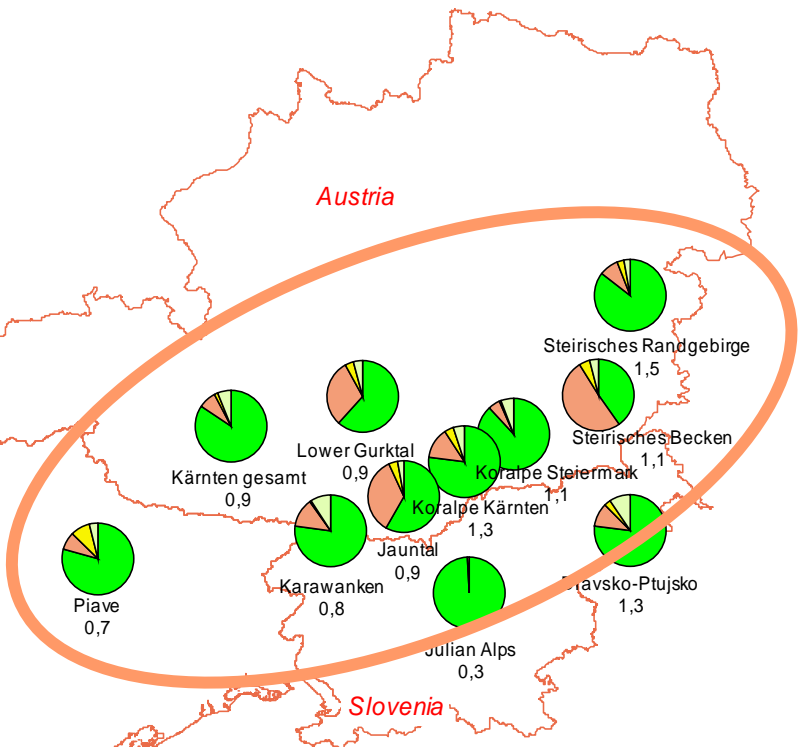
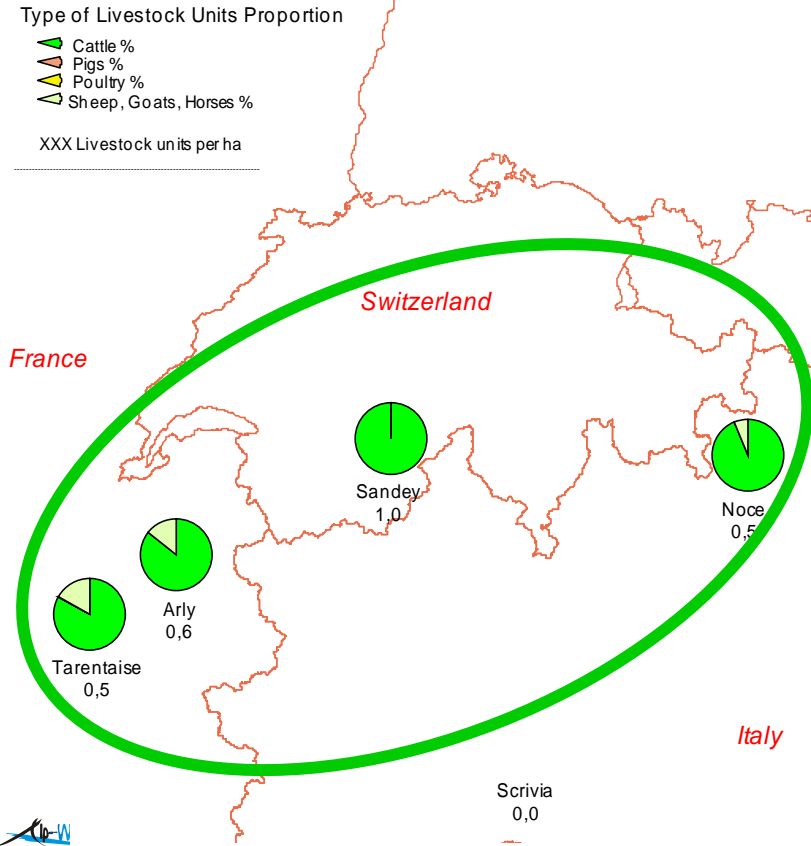
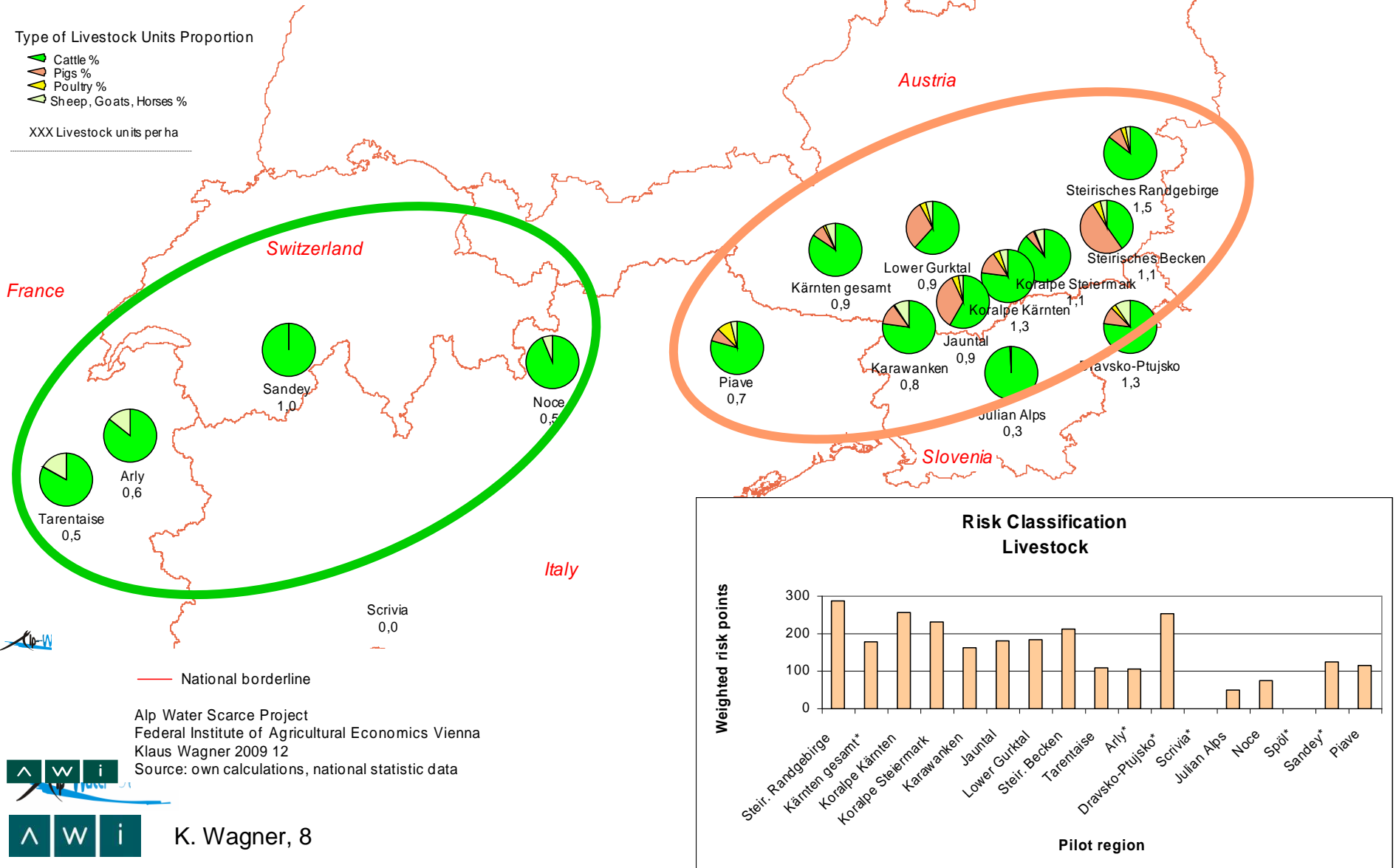


Alp Water Scarce Project  
Federal Institute of Agricultural Economics Vienna  
Klaus Wagner 2009 12  
Source: own calculations, national statistic data



# 2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity  
Pilot regions - overview



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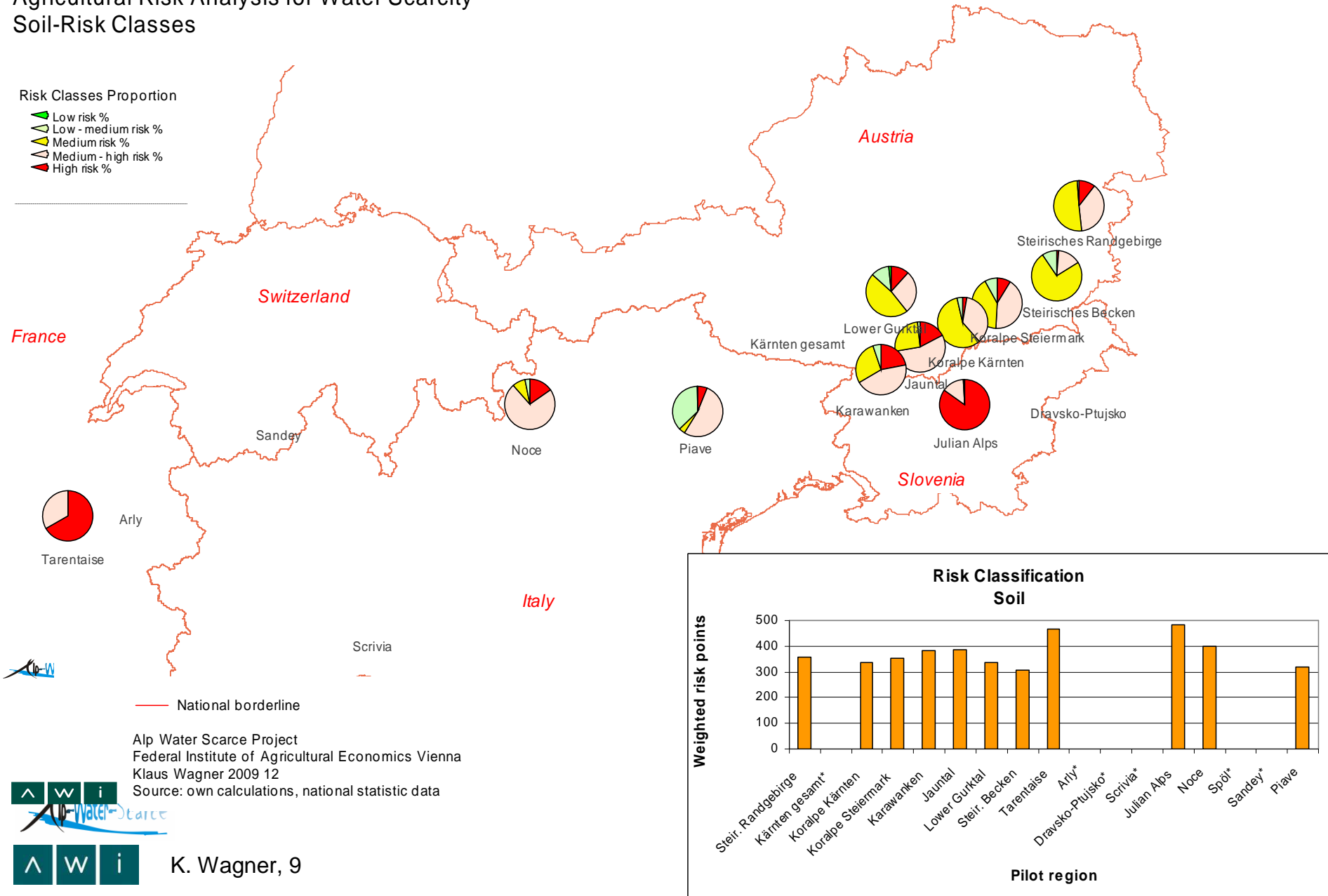


# 2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity  
Soil-Risk Classes

Risk Classes Proportion

- ▲ Low risk %
- ▲ Low - medium risk %
- ▲ Medium risk %
- ▲ Medium - high risk %
- ▲ High risk %

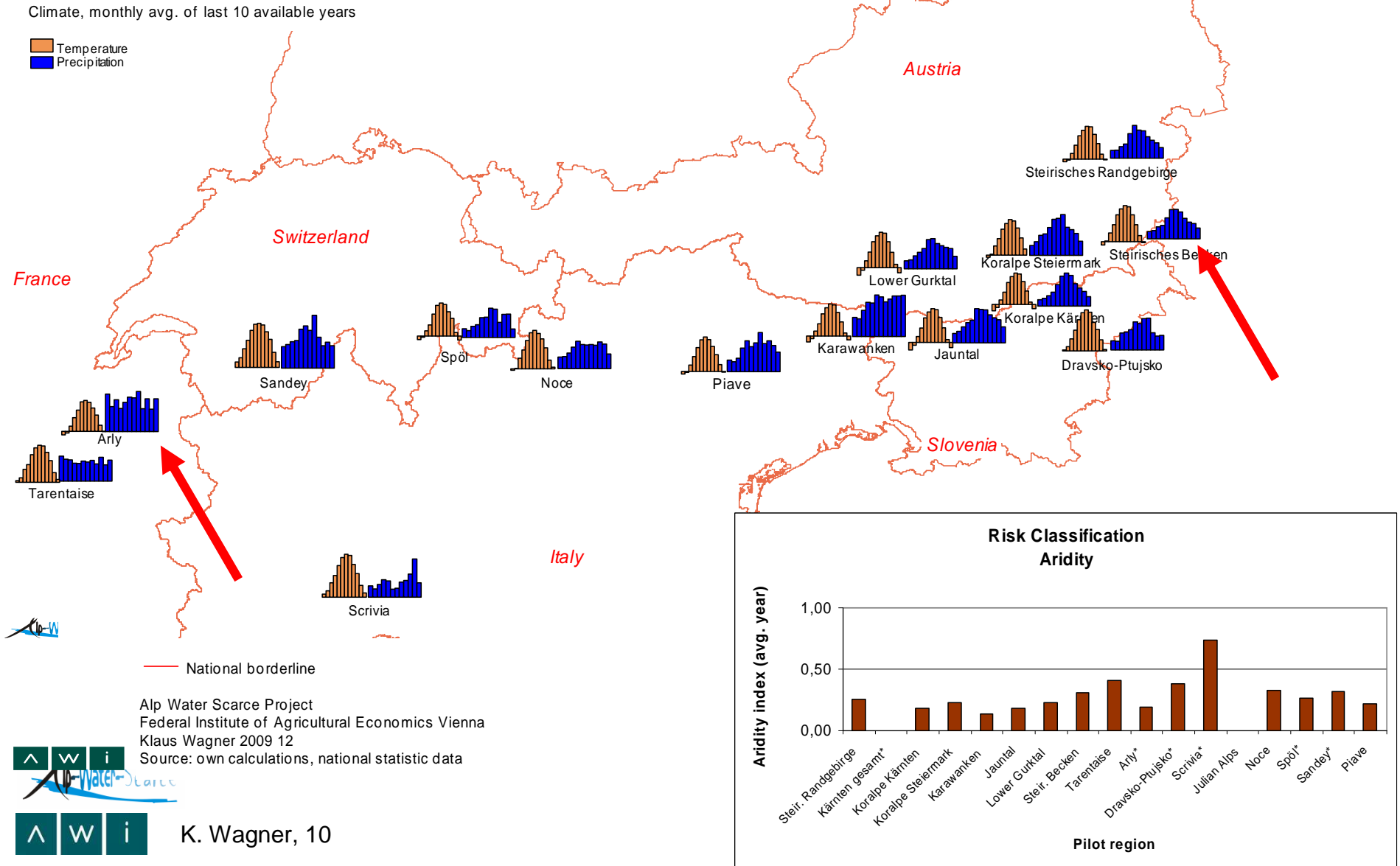


Alp Water Scarce Project  
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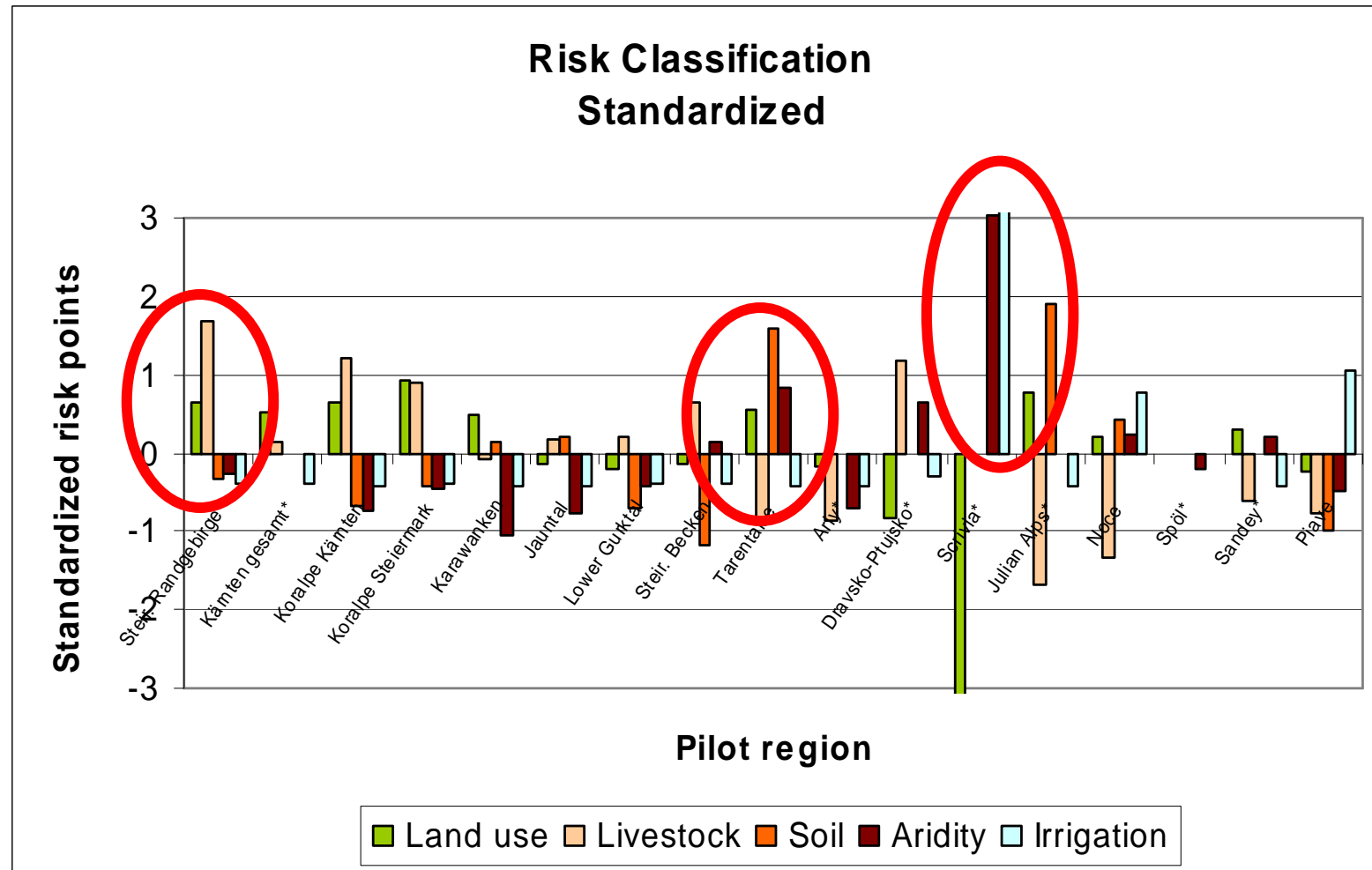


# 2.1 Current Situation

Agricultural Risk Analysis for Water Scarcity  
Pilot regions - overview



## 2.1 Current Situation



## 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

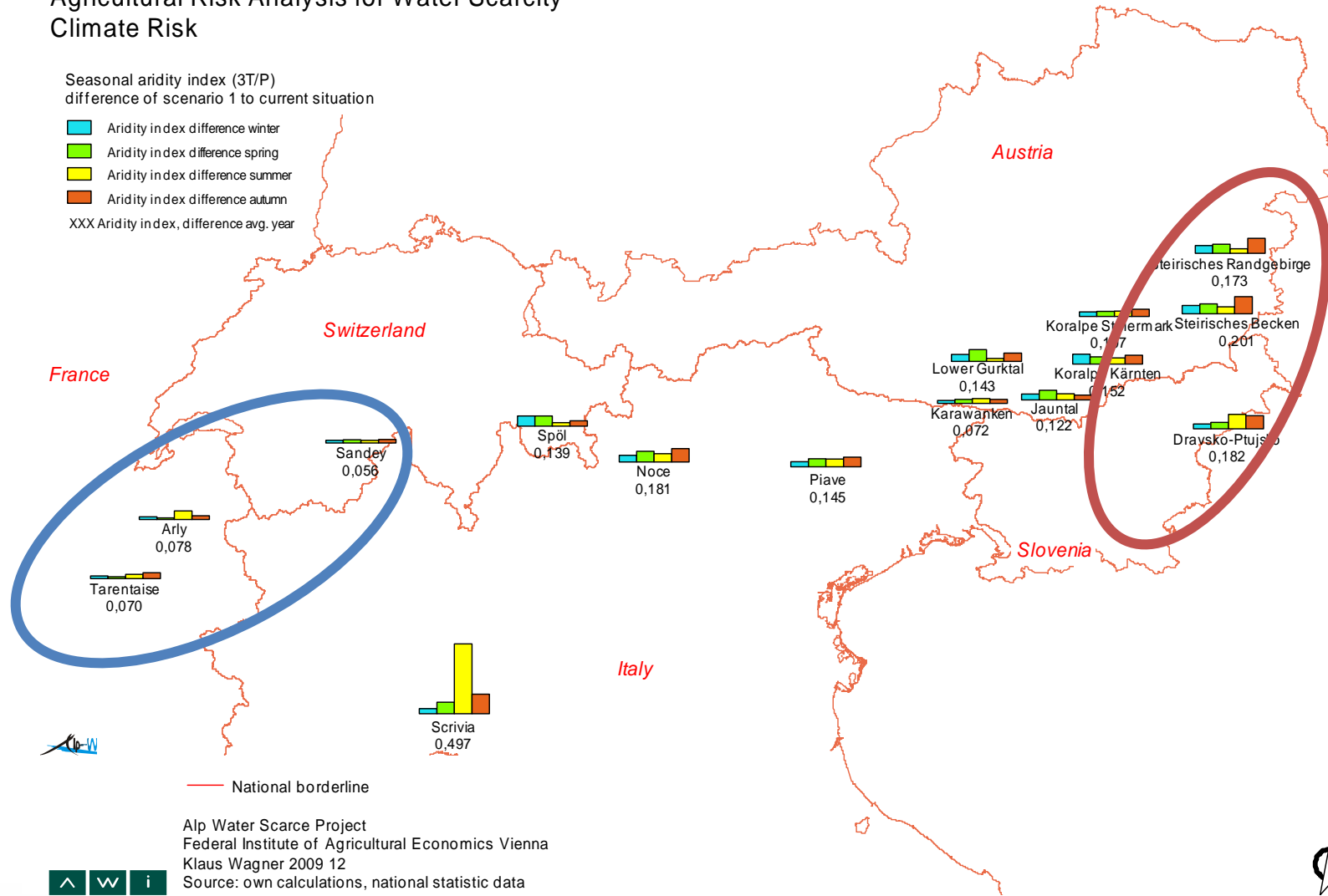
**Conservative scenario:** more policy intervention: keeping production in disadvantaged regions (environmental, regional economy concerns), environmental concerns in intensively used regions, development more balanced

# 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

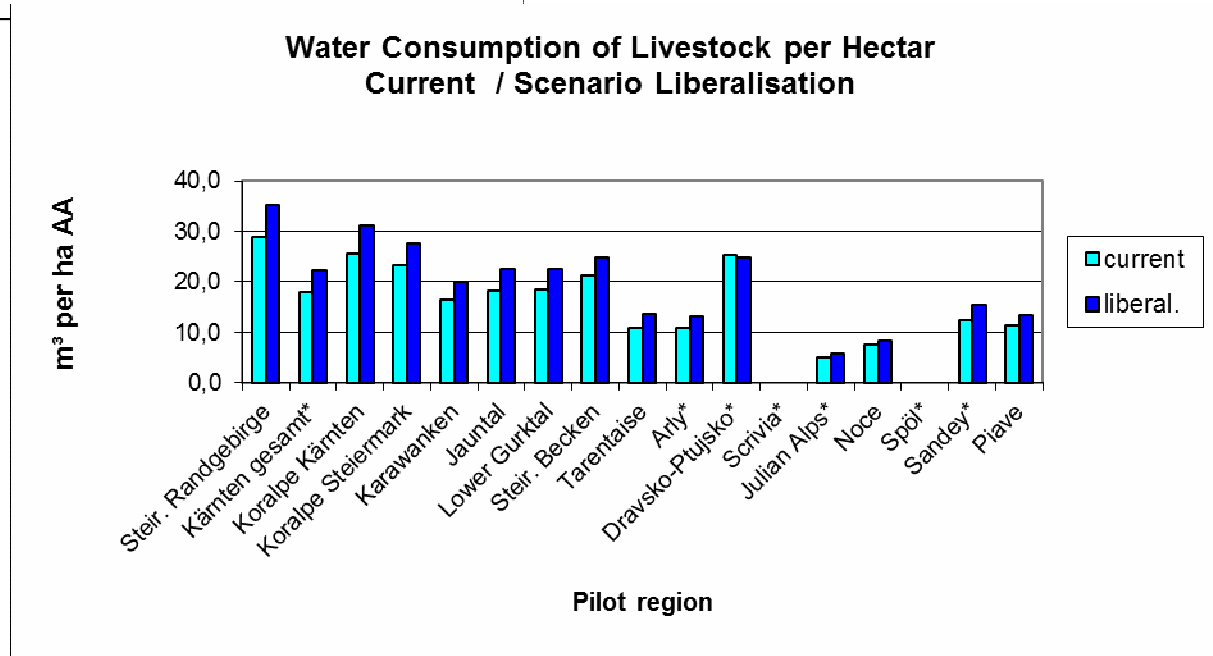
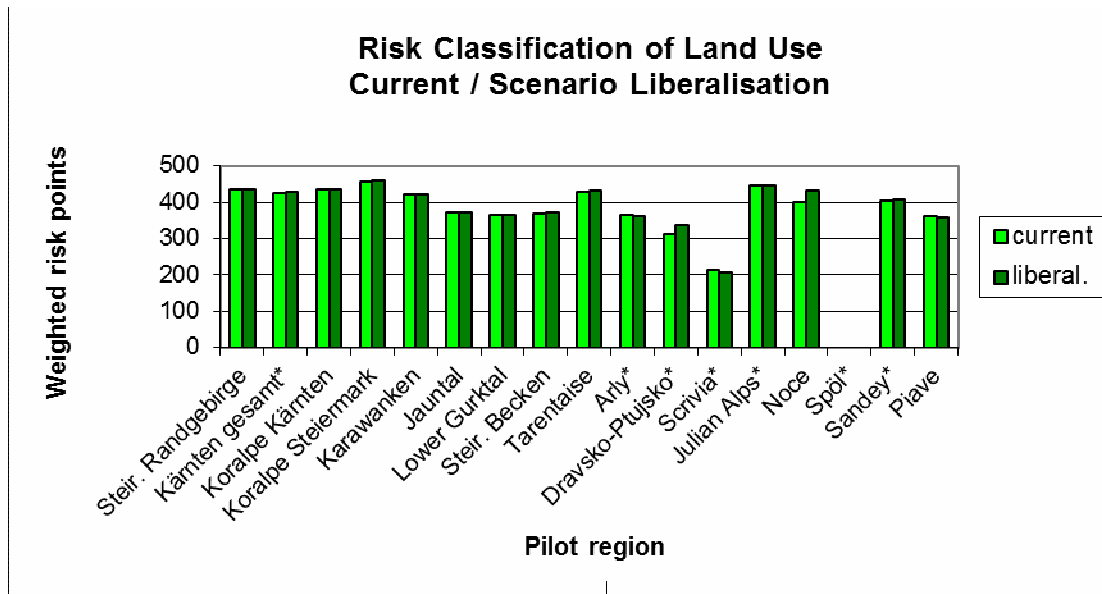
- Aridity in dex difference winter
- Aridity in dex difference spring
- Aridity in dex difference summer
- Aridity in dex difference autumn
- XXX Aridity in dex, difference avg. year



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



# 2.3 Future Risk Patterns Agriculture



## 3 Agricultural policy measures and its influence on water consumption

Measure category	Effects related to water scarcity		Austria	France	Italy	Slovenia	Switzer-land
	Type	Tendency					
<b>Decoupled direct payments</b>	Indirect	Positive	X	X	X	X	X
<b>Coupled direct payments</b>	Direct	Positive	X	X	X	X	X
<b>Market regulation measures</b>	Direct / indirect	Positive/ indifferent/ negative	X	X	X	X	X
<b>Rural Development – Competitiveness</b>	Direct	Positive	X	-	X	X	X
<b>Rural Development - Environment and Countryside</b>	Direct / indirect	Positive / indifferent	X	X	X	X	X
<b>Rural Development - Quality of Life and Diversification</b>	Indirect	Indifferent	X	-	X	-	X
<b>Leader</b>	Indirect	Indifferent	X	X	X	X	-

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



# Subsidies in pilot regions

Percentage of subsidies with:	Austria	France	Italy	Slovenia	Switzerland
Indifferent effects	65	77	46	51	n.a.
Effects of decreasing water consumption	35	23	54	49	n.a.

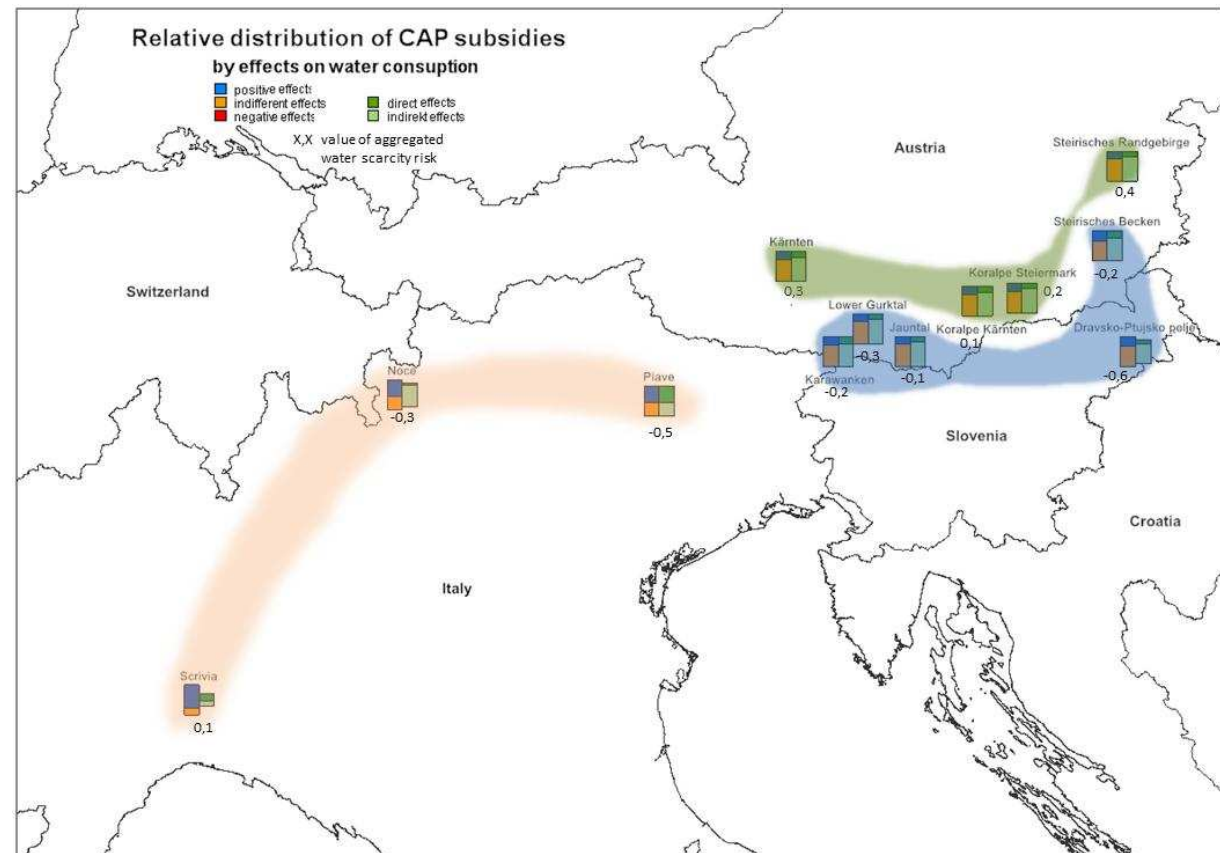
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### 3 Clusters:

**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



## 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, Steirisches 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), 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**

