

# Quality of water is the bottleneck for agriculture



**The consequences of climate change for town and country planning and the environment are now attracting a great deal of attention from politicians and scientists. But what about the effects of climate change on European agriculture? What is striking here is the direct relationship between climate change and water management.**

**KARIN ANEMA**

Professor Simone Orlandini, a research scientist at the University of Florence, has been looking closely at the impact of climate change on agriculture as part of the COST 734 science network. He concentrates on Europe's most important crops, such as maize, grazing land, wheat, potatoes, sugar beet, apples and citrus fruit, examining the effects of drought, intense rainstorms, frost, heat and disease. The team looked at past, present and future climate trends and their effects.

Orlandini explains: "These trends will be used to develop suggestions and warning systems. It is clear that higher temperatures, intense rainstorms and drought have relevant consequences. It is estimated that, depending on the crop, production will decline by an average of ten per cent."



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He recalls the hot summer of 2003, which had major effects on ground water levels and both the quantity and quality of the harvest, especially in Central and Southern Europe. The high temperatures and solar radiation caused the crops to take up far more water than usual. "The arable farmers, the cattle feed industry, dairy farmers and forestry were especially badly hit. The potato growers and winemakers suffered too. Compared to 2002, EU grain production fell by 23 million tons. Side effects, such as soil erosion and flooding, came to light in 2004."

#### **Climate and the market**

Tia Hermans (researcher at Alterra, part of the Wageningen University and Research Centre) looked at the effects of climate change on the European arable sector and the dairy industry, using average climate scenarios. In contrast to Orlandini, she sees the effects of climate change on European agriculture in quite relative terms. "In general, the future of agriculture de-

pends far more on changes in the market than climate change." In her view, the Burgundy winemakers are exaggerating when they seek to blame climate change for poorer quality grapes; it's much more a market issue. According to Tia Hermans, if you want an estimate of agriculture's future, research and policy must concentrate on both climate change and the market.

She finds the effects on agriculture in north western Europe acceptable and believes that farmers will not have to adapt any more or differently than they normally do in any case. "The consequences may certainly be somewhat worse in parts of Portugal, Spain and Italy. The only real bottleneck associated with climate change in the next half-century is good quality water. A lot of the water will soon start to contain too much salt." A lack of fresh water, coupled with extreme temperatures, means that farmers in southerly areas will



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have to adapt, perhaps by switching to a salt-resistant crop. Or maybe a cultivar from an earlier time. Another option is water desalination, which is being done in Southern Spain.

#### **Turkey's precarious water balance**

Turkey is a country that will experience water shortages around 2030. The largest area of the country lies in a semi-arid region: heavy rainfall in the winter months with long, dry summers. So Turkey will have to store water in the brief rainy season.

In 2007, the European Commission set up the twinning project for capacity building support in the Turkish water sector which they initiated to support Turkey in its implementation of the European Water Framework Directive. The goal is to have water management in Turkey accord with the European water and environmental directives in order to advance the process of admission to the EU. The project is being conducted



## The strawberry growers' story clearly shows that climate change has economic consequences

by the Dutch Countryside Commission, in close association with others including the UK Environment Agency, the Slovakian Hydro-meteorological Institute, and Alterra.

Alterra's research, which concentrates on monitoring and climate adaptation, is based on existing climate scenarios. Hydrologist Dr Jochen Froebrich tells us: "It's clear that extreme events will increase throughout the entire Mediterranean region; there will be more intense, shorter periods of rainfall. But it is virtually impossible to make any specific, local forecasts."

What is clear is that climate change will lead to a dramatic decline in the availability of water during the growing season. Moreover, if we are to safeguard our future supply of good-quality water, his colleague Dr Joop Harmsen tells us we shall need to devote great efforts to the treatment of 'used' water. River flows will drop by about 20 per cent in 2050. Higher temperatures will increase evaporation by as much as 30-50 per cent. Productivity will increase, more biomass will be created. Salt will become a serious problem.

William Oliemans, at the Dutch Countryside Commission, says: "Less water, which is simultaneously more saline, coupled with unreliable precipitation, will have major, system-wide effects throughout the entire water system."

### A full river basin plan

A management plan has been drafted – Turkey's first – for the 600 km long Büyük Menderes river basin in south-western Turkey. The area is inhabited by 2.5 million people, who depend on agriculture and industries such as olive oil, cotton and leather. With irrigation, the rich clay soil will allow many crops to be raised,

from strawberries to cotton, from vegetables to olive trees, figs, lemons, wheat and maize.

As Henk Sterk, project leader and Twinning Adviser in Turkey puts it: "The decreased water flow, coupled with increased evaporation, will have serious effects on agriculture, which uses 75 per cent of all the river flow for irrigation. Right now, the farmers are experiencing major water shortage problems. The strawberry growers are having difficulty marketing the products in Europe because the berries are too polluted. The river pollution has stayed the same, but it has been concentrated thanks to the lower flow rate. These problems have become increasingly serious in recent years."

Due to the water shortage, drainage water and polluted river water are being re-used with increasing frequency, says William Oliemans: "Among other things, it contains coliform bacteria and pollution from the tanneries." The result? Further pollution of the groundwater and surface waters.

And that, says Froebrich, is where another problem rears its head: the demand for water is increasing, not just from agriculture, but from the towns too. "Water consumption has increased by tens of percentage points, while the supply has decreased."

### Saving water on the farm and in the home

The project is scheduled for completion in 2010. The basin management plan is now ready. The advice on adaptation takes account of future water shortages. It includes drip-feed irrigation, phased improvements to water quality, an approach to untreated or inadequately treated water, or switching to other crops that depend less on water. In Turkey, for instance, the cultivation of cotton, tobacco and rice is very water



## Climate change and winemaking

Agronomists, vegetation experts and economists in the European COST Action 734 looked at the effect of climate change on wine and olive oil production in Italy. It is expected that, even before 2050, the grape growing season will be about three weeks longer, the period of snow and frost will be noticeably shorter, there will be more water shortages, with more suitable days for planting and harvesting. The grapes will be heavier. Winemaking will shift a long way to the north and to the south. The winemakers in Burgundy are complaining that all this is leading to a loss of quality: their wine will lose its elegance they say.



## Attempts to encourage greater consumption of local food produce (zero kilometre chain) are very interesting

intensive. Rice consumes 15,000 to 20,000 cubic metres of water per hectare per annum. As Sterk puts it: "It's all about making the farmers aware that they just can't grow rice any more." One alternative might be vegetable growing. Or relatively salt-resistant citrus and cotton. Oliemans adds: "The water shortage may also mean that herders will have to switch to another lifestyle."

The advice is not just concerned with agriculture, though; it is also directed at households. In Sterk's words: "At the moment, water consumption is often paid for with a lump sum. But by just paying for actual water consumption, our hope is that people will become much more aware of their water usage."

### Adaptation at the local level

Translating general advice to the local level is a challenging task, says Sterk: "The measures are pretty abstract as they relate to the entire basin. A series of steps will have to be taken to delve deeper into the techniques needed to cut water consumption. The details will have to go into production methods and crop selection, for instance." One major benefit, in his view, is that the effects of climate change on agriculture are now on the agenda; it's now possible to discuss the topic. "A few years ago it was all denied, or else invisible. By way of illustration, Turkey only signed up to the Kyoto Protocol six months ago.

The strawberry growers' story clearly shows that climate change has economic consequences. The downstream growers blame their upstream colleagues, saying they extract too much water from the river. This hasn't led to conflicts yet, because government has taken the responsibility for spreading the water shortages around, but I expect tensions to rise if the levels drop any further."

The EU is working on ways to improve forecasts so they can also apply to the local level. Jochen Froebrich sees yet another missing link. "Hydrological research still concentrates too much on visible, major rivers. The European Framework Directive doesn't pay enough attention to tributaries and dry river beds, but it's exactly those that illustrate the weather dynamics and the situation in Southern Europe. Extreme situations make it difficult to gain any insight into real evaporation, real flow rates, and water consumption. It's an exciting challenge to get a picture of the Mediterranean area using system analyses, getting a complete picture of an entire basin, as we've done in Turkey. But it's essential if we're to secure improvements in water quality and improve the water shortage situation.' His department has submitted a proposal for follow-up research into improving the quality of the water balance in the Mediterranean, using Turkey as a model project. 'Countries like Italy and Greece in particular need permanent support if they are to fulfil the Water Framework Directive."

The key question, according to Tia Hermans, is how to ensure sufficient water for agriculture in the future. "How will policy be used to allocate a scarce water resource? If agriculture is the last function in the Netherlands to receive a water allocation, then we're in real trouble."

According to Orlandini, the consequences of climate change can only be ameliorated by cutting energy consumption while increasing sustainable energy generation. "What we must do is cut transport. Attempts to encourage greater consumption of local food produce (zero kilometer chain) are very interesting. But agriculture must also play a major role in cutting greenhouse gas emissions and in absorbing them."

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