

## Tackling the challenges of agricultural groundwater use

Groundwater is increasingly important for agriculture irrigation in semi-arid regions. Groundwater use has grown progressively to reach 40% of global and a third of OECD irrigation use. It provides a highly important resource to cope with increasingly variable water supplies, especially under climate change.

Intensive use of groundwater for irrigation leads to the lowering of water tables, reducing its potential for future use. It also generates multiple negative externalities, including salinity, stream depletion, or land subsidence that directly affect agricultural productivity, water users and the environment.

Governments can alleviate the negative effects of agricultural groundwater use and sustain the capacity of aquifers for the future. To this effect they should:

- Invest in groundwater information, which remain incomplete and insufficient in many OECD countries, to properly manage groundwater.
- Ensure that existing groundwater policies are enforced; that they favour reducing water demand; that they account for connections with surface water systems; and that other policies, such as energy subsidies, do not create counteracting incentives.
- In regions with intensive groundwater use, employ a combination of regulatory, economic and collective action policy approaches, customised to local circumstances.

### What are the issues?

#### Groundwater is an increasingly important resource for irrigated agriculture

[Groundwater resources sustain a significant and increasing share of irrigated agricultural production.](#) Groundwater is used for over 40% of global irrigation on almost 40% of irrigated land. It has become indispensable for agriculture production in many countries; it accounts for half of South Asia's irrigation and supports two-thirds of grain crops produced in China. Just like China, India and Pakistan, the leading groundwater irrigating OECD countries have increased their use of groundwater over the past 25 years (Figure 1 left panel). OECD countries now withdraw 123.5 km<sup>3</sup> of groundwater each year to irrigate semi-arid areas, representing 56% of total OECD groundwater withdrawals.

[The growing importance of groundwater for agriculture can largely be explained by the capacity of groundwater to act as a reliable water source for irrigation,](#) providing water on demand, while being largely unaffected by seasonal surface hydrological variation. In particular, groundwater irrigation enables the high-value agricultural production in the drought-prone regions of Southern Europe and California.

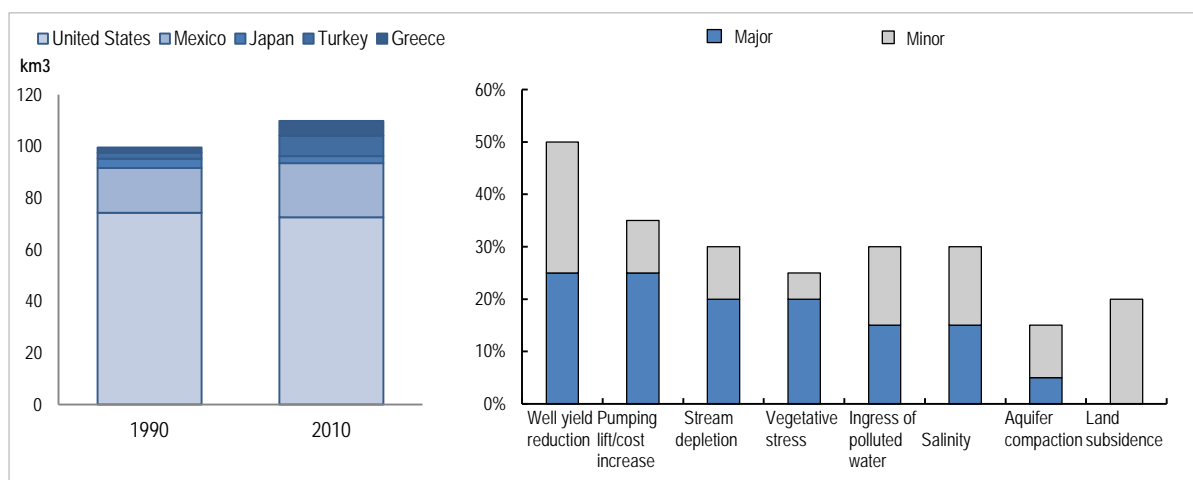
#### Intensive groundwater pumping for irrigation has a negative impact on the environment and farmers

[This expansion of irrigation with groundwater has led to the use of groundwater beyond natural recharge in many regions.](#) Continued abstraction results in the lowering of water tables, which in turn increases the cost of pumping and could possibly create a “race to the bottom” among producers.

[Where use is intensive, reaching unsustainable level, groundwater overdraft has further resulted in significant negative externalities with direct impacts on agriculture production](#) (Figure 1, right panel). Intensive groundwater withdrawals for agriculture have contributed to depleted streams, rivers and lakes in some regions and caused the sometimes irreversible salinization of aquifers in coastal areas, impacting all surface water users, including farmers, and damaging ecosystems. Intensive pumping is also responsible for land subsidence in some regions, causing costly damage to infrastructure in urban and rural areas, while diminishing the capacity of aquifers to store water for future uses.

**Figure 1. Agriculture groundwater use increased (left) and has generated local environmental externalities (right)**

Agricultural groundwater use in major withdrawing OECD countries, 1990 and 2010 (left), and proportion of OECD regions with at least one externality linked to withdrawing groundwater for agriculture (among 20 regions surveyed, right)



Source: OECD (2015).

## What should governments do?

**Governments should improve information systems and apply a combination of management approaches**

Agriculture production and groundwater supplies will suffer unless governments pay closer attention to the issue. Governments should as a priority develop more robust information systems on these increasingly important resources. OECD countries still lack key information about stocks and flows of groundwater over time, preventing effective management.

In all regions with groundwater stresses, governments should favour demand-side measures that curtail water consumption and that take into account surface and groundwater interactions. They should also enforce existing regulations and remove perverse incentives, such as energy subsidies, which encourage excessive use.

In those regions with intensive groundwater use, governments should use a combination of regulatory, economic and collective-action approaches, adapted to local circumstances. In particular, they should support a well-defined groundwater entitlement system, provide economic incentives towards a more efficient resource use (e.g., via groundwater trading or pricing), and involve collectives of users in management for locally-adapted outcomes. When facing very high groundwater stress, governments may also look to increase agricultural water productivity and implement supply-side mechanisms that allow groundwater sources to recharge.

**The stakes are rising: actions should be taken now to mitigate future problems**

With climate change, the need for better policies to manage groundwater use increases in a growing number of regions. Climate change is expected to increase water stress in more regions, increasing the role of groundwater management. Surface water volatility and weather shocks will greatly expand the role of groundwater in current and future irrigated areas. As a result, several regions that do not significantly use groundwater for agriculture will likely do so in the future and risk facing the same challenges currently experienced in the regions which already use groundwater intensively.

The implementation of the sustainable resource management policies outlined above would allow groundwater to act as a powerful climate change adaptation option, a natural insurance mechanism, and not just a component of freshwater supplies.

## For more information

OECD (2015), *Drying Wells, Rising Stakes: Towards Sustainable Agricultural Groundwater Use*, OECD Studies on Water, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264238701-en>

Groundwater policy country profiles: <http://www.oecd.org/tad/sustainable-agriculture/groundwater-use.htm>