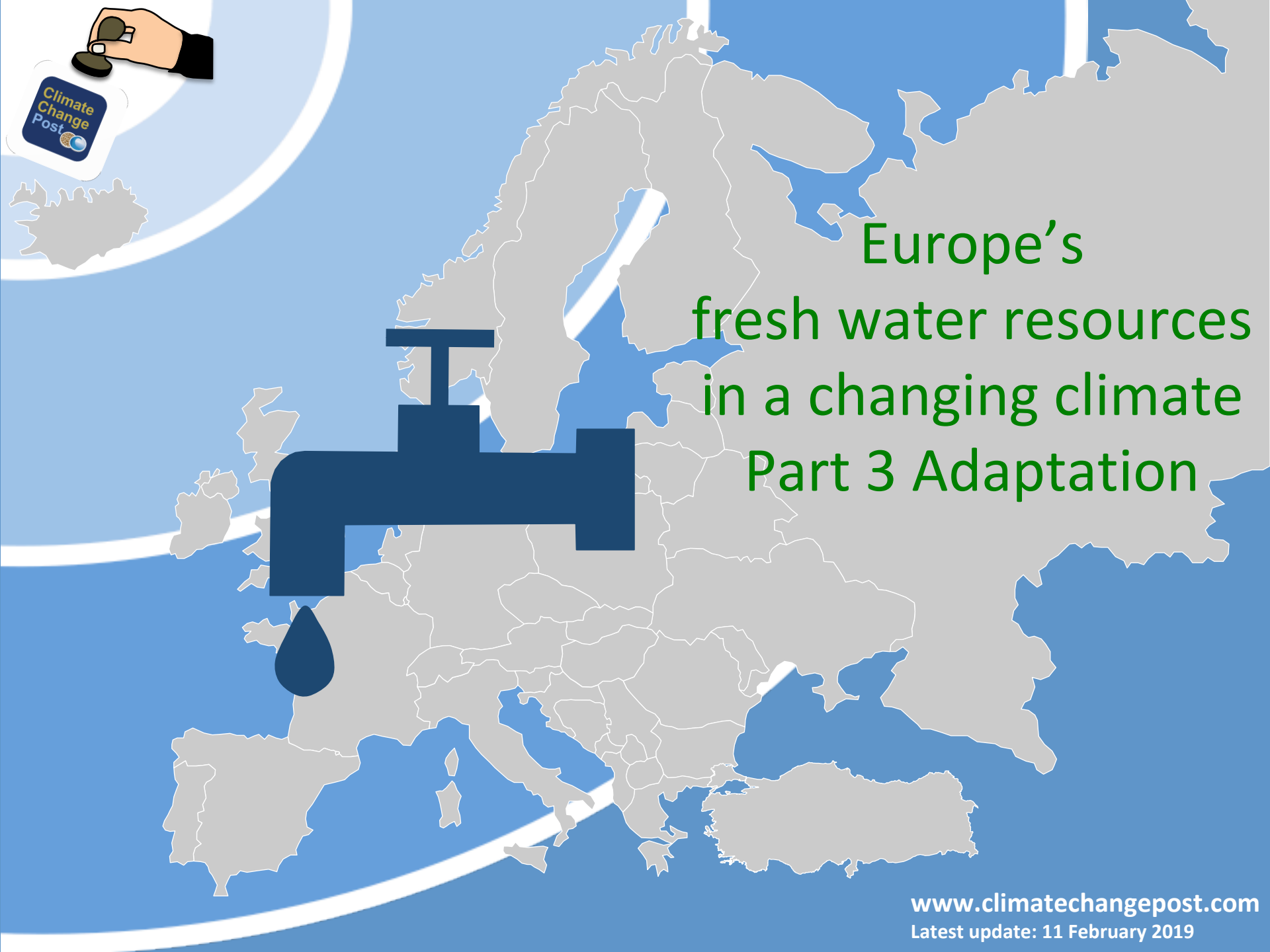

Europe's fresh water resources in a changing climate Part 3 Adaptation

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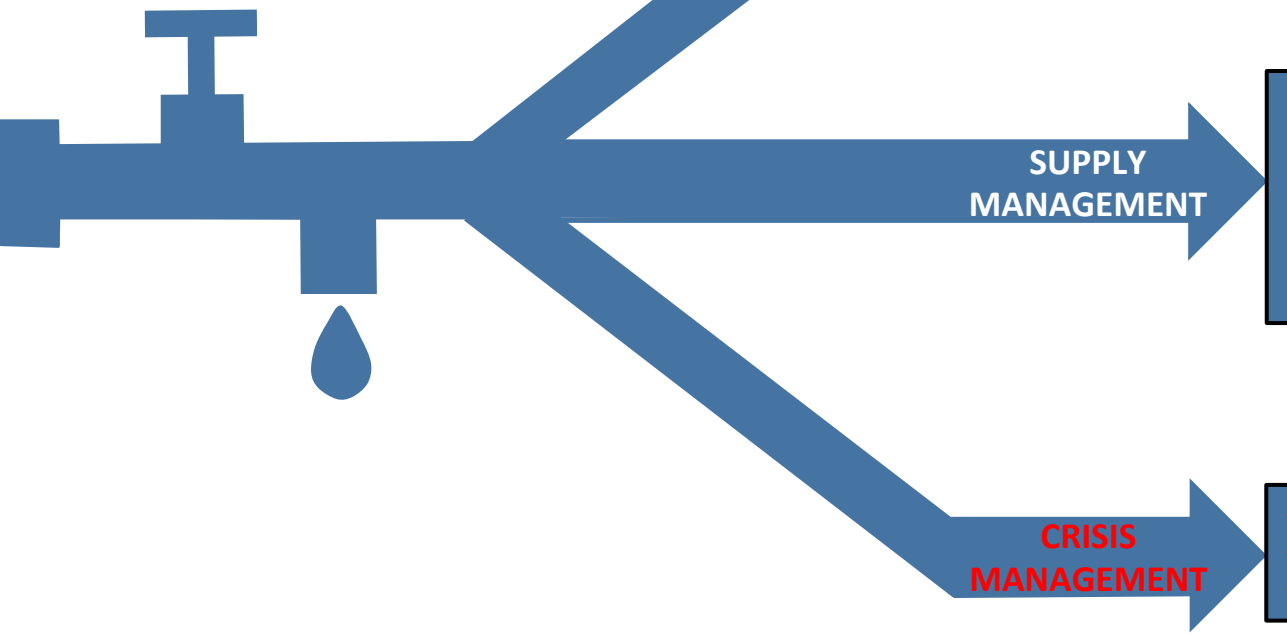
Latest update: 11 February 2019

Adaptation



DEMAND MANAGEMENT

- Water saving devices
- Reduce leakage
- Change behaviour consumers
- Water pricing en metering
- Optimised irrigation efficiency
- Drought tolerant crops
- Insurance schemes against drought damage

SUPPLY MANAGEMENT

- Wastewater re-use
- Harvest rainwater
- Managed aquifer recharge
- Desalination
- Infrastructural measures
- Changes in land use / forest management

CRISIS MANAGEMENT

- Supply by tankers
- Emergency pumps
- Restrictions on supplies

Managed aquifer recharge wherein excess surface water, desalinated water and treated waste water are stored in depleted aquifers could also supplement groundwater storage for use during droughts. The use of aquifers as natural storage reservoirs avoids many of the problems of evaporative losses and ecosystem impacts associated with large, constructed surface-water reservoirs. Artificial water recharge has been practiced widely in Europe since the nineteenth century and today is used to produce drinking water in many countries.

SUPPLY MANAGEMENT

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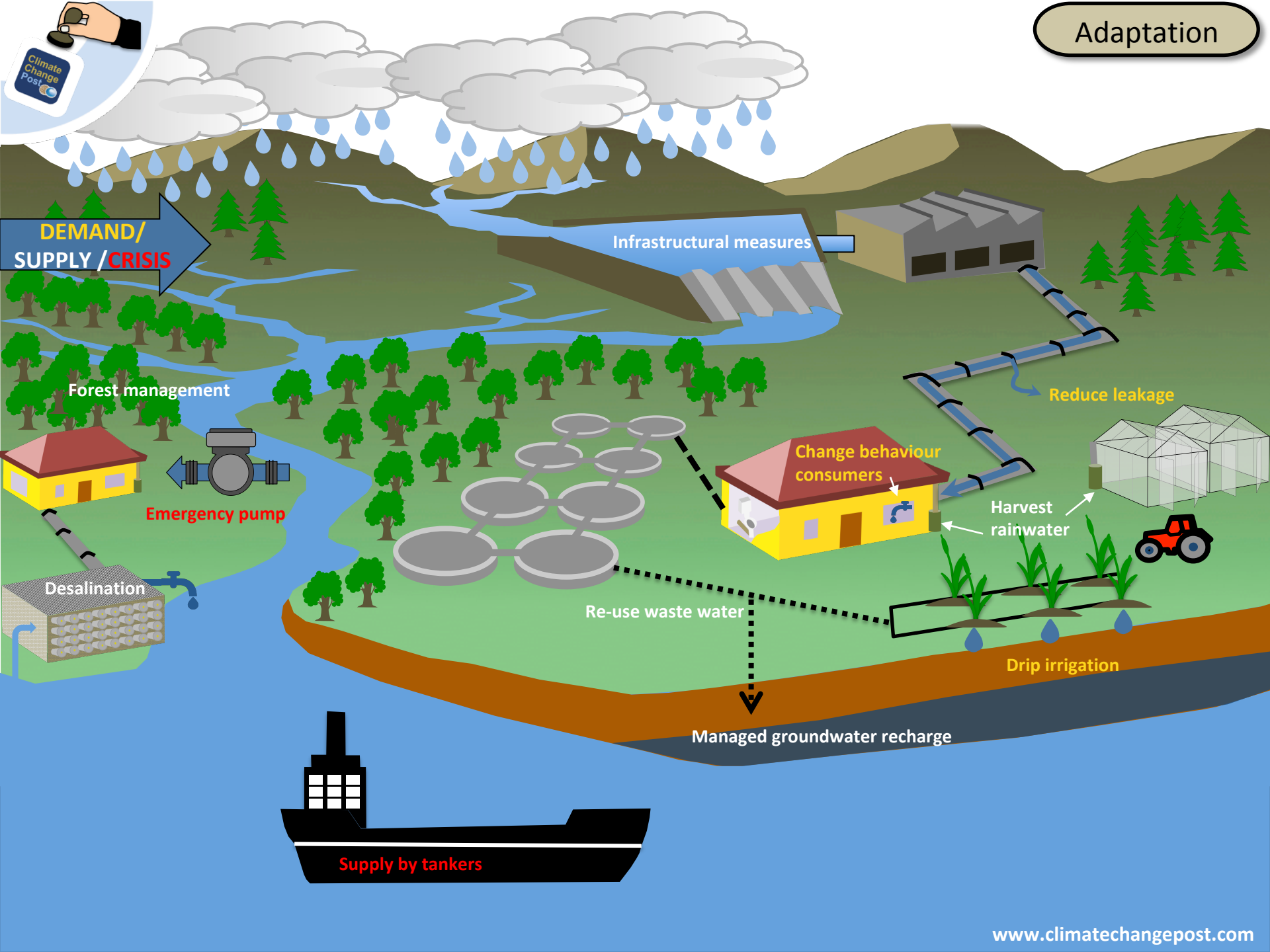
Downsides to **desalination** are: negative effects on marine ecosystems, high-energy consumption, and high CO2 emissions. Furthermore desalination may increase water prices, induce uncontained urban growth, and increase dependence on technical expertise.

Reservoirs, storage units and retention basins, but also adequate management of reservoirs and runoff regulation, are important components of the **infrastructure for fresh water supply**. In parts of Europe, increase of reservoir capacity, infrastructure for water transfer from one river basin to another, more storm water collection, and reconstructing of water supply networks is needed.

Forest management can mitigate the effects of climate change on fresh water resources. Increasing or decreasing forest cover, altering dominant species, or converting deciduous to conifer forests can enhance or lessen the effects of changes in precipitation patterns on stream flows. Other land use changes to protect or enhance fresh water resources are restoring riparian vegetation and relocating intensive farming to less vulnerable areas.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DEMAND/
SUPPLY /CRISIS
Infrastructural measures
Forest management
Reduce leakage
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Desalination
Re-use waste water
Drip irrigation
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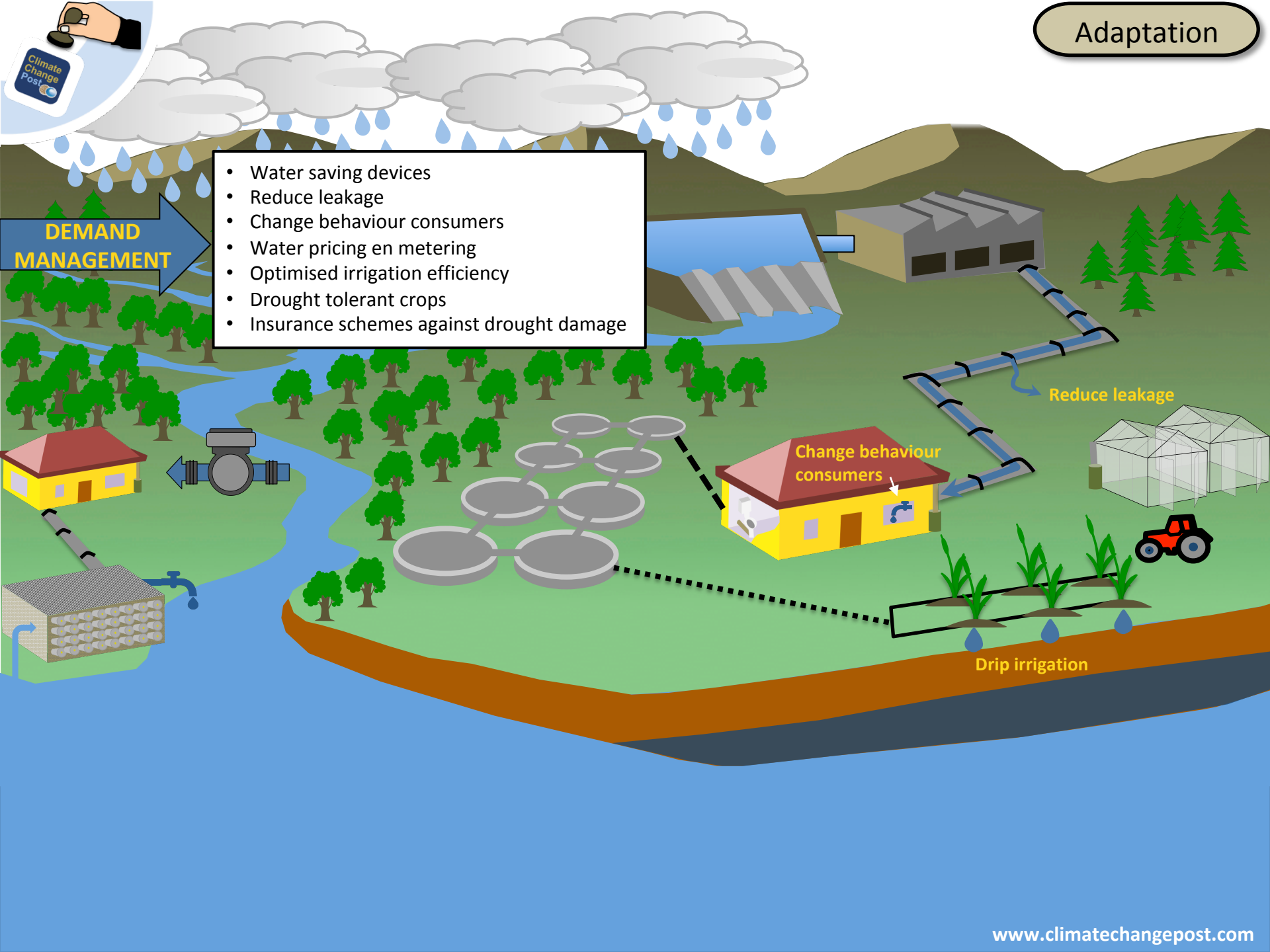
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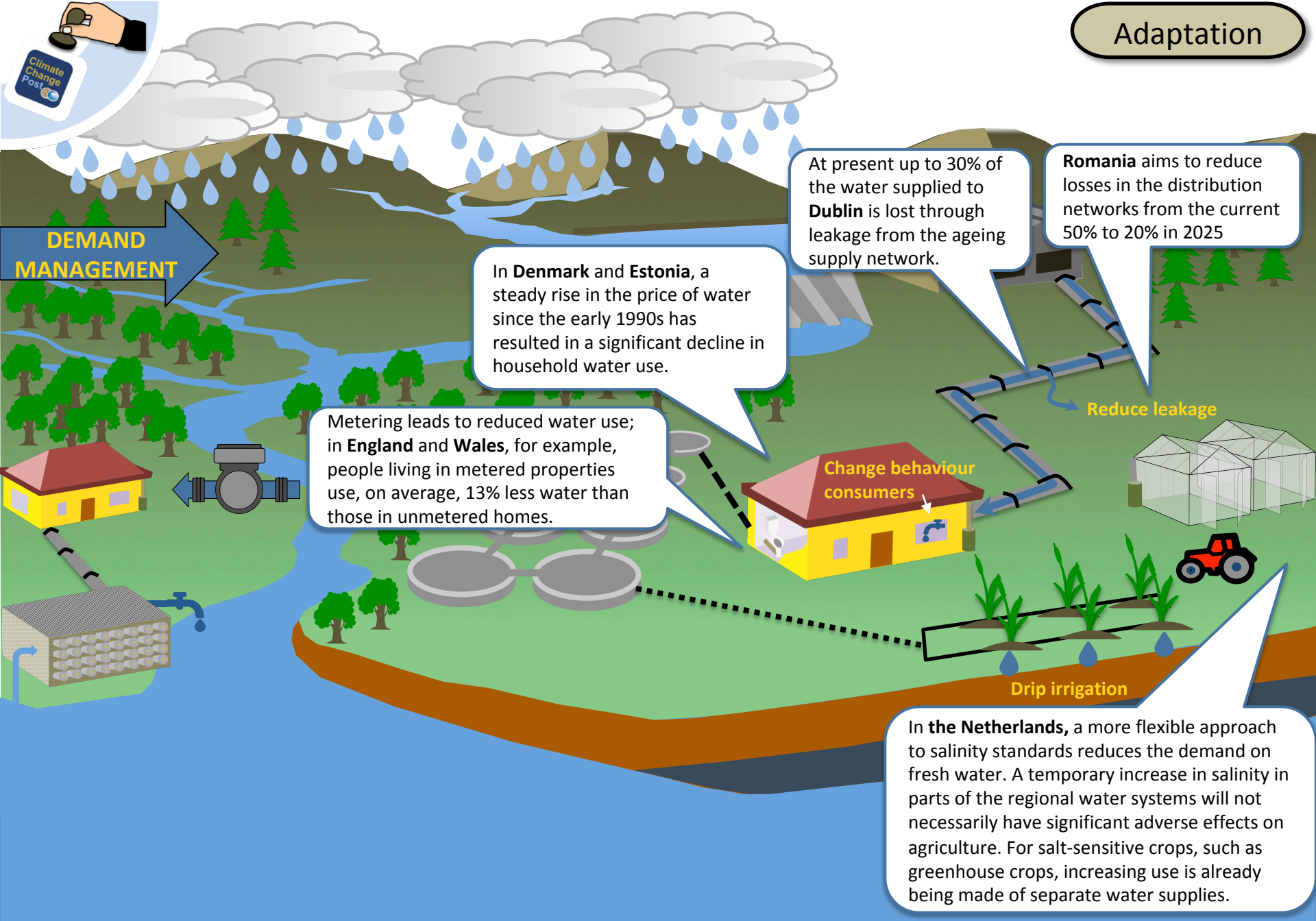
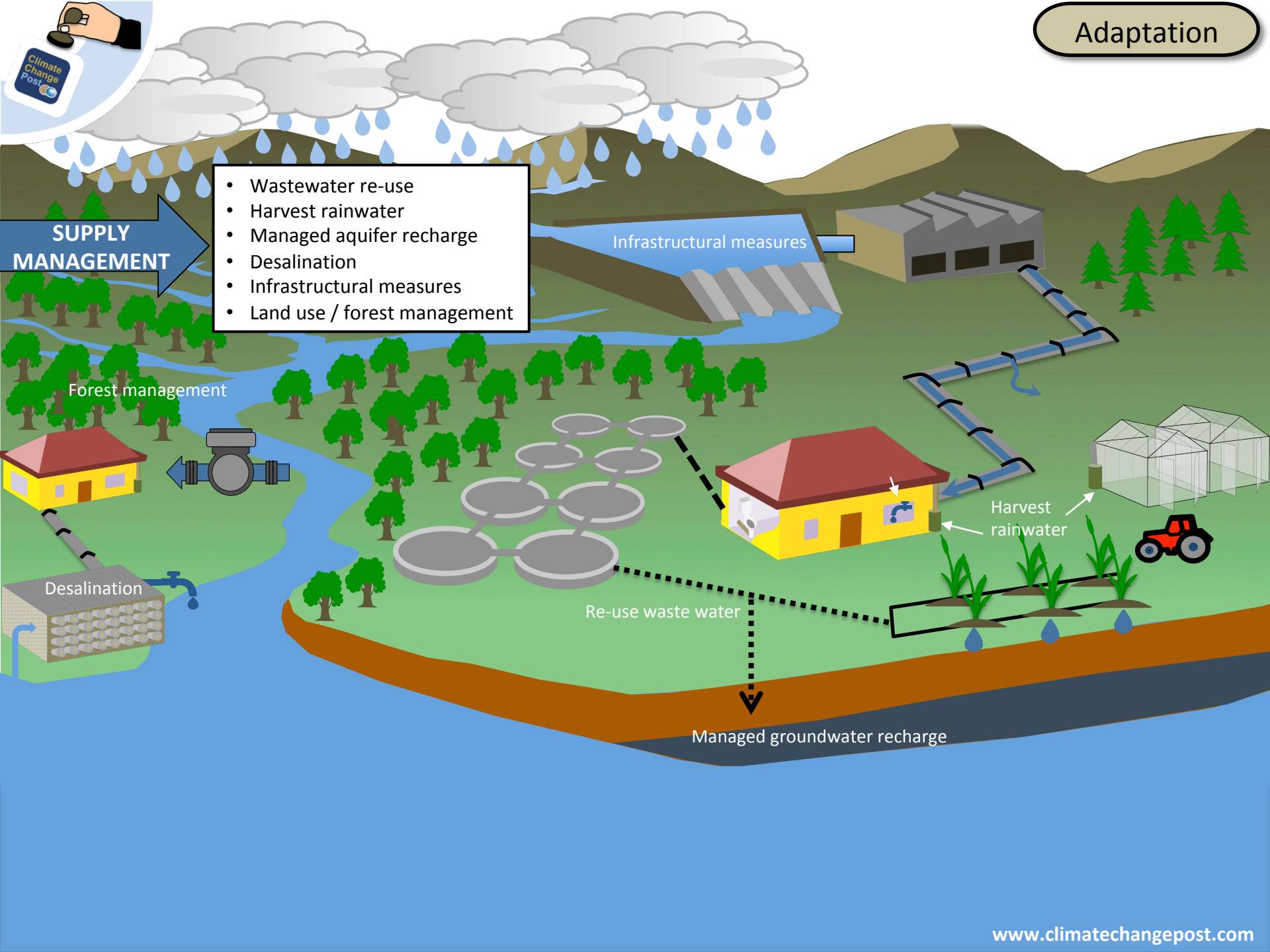

DEMAND MANAGEMENT
In **Denmark** and **Estonia**, a steady rise in the price of water since the early 1990s has resulted in a significant decline in household water use.
At present up to 30% of the water supplied to **Dublin** is lost through leakage from the ageing supply network.
Romania aims to reduce losses in the distribution networks from the current 50% to 20% in 2025
Reduce leakage
Metering leads to reduced water use; in **England** and **Wales**, for example, people living in metered properties use, on average, 13% less water than those in unmetered homes.
Change behaviour consumers
Drip irrigation
In **the Netherlands,** a more flexible approach to salinity standards reduces the demand on fresh water. A temporary increase in salinity in parts of the regional water systems will not necessarily have significant adverse effects on agriculture. For salt-sensitive crops, such as greenhouse crops, increasing use is already being made of separate water supplies.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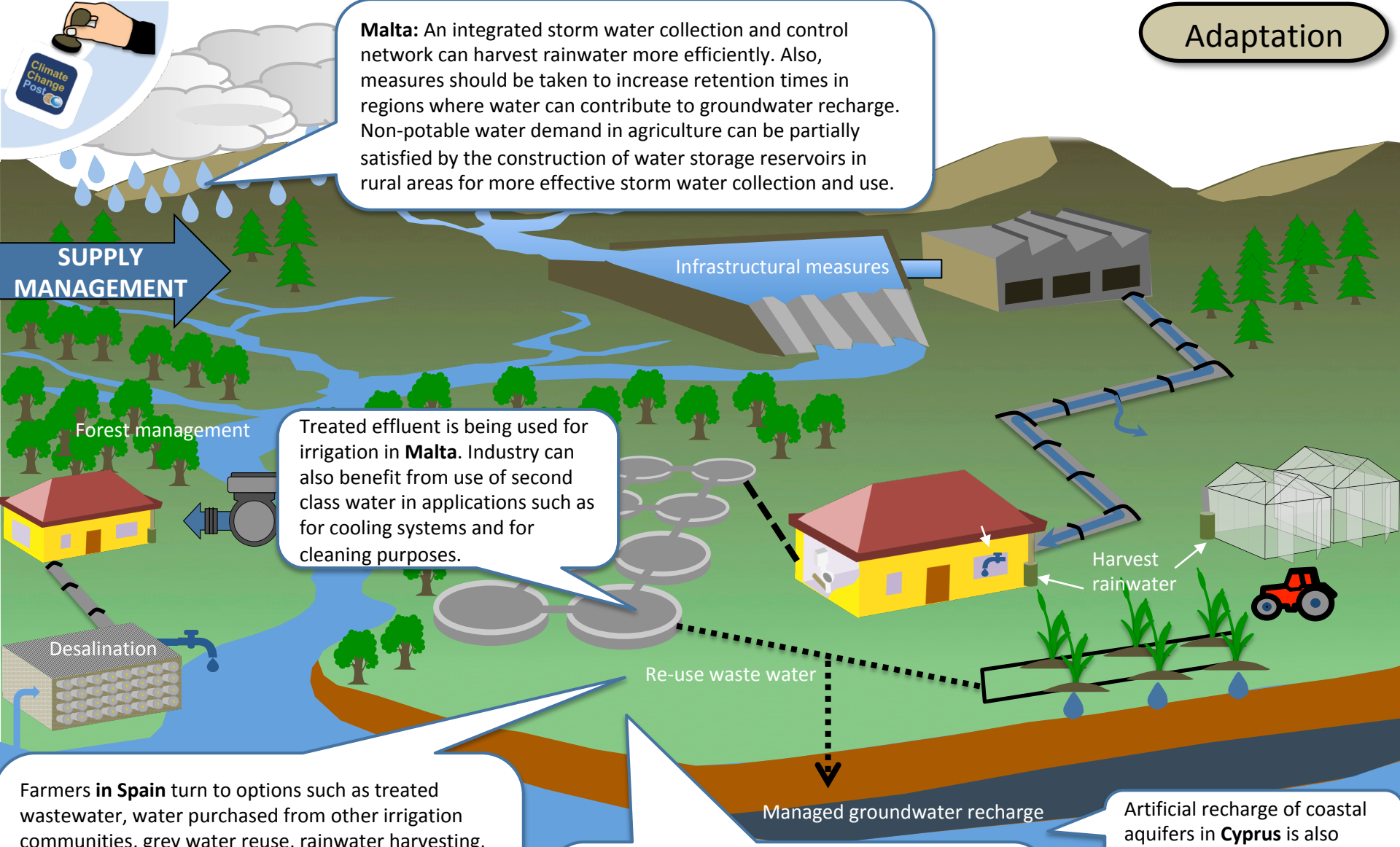
Malta: An integrated storm water collection and control network can harvest rainwater more efficiently. Also, measures should be taken to increase retention times in regions where water can contribute to groundwater recharge. Non-potable water demand in agriculture can be partially satisfied by the construction of water storage reservoirs in rural areas for more effective storm water collection and use.



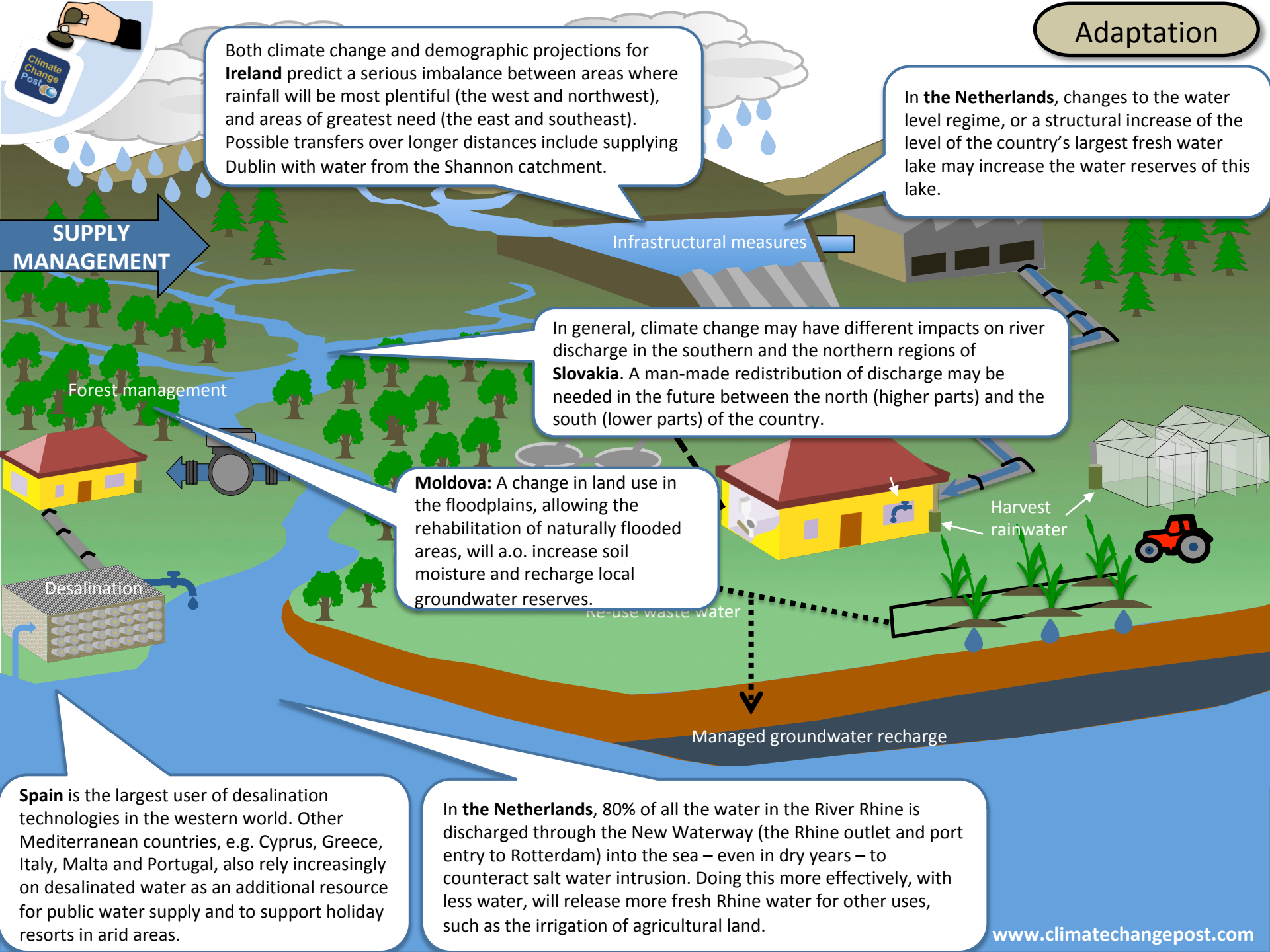
Treated effluent is being used for irrigation in **Malta**. Industry can also benefit from use of second class water in applications such as for cooling systems and for cleaning purposes.

Farmers **in Spain** turn to options such as treated wastewater, water purchased from other irrigation communities, grey water reuse, rainwater harvesting, or even desalted water mixed with other water sources to decrease costs. Examples of successful use of wastewater in agriculture exist in Gran Canaria, where 20 % of water used across all sectors is supplied from treated wastewater, including irrigation.

Cyprus also re-uses tertiary treated wastewater, more than half of which is used for irrigation of crops, either directly or through the artificial recharge of aquifers. The re-use of wastewater for agriculture raises soil contamination and public health concerns, particularly with respect to pathogens and hazardous substances.

Artificial recharge of coastal aquifers in **Cyprus** is also used to control against seawater intrusion.

Adaptation



Both climate change and demographic projections for **Ireland** predict a serious imbalance between areas where rainfall will be most plentiful (the west and northwest), and areas of greatest need (the east and southeast). Possible transfers over longer distances include supplying Dublin with water from the Shannon catchment.

In **the Netherlands**, changes to the water level regime, or a structural increase of the level of the country's largest fresh water lake may increase the water reserves of this lake.

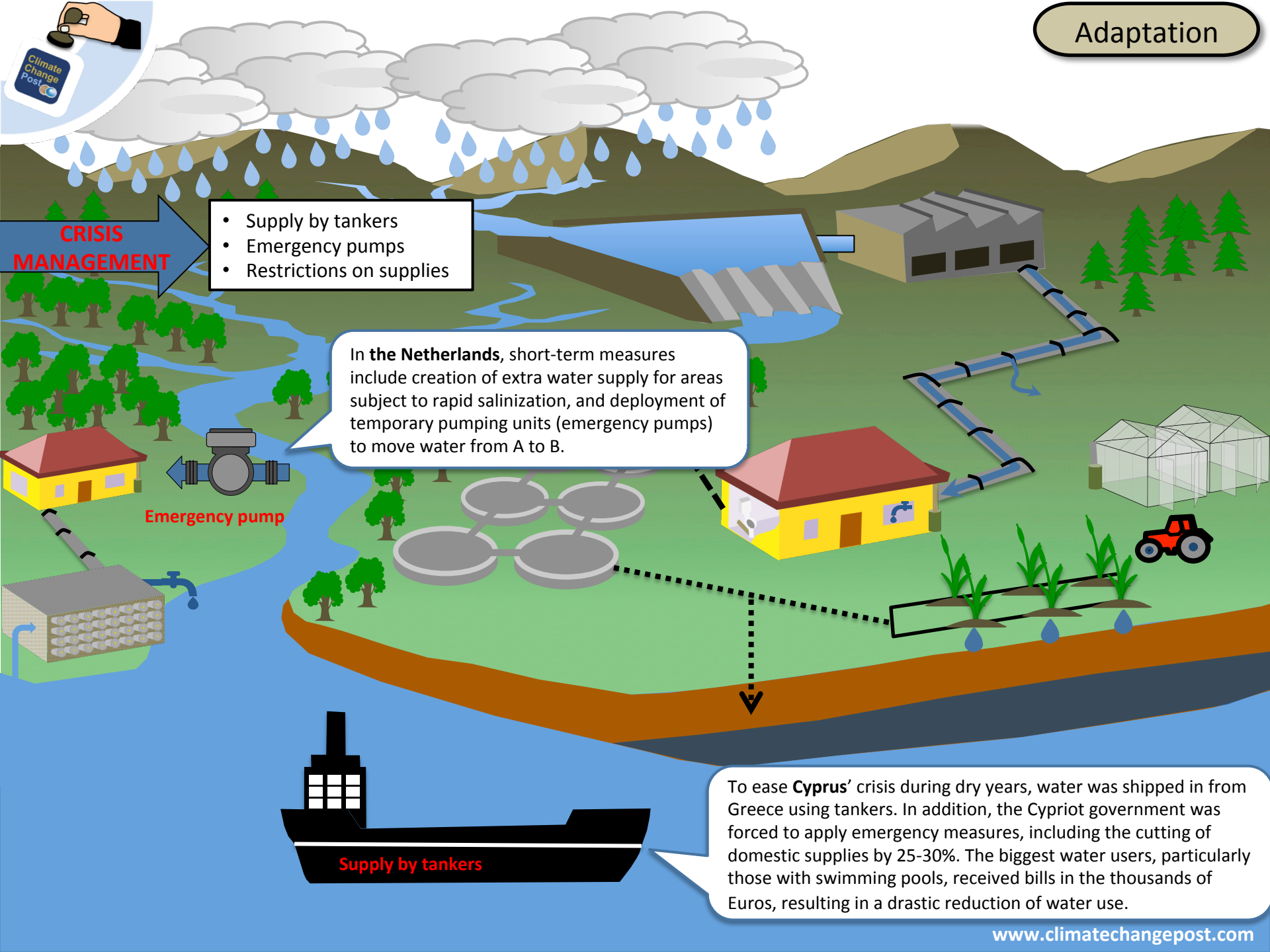
In general, climate change may have different impacts on river discharge in the southern and the northern regions of **Slovakia**. A man-made redistribution of discharge may be needed in the future between the north (higher parts) and the south (lower parts) of the country.

Moldova: A change in land use in the floodplains, allowing the rehabilitation of naturally flooded areas, will a.o. increase soil moisture and recharge local groundwater reserves.

Spain is the largest user of desalination technologies in the western world. Other Mediterranean countries, e.g. Cyprus, Greece, Italy, Malta and Portugal, also rely increasingly on desalinated water as an additional resource for public water supply and to support holiday resorts in arid areas.

In **the Netherlands**, 80% of all the water in the River Rhine is discharged through the New Waterway (the Rhine outlet and port entry to Rotterdam) into the sea – even in dry years – to counteract salt water intrusion. Doing this more effectively, with less water, will release more fresh Rhine water for other uses, such as the irrigation of agricultural land.

Adaptation


CRISIS MANAGEMENT
• Supply by tankers
• Emergency pumps
• Restrictions on supplies
In **the Netherlands**, short-term measures include creation of extra water supply for areas subject to rapid salinization, and deployment of temporary pumping units (emergency pumps) to move water from A to B.
Emergency pump
Supply by tankers
To ease **Cyprus**' crisis during dry years, water was shipped in from Greece using tankers. In addition, the Cypriot government was forced to apply emergency measures, including the cutting of domestic supplies by 25-30%. The biggest water users, particularly those with swimming pools, received bills in the thousands of Euros, resulting in a drastic reduction of water use.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