Reducing water scarcity possible by 2050

Water Program, IIASA

Yoshihide Wada

Strategies to reduce water stress

“Soft measures”

1. Agricultural water productivity could be improved in stressed basins where agriculture is commonly irrigated. Reducing the fraction of water-stressed population by 2% by the year 2050 could be achieved with the help of new cultivars, or higher efficiency of nutrients application. Concerns include the impacts of genetic modification and eutrophication.

2. Irrigation efficiency could also be improved in irrigated agricultural basins. A switch from flood irrigation to sprinklers or drips could help achieve this goal, but capital costs are significant and soil salinization could ensue.

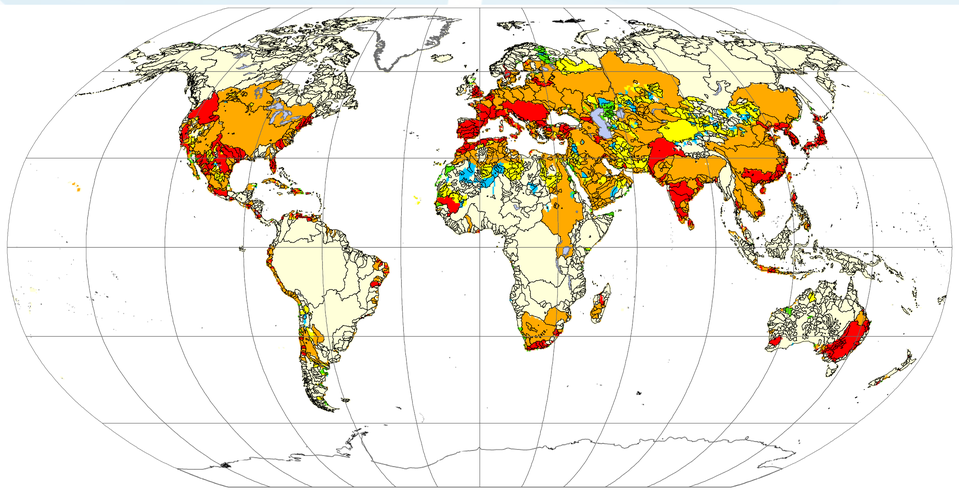
3. Improvements in domestic and industrial water use could be achieved in water stressed areas through significant domestic or industrial water use reduction, for example, by reducing leakage in the water infrastructure and improving water-recycling facilities.

4. Limiting the rate of population growth could help in all water-stressed areas, but a full water-stress relief would require keeping the population in 2050 below 8.5 billion, for example, through help with family planning and tax incentives. However, this could be difficult to achieve, given current trends.

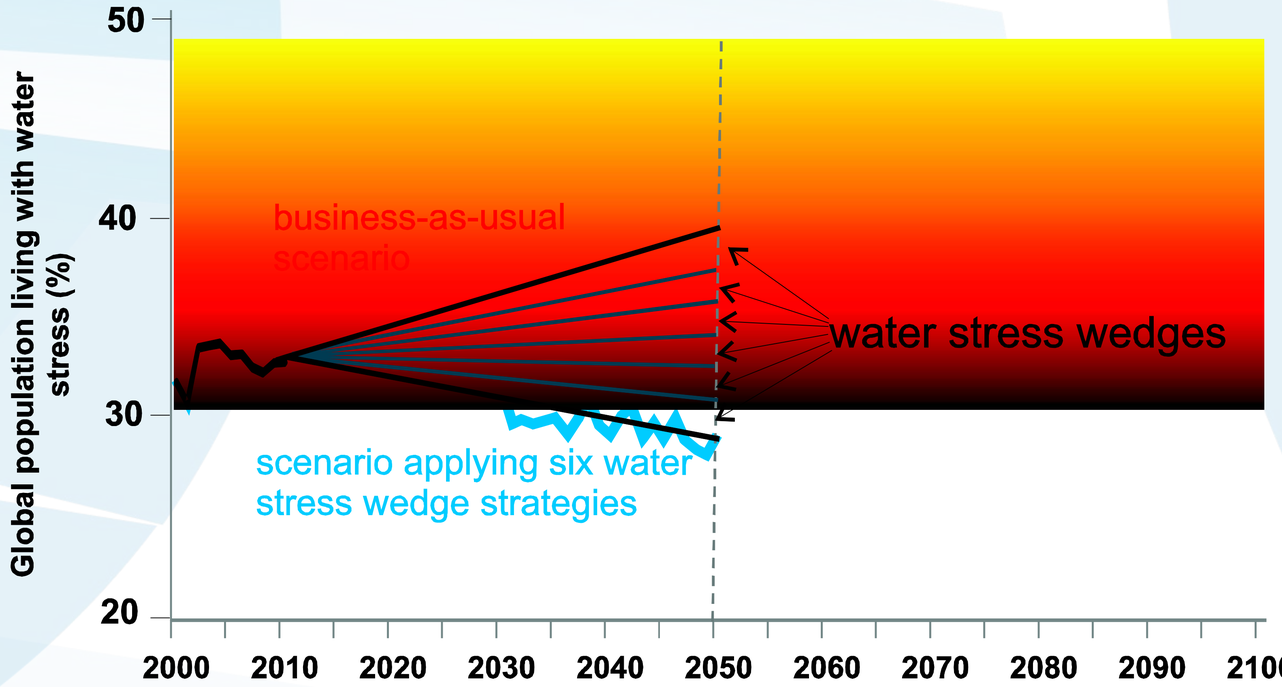
“Hard measures”

5. Increasing water storage in reservoirs could, in principle, help in all stressed basins with reservoirs. Such a strategy would require an additional 600 km^3 of reservoir capacity, for example, by making existing reservoirs larger, reducing sedimentation or building new ones. This strategy would imply significant capital investment, and could have negative ecological and social impacts.

6. Desalination of seawater could be ramped up in coastal water-stressed basins, by increasing either the number or capacity of desalination plants. A 50-fold increase would be required to make an important difference, which would imply significant capital and energy costs, and it would generate waste water that would need to be disposed of safely.



Increased water-recycling and improved irrigation techniques among six strategies identified as key to successfully reducing global water scarcity



About 30% of the global population currently lives with water stress, that is, more than 40% of the available water is withdrawn within a basin. This fraction may increase up to about 50% by the end of the century. We present six strategies, or water wedges, that collectively lead to a reduction in the population affected by water stress by 2050, despite an increasing population. For simplicity, the water wedges are shown here as linear implementations although the proposed efforts are unlikely to produce consistent and linear results. The climatic variability of precipitation is included in the colored lines whereas the water wedges are simplified straight-line projections.

Regional feasibility of water-stress wedges. Different basins lend themselves to different measures for reducing water stress. In most basins under water stress, at least five of the six strategies.

Reference:

Wada, Y., T. Gleeson, and L. Esnault (2014), Wedge approach to water stress, Nature Geosci., 7, 615–617, doi:10.1038/ngeo2241.