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Business Case for Water Footprint in California

Why the Water Footprint is a Useful Water Planning Tool

By measuring and understanding the many ways that Californians use water, whether it is through pipes or from food production, we can reduce the risks and uncertainty associated with certain ways of using water in production and improve our water sustainability. As global climate change occurs, different parts of the world will be affected differently, which will affect the reliability of receiving imported goods and services.

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Business Case for Water Footprint in California

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How Water Footprint Can Inform Policy Discussions

By measuring and understanding the many ways that Californians use water, whether it is directly through pipes or resulting from our consumption of goods and services, we can reduce the risks and uncertainties associated our water use and improve our water sustainability. Global climate change will affect regions in different ways and is likely to affect the reliability of receiving imported goods and services. This will in turn affect water management in California as domestic sources either make up for shortfalls in imports through increased production, or reduce their water use due to international trade pressures. Calculating and using the Water Footprint (WF) in water planning and assessment is an acknowledgement that we participate both in global trade and in one water cycle.

The water footprint is a composite of water use and impact indicators ("blue water", "green water" and "gray water"). Blue water is the volume of water that is retrieved from a natural source and managed (e.g., through a reservoir or pipes) before it used to produce a good or service. Green water is the volume of naturally-occurring precipitation that plants use to grow (e.g., crop plants). Gray water is the volume of water contaminated to unacceptable levels by the discharge from production; this can also be thought of as the sum of the water required to reduce pollutants to acceptable levels.

The Water Footprint Network developed a global water footprint standard that contains definitions and calculation methods for determining WF for different purposes and scales. The assessment contains four steps: Setting goals and scope, water footprint accounting, water footprint sustainability assessment, and water footprint response formulation. There are different types of WF: the WF of a product, consumer, community, national consumption, business, and any geographic area. The level of detail needed for data as well as the frequency of measurements depends on the spatial scale assessed.

A water footprint assessment can be used by several groups for a variety of purposes. For example, individuals may choose to reduce their consumption patterns and support for broader water management efforts based on an improved understanding of the relative sustainability of water used in particular goods and services. Companies can improve their understanding of how components of their supply chain may be at risk from variations in water availability and take actions to minimize those risks. Water managers can improve their understanding of how regional water use may change in response to the effect of water use in global-trade in products used in the region. Below, we provide additional information on each of these uses.

WF User Groups

- Local and regional water agencies
- Agricultural water users
- Industrial water users
- Water managers (Fish and Wildlife, Water Quality, Public Health)
- Environmental NGOs
- Tax/Ratepayer organizations
- General public

California's Vulnerability to International Trends in Climate, Water, and Exports

Over two-thirds of California's water footprint is associated with products made outside the state's borders, including other states ("External Water Footprint", Figure 1). This is dramatically different than 20 years ago, when Californians consumed roughly the same proportion (2/3) from products made in California ("Internal Water Footprint", Figure 1). This means that California is becoming increasingly dependent upon goods from other states and countries and therefore dependent upon water availability and management in those regions.

There are advantages and disadvantages to these changes. On the one hand, a larger external water footprint makes California less vulnerable to droughts and other water supply constraints within California. However, it may also make us vulnerable to water resource conditions outside the state's borders. For example, a drought in the Midwest U.S. can affect the availability and price of grain that is used for products produced and consumed in California. Likewise, long-term groundwater depletion, such as is occurring in the Ogallala Aquifer, can affect the long-term sustainability of agriculture and our ability to source products from that region. This suggests that California is becoming more exposed to the economic, political, and environmental conditions in other parts of the country and the world.

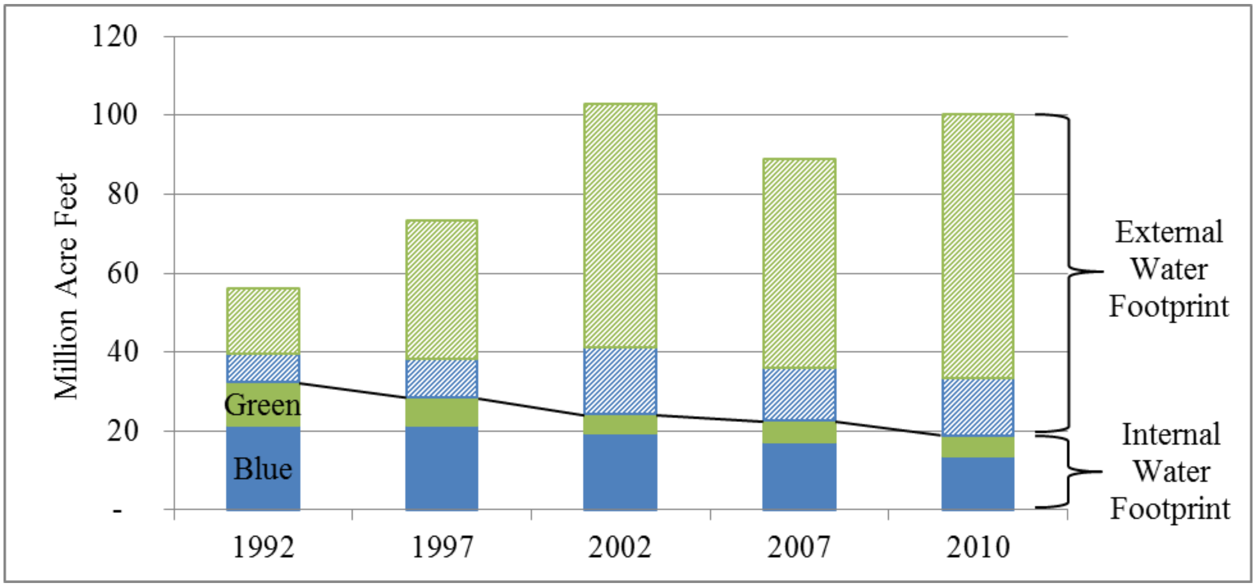


Figure 1. The total water footprint of goods and services consumed within California (million acre-feet) between 1992 and 2007. The blue part of each bar represents the blue water footprint and the green part of each bar represents the green water footprint. Hatching represents the "external water footprint", the virtual water from outside California, and the non-hatched areas represent the "internal water footprint", the virtual water from inside California.

A water footprint assessment, by itself, provides limited information about the relative advantages and disadvantages of relying on imports to support the state's population. This information, however, can be combined with a parallel assessment of water resource conditions in those regions, today and in the future. Several groups have developed water scarcity indices in an effort to compare water resource conditions around the world. For example, the World Resources Institute (WRI) developed a water stress indicator for countries and river basins around the world. Baseline water stress is defined as the ratio of the amount of water withdrawn from a basin to the amount available from natural sources and imports (Figure 3a).

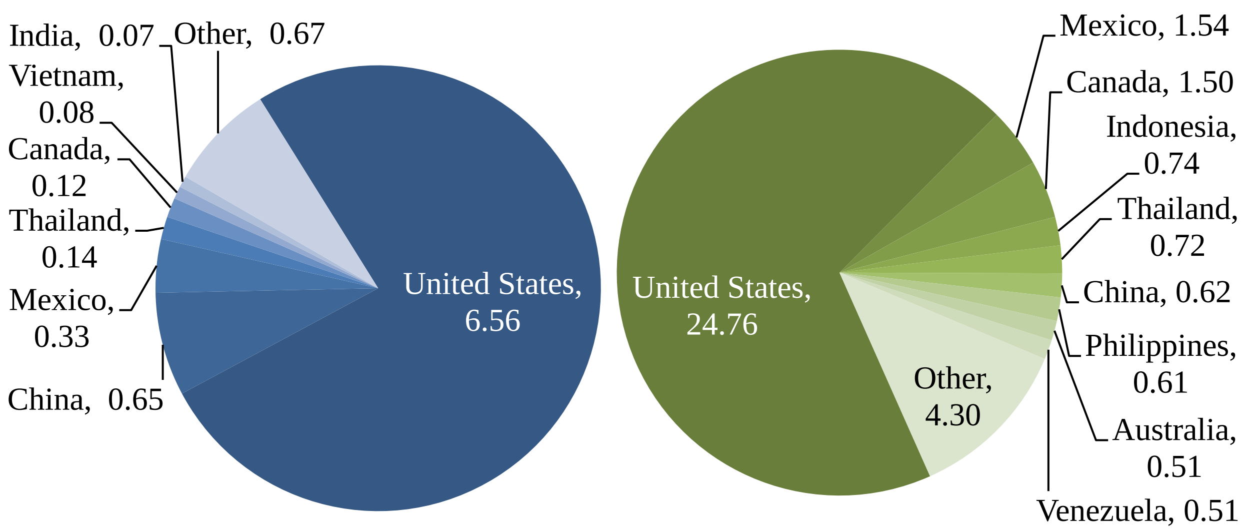
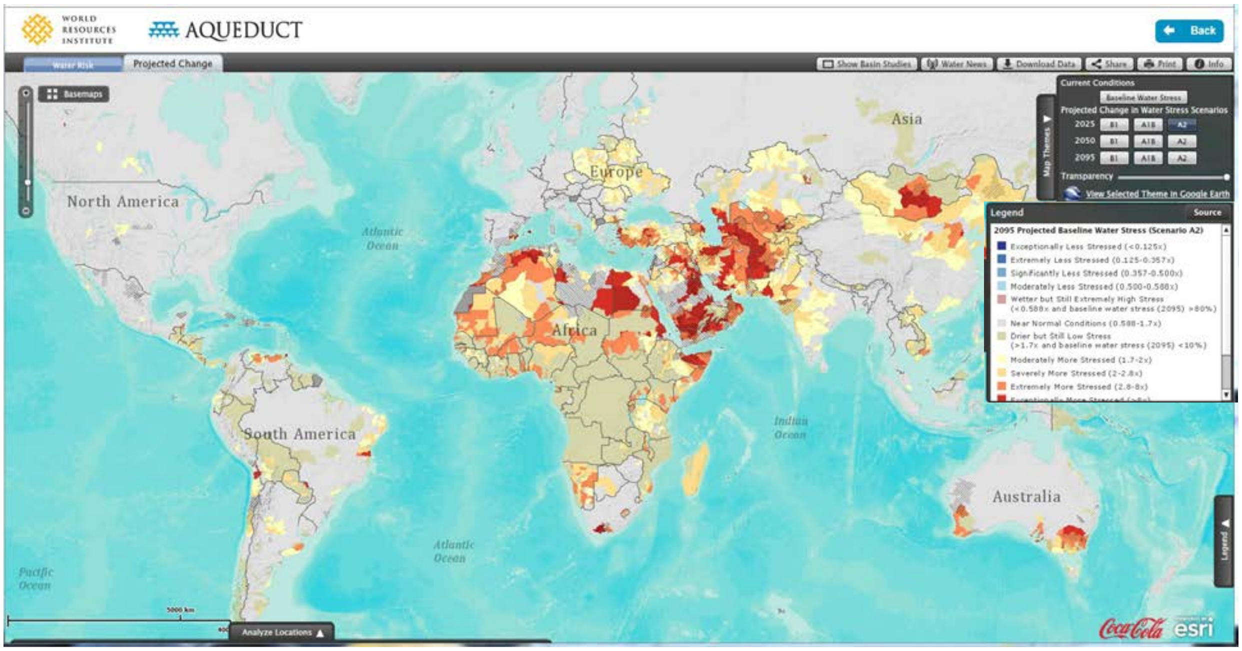


Figure 2. Blue and green WFs of products produced outside of California and imported, by origin (MAF). Data for 2007.

Figure 3a provides a water stress index for every country and major river basin for the years 2025, 2050, and 2095 under various climate scenarios. By 2025, most of the countries from which California imports goods and services (Figure 2) will potentially experience some water stress. By 2095, virtually all of the countries imported from and much of the mid-North American continent will potentially experience water stress (Figure 3b).

The extent and severity of water stress indicated by these maps suggests risk to California's supply chain from global and US water stress. However, there are two big unknowns associated with these kinds of projections. First, the projections are based on climate models, which have their own uncertainties associated with them. Conditions may end up much worse or better than indicated. Second, every country and US state that has trade relations with California has their own priorities, based on local and regional needs and politics. As other regions become stressed, their response in terms of trade and water-intensive production remains uncertain. This combination of water and food insecurity is recognized by the UN and others as one of the greatest risks facing the world (http://www.un.org/waterforlifedecade/food_security.shtml).

A



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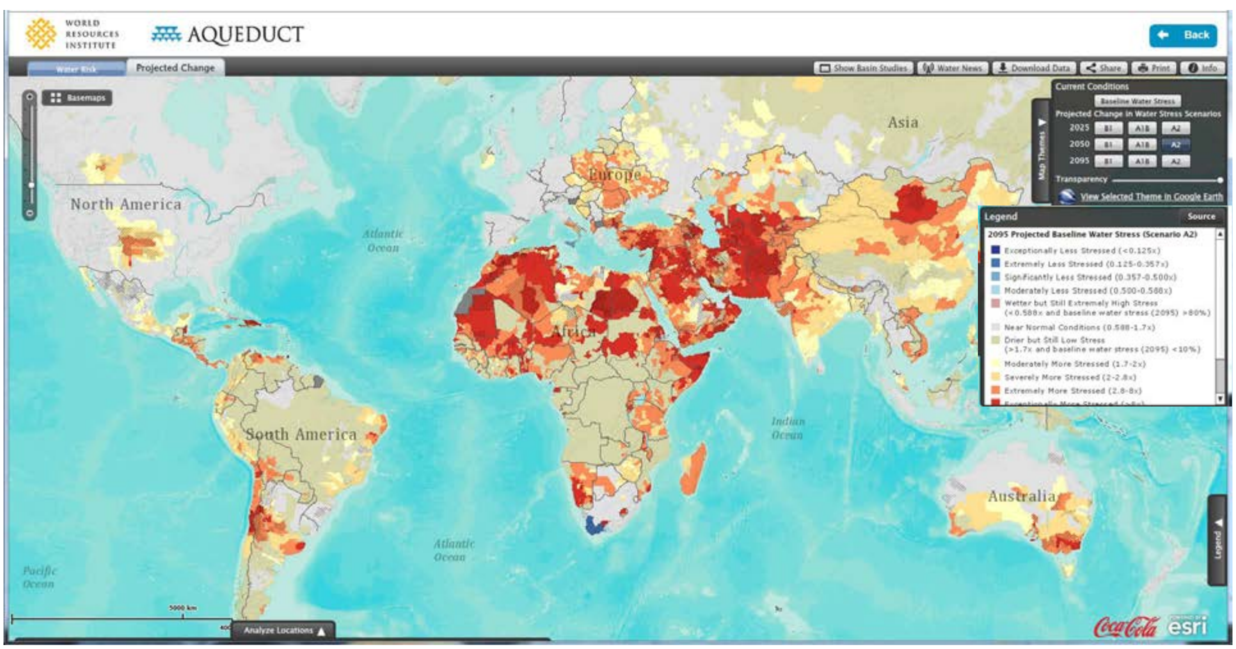

Figure 3. Future baseline water stress by country (a: 2025, b: 2095). The darker the red color the greater chance that stress will be experienced and the greater the severity of stress.

Calculating WF for a user/interest

Water footprint assessment as a tool for water stewardship in the agriculture sector

The concept of virtual (or embedded) water provides an estimate of the water consumed to produce a good or service, including agricultural products. Expressed in terms of crop water use per ton of yield, the concept can help achieve more efficient allocation of water resources in agriculture and inform crop production and trade decisions.

Coupling virtual water with economic information describing the production value of a crop can strengthen agricultural water management. Spain was the first country in the European Union to include water footprint analysis into its river basin management plan (in 2009). The analysis included questions on when and where water footprints exceed water availability, how much of a catchment's total water footprint is used in producing exports, and the volume and value of crops produced per unit of water (WFN, 2012). 'Water economic productivity', expressed in terms of crop market value per cubic meter of water used, has been derived, for example, for the Mancha Occidental region, Spain (Aldaya et al., 2010). That study distinguished 'low virtual water, high economic value' crops from 'high virtual water, and low economic value' alternatives, in a semi-arid region characterized by irrigated agriculture. The findings showed that 'high virtual water, low economic value' crops, such as cereals, are widespread in the region, in part due to the legacy of subsidies. An expansion of low water consumption and high economic value crops such as vines was identified as a potentially important measure for more efficient allocation of water resources (Aldaya et al. 2010).The study concludes that the agricultural sector will need to modify its water use if it is to achieve significant water savings and environmental sustainability. Pricing can play a role as a mechanism to allocate water to those crops that generate the highest economic value at low water demand (Bio Intelligence, 2012a).

Water footprint as a tool for water stewardship in the corporate supply chain

Water Footprint assessment has been recognized by various corporations as important in understanding the vulnerability of their supply chains to the changing availability of water to make products that feed into their supply chain. Because many water footprint assessments have not addressed the environmental impacts of water use, corporate organizations are increasingly moving beyond water footprint assessments to water stewardship approaches.

At the corporate level the relevance of water, its value and costs, is increasingly recognized. Consequently the interest in stewardship, water accounting, footprint assessments and waterrelated LCA analysis is increasing to support sustainable water management throughout all sectors. The different methodologies and their application are still being developed and transparent case studies are needed that apply the techniques across the entire supply chain, thereby reflecting the effects of European production and consumption on water scarce river basins outside Europe.

Water footprint assessment as a tool for water stewardship by individuals

Water Footprint is a useful meme to characterize both our dependence on water and our impacts on water systems. Consumption of goods and services requires delivery of water through natural and engineered pathways and return of wastewater to the environment. The greater the consumption, the greater the water footprint. There are several primary ways that individuals increase or decrease their WF: 1) Diet – food production and consumption is the largest component of WF and eating meat has the largest impact on an individual's WF; 2) Income – consumption of goods and services tends to increase with income, as we make and spend more money, we tend to consume more; 3) Supply Chain Length – the further products and services are produced from the consumer, the greater the likely WF of consumption.

Because there is variation in income in California and the US, as there is elsewhere in the world, it is useful to estimate water footprint using income classes as one way to control for this variation. The Water Footprint Network has developed an online calculator that estimates the water footprint based on income (http://www.waterfootprint.org/?page=cal/waterfootprintcalculator_indv). The calculator can be used by individuals, or in combination with Census Bureau data to estimate the water footprints of communities.

A higher water footprint is both a greater impact on world water systems and a sign of vulnerability. Maintenance of a high water footprint may not be sustainable in a water-constrained world. Meat-containing diets and higher incomes will mean that individuals have greater water footprints. These lifestyles may become less sustainable with increased water limitations, or, if maintained, put unsustainable strain on water limited systems.

WF as an Indicator of Sustainability

The water footprint is a composite of water use indicators ("blue water", "green water" and "gray water") and because of its comprehensive coverage of water use is used in the California

Water Plan Update 2013 as an index of water sustainability. WF is expressed as an aggregation of virtual blue, green, and grey water, however the disaggregated information, including import and export of blue, green, and grey water are useful in water evaluation, education and planning. In concert with indicators measuring water supplies, water quality, ecosystem health, and socio-economic conditions in relation to water, the water footprint can inform more sustainable use of increasingly-stressed sources of water.

WF as a Policy, Planning and Reporting Instrument

The water impact of making goods and services relied upon by society is called the Water Footprint (WF). The water used to make goods and services is sometimes called embedded water or virtual water and can be associated with trade and consumption patterns. The widespread use of the WF as a tool for state and private entities could be very useful in measuring water sustainability. Several critical policy implications for California arise from this proposition: 1) California has transitioned over 20 years from meeting most of its WF needs through internal production to externalizing its WF through the increasing importation of water-intensive goods; 2) the externalization of California's WF within and outside the US has followed trade patterns and not necessarily current and future water availability; 3) Given current and likely future limitations on surface and ground water systems, it will become critical to understand the risks to California's supply chain of virtual water; 4) It is an open question whether or not California will be able to re-ingest its externalized WF without radical changes to water use; 5) Resolving California's diversification of risk from external sources of water by re-internalizing the WF of production may result in political tension; and 6) Further investigation is needed of the role that market forces play in the sources and supply chains for a given state's WF.

Because the details of the trade-offs inherent in these issues are largely unknown, this should encourage water agencies and others involved in water use to understand and use WF as part of planning and water management.

Citations

Fulton, J., H. Cooley, and P.H. Gleick. 2012. California's Water Footprint. Report of the Pacific Institute. Pp. 53.