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Virtual Water

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Market Report	Yr Ago	4 Wks Ago	1/25/13
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight	$122.00	$127.26	$122.17
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	189.01	*	172.33
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	153.90	*	146.11
Choice Boxed Beef, 600-750 lb. Carcass	184.26	194.00	188.96
Western Corn Belt Base Hog Price Carcass, Negotiated	85.07	*	87.38
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean	84.14	82.07	84.68
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct	147.50	*	91.00
National Carcass Lamb Cutout, FOB	387.00	298.70	291.01
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	6.27	7.55	7.69
Corn, No. 2, Yellow Nebraska City, bu.	*	7.01	7.31
Soybeans, No. 1, Yellow Nebraska City, bu.	*	14.19	14.46
Grain Sorghum, No. 2, Yellow Dorchester, cwt.	10.93	11.68	12.16
Oats, No. 2, Heavy Minneapolis, MN , bu.	3.23	*	3.91
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	250.00	*	247.50
Alfalfa, Large Rounds, Good Platte Valley, ton.	137.50	*	230.00
Grass Hay, Large Rounds, Good Nebraska, ton.	100.00	*	212.50
Dried Distillers Grains, 10% Moisture, Nebraska Average.	206.00	273.00	287.50
Wet Distillers Grains, 65-70% Moisture, Nebraska Average.	71.88	101.00	107.50

***No Market**

Life on earth depends on water. Unfortunately, water resources are not evenly distributed. There are countries with abundant water supplies, such as Brazil or Canada, and countries that lack water resources, such as Egypt or Jordan. Because water is critical for the production of food and other goods, as well as for human consumption, recreation and ecosystem support, competition among the various users for available supplies is often intense. The problem is compounded by the fact that water markets often work imperfectly or are lacking altogether.

What can countries with limited water resources do? In rare cases, it may be possible to transfer water from water-abundant regions. For example, the small African country of Lesotho has abundant water supplies and sells its surpluses to South Africa (Mwangi, 2007). Another possibility is to build hydraulic infrastructures (wells, desalination plants, dams, etc.), which can be very expensive and often prove to be environmentally problematic (Velazquez, 2007). Yet another possibility is to consider importing agricultural products that require a lot of water during their production processes. Imports of such goods reduce the need to produce them in the country with scarce water resources. Water imported in the form of water-intensive goods is often referred to as "virtual water."

Virtual water is the amount of water needed to produce a product or a crop (Velasquez, 2007, p. 203). The term was coined in the 1990s by Allan (1998), who was particularly interested in the potential for arid countries in the Middle East and North Africa (MENA) to enhance their water supplies through virtual water imports. According to Allan (1998), the import of water-intensive commodities helped the MENA countries to avoid the consequences of their natural water deficits.

For example, Israel and Jordan implemented policies to reduce or abandon the production and export of water-intensive crops (Velazquez, 2007).

Examples of the virtual water content of common consumer goods are shown in Table 1, below. Note that generally, livestock products contain more water than crop products. For instance, it takes about three years before a cow is slaughtered to produce about 200 kg of boneless beef (in an industrial farming system). During these years, the cow consumes nearly 1,300 kg of grains, 7,200 kg of roughage (which also contain the virtual water used in their production), 24 cubic meters of water for drinking and 7 cubic meters of water for servicing (Chapagain and Hoekstra, 2004).

Table 1. Average Virtual Water Content of Selected Products (per unit of product), adapted from Chapagain and Hoekstra (2004, p. 42)

Product	Virtual Content (liters)
1 glass of beer (250ml)	75
1 glass of wine (125ml)	120
1 glass of milk (200ml)	200
I cup of coffee	140
1 cup of tea	35
1 slice of bread (30mg)	40
1 apple (100g)	70
1 orange	50
1 hamburger (150g)	2400
1 tomato	12
1 bag of potato crisps (200g)	185
1 sheet of A4-paper (80g/m^2)	10
1 cotton T-shirt (medium sized, 500g)	4100

The biggest net exporters of virtual water are the United States, Canada, Brazil, Argentina, India, Pakistan, Indonesia, Thailand and Australia. The biggest net virtual water importers are North Africa, the Middle East, Mexico, Europe, Japan and South Korea (Figure 1, on next page). Trade in agricultural products comprises about 80 percent of these virtual water flows (Chapagain and Hoekstra, 2004).

Economist have long seen international trade as a way to smooth out the uneven distribution of resources around the world. Classic models of international trade suggest that countries will specialize in the production and exportation of goods that are best produced with their abundant resources (land, labor, capital). Thus China, with abundant (and relatively cheap) unskilled labor specializes in textiles for which the critical input (and therefore, the main cost) is unskilled labor. The U.S., with relatively less unskilled labor imports textiles from China, while exporting such land-intensive goods as corn and soybeans because of its abundant land resources. From this perspective, international trade is the exchange of goods that embody such resources as land or labor. Virtual water is fully consistent with this conceptualization, as water is simply another resource that is unevenly distributed around the world. Other types of resources could also be incorporated into this framework. For example, Galloway, et al. (2007), calculate the amounts of virtual nitrogen, water and land in traded meat products, finding that meat-importing countries that lack these resources benefit from these exchanges, while meat-exporting countries may be harmed by inappropriately accounting for the environmental costs of the virtual resources being exported.

For trade to accomplish its function of moving goods that embody particular resources from places where these resources are abundant to other places where they are scarce, there is a need for resource markets to establish prices that act as signals of abundance or scarcity. These signals provide incentives for producers, traders and consumers to exchange goods in line with the relative abundance or scarcity of the resources used to produce them. If water markets fail to appropriately price water, it may turn out that regions with scarce water supplies end up exporting water-intensive goods, which is contrary to Allan's original description of the beneficial role of virtual water. For example, one of Nebraska's major exports is fresh, chilled and frozen beef, a commodity that contains a lot of virtual water. Does this mean that Nebraska is an area with abundant water supplies? True, there are large amounts of water in the Ogallala Aquifer, which is the source of water applied to the extensive irrigated acreage in Nebraska. On the other hand, the Great Plains are suffering a severe drought and there have been conflicts with other states over surface water deliveries. It is not clear that exporting large amounts of virtual water in the form of beef is the best use of Nebraska's water resources. The concept of virtual water may be a useful addition to studies of international food and agricultural trade.

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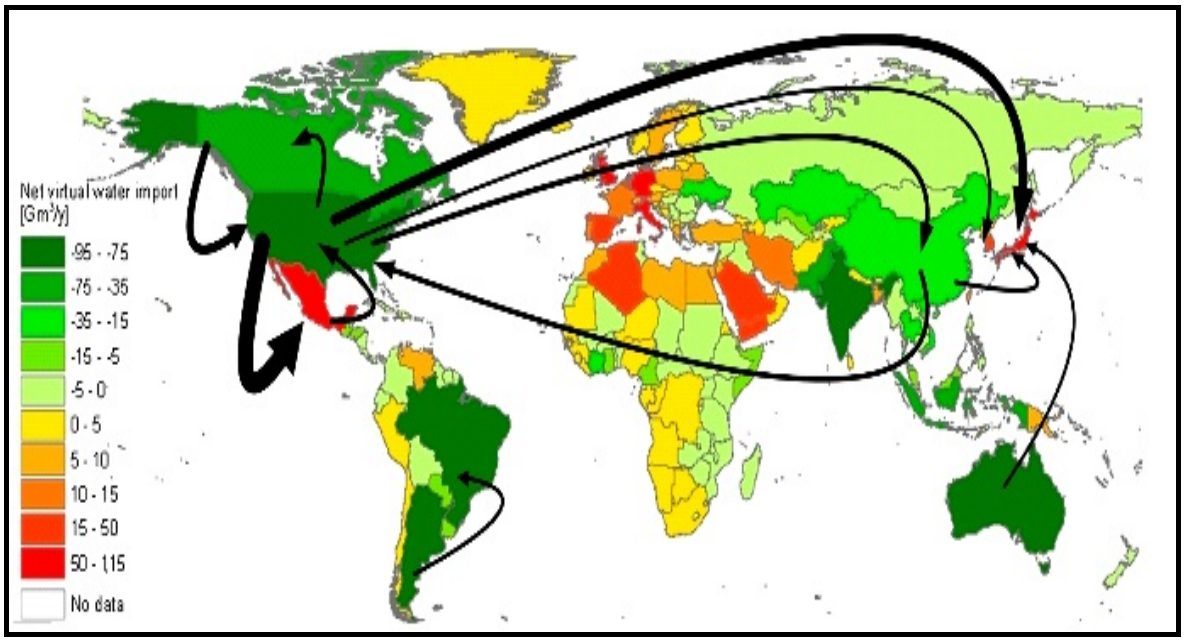

Figure 1. Virtual water balance per country and direction of gross virtual water flows related to trade in agricultural and industrial products, period 1996-2005, only flows >15 Gm^3/y are shown, (Hoekstra and Mekonnen, 2012).