

## 1. INTRODUCTION

Food security in South Korea is tightly linked to the global food system. The country's production of major grains declined from 5.8 million metric tons (mmt) in 1998 to 4.8 mmt in 2014, which caused the country's grain self sufficiency to decline from 31.4% to 24%. This decline is a consequence of several factors including reductions in domestic agricultural land, governmental policies supporting industry over agriculture, and a push towards trade liberalization. South Korea's self sufficiency is now one of the lowest among Organisation for Economic Co-operation and Development (OECD) countries, leaving it vulnerable to disruptions in the global food system.

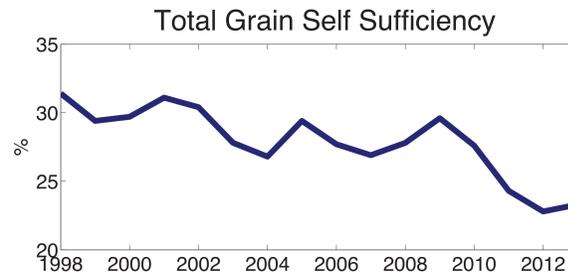
## 2. METHODS & BACKGROUND

We analyze South Korea's domestic food production and its links to the global food trade network to understand its vulnerability to systemic risk in the global food system. For our domestic analyses, we use data from Statistics Korea ([www.index.go.kr](http://www.index.go.kr)) for the period 1998 to 2013. We also make use of the report *Agriculture in Korea 2015* from the Korea Rural Economic Institute. We focus on assessing self sufficiency in South Korea's grain production over time (Figures 1 and 2). Also, we assess changes in cultivated area (Figure 3).

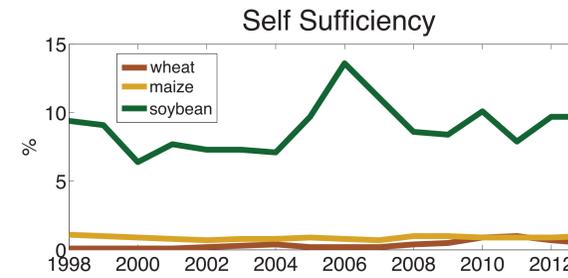
For the trade data, we obtain bilateral trade data from the Statistics Division of the Food and Agriculture Organization (FAOSTAT, <http://faostat3.fao.org/>). We aggregate by converting wheat, maize, and soybean commodities into kilocalories. Our list of commodities includes: wheat, flour of wheat, bran of wheat, macaroni, bread, bulgur, pastry, breakfast cereals, wafer, maize, germ of maize, flour of maize, maize oil, soybeans, soybean oil, cake of soybeans, soya sauce, and soya paste.

Rice is the primary staple grain in South Korea. As such, governmental policies have kept self sufficiency high, with a rate of 95.7% in 2014. Importantly though, the consumption of rice has been rapidly declining due to diet change. Until the food policy reforms of 2004, the Korean government played an important role in increasing and stabilizing the income of rice farmers. A rice reserves policy was then initiated in 2005 to enhance food security (see Figure 6). Under this program, the Korean government specifies the amount of rice stocks and re-evaluates this amount every three years. In 2014, Korea joined the Emergency Rice Reserve program of the Association of Southeast Asian Nations and the three East Asia nations of China, Japan, and South Korea (known as ASEAN+3). The goal of this group is to strengthen food security among member states while minimizing market disruptions.

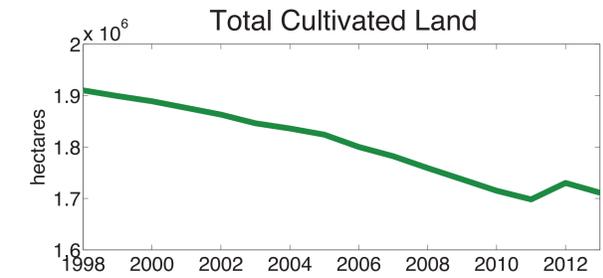
## 3. DEPENDENCIES OF SOUTH KOREA ON THE GLOBAL FOOD SYSTEM



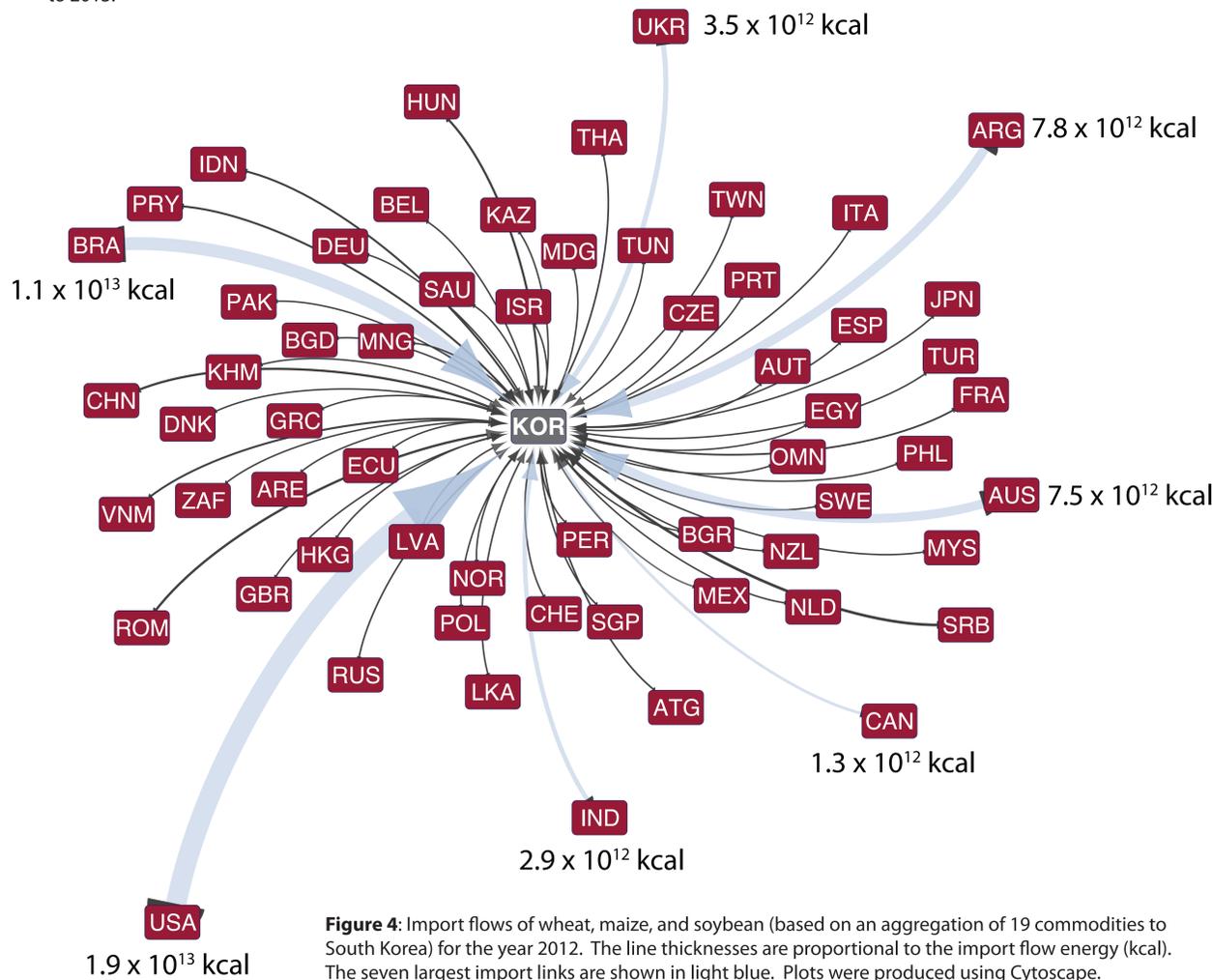
**Figure 1:** Korea's self sufficiency in total grain production (including wheat, maize, barley, rice, etc.) for the years 1998 to 2013.



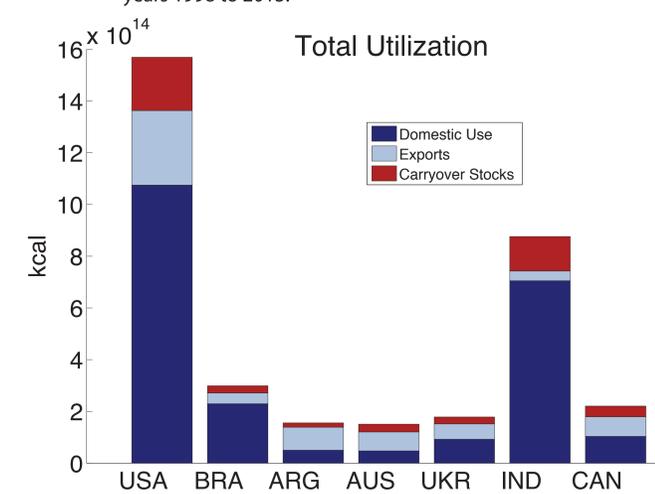
**Figure 2:** Korea's self sufficiency in wheat, maize, and soybean production for the years 1998 to 2013.



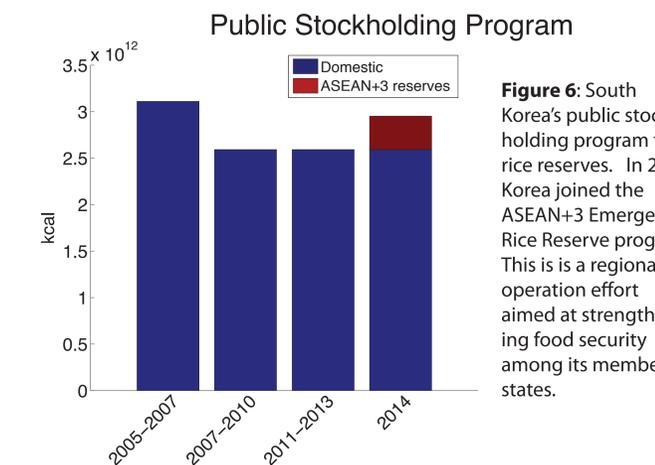
**Figure 3:** Reduction in total cultivated land within South Korea due to urbanization, industrial expansion, etc. for the years 1998 to 2013.



**Figure 4:** Import flows of wheat, maize, and soybean (based on an aggregation of 19 commodities to South Korea) for the year 2012. The line thicknesses are proportional to the import flow energy (kcal). The seven largest import links are shown in light blue. Plots were produced using Cytoscape.



**Figure 5:** Total utilization of food supplies includes domestic use, exports, and carryover stocks of wheat, rice, maize, millet, oats, sorghum and other minor coarse grains based on FAOSTAT data.



**Figure 6:** South Korea's public stockholding program for rice reserves. In 2014, Korea joined the ASEAN+3 Emergency Rice Reserve program. This is a regional co-operation effort aimed at strengthening food security among its member states.

## 4. DISCUSSION

The consumption of rice has been diminishing in South Korea, while the demand for other major grains has sharply increased in recent years. Yet rice is still the only grain that the government actively manages for food emergencies. Further, South Korea is dependent on a few major exporters for commodities like wheat, maize, and soybean. It is therefore essential for the government to understand better the stability of its major trade partners. In fact, South Korea's seven largest food trade partners have a very limited capacity to buffer food disruptions (Figure 5). Thus South Korea is vulnerable if one or more of these countries were to encounter production difficulties. We recommend that the Korean government assess the stability of its trade partners and develop strategies to deal with a broader range of potential food disruptions. Acknowledgments: M.J. Puma gratefully acknowledges support from the Interdisciplinary Global Change Research under NASA cooperative agreement NNX08AJ75A. References: *Agriculture in Korea 2015*, KREI, <http://www.krei.re.kr/>; Statistics Korea, [www.index.go.kr](http://www.index.go.kr/); FAOSTAT, <http://faostat3.fao.org/>.