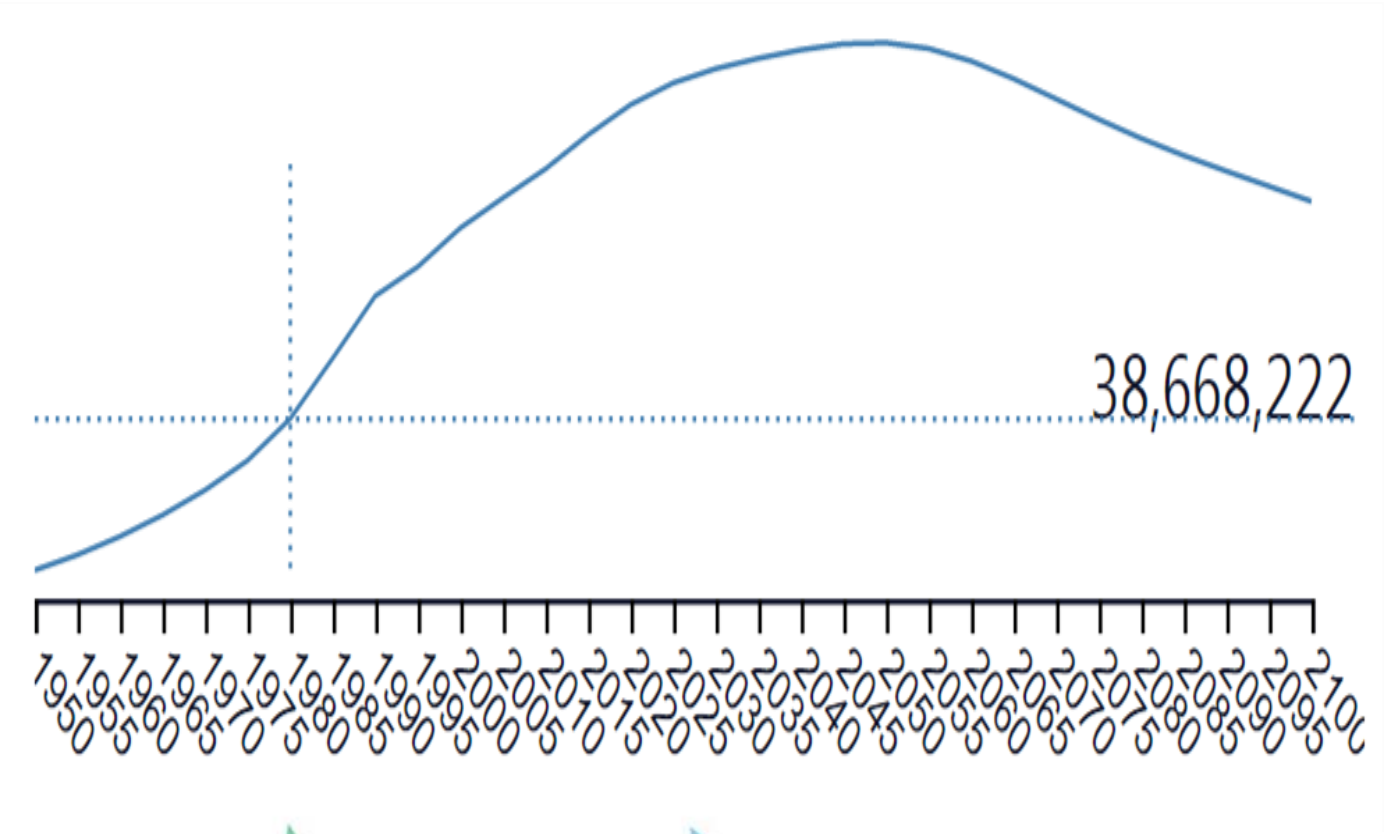
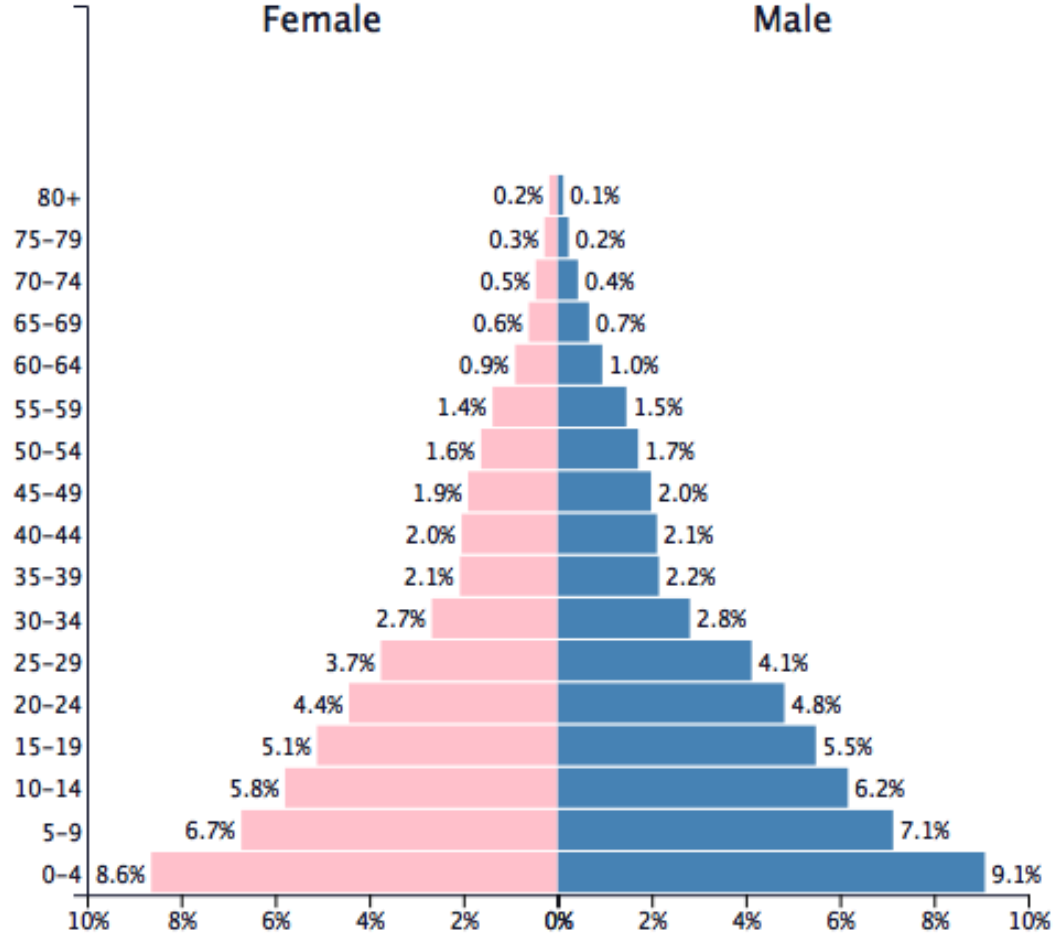
Food Security and Virtual Water Trade in Iran

Abbas Keshavarz
Azam Baiky
Raheleh Malekian
Samaneh Iravani

Population of Iran: Current, Historical and Projected

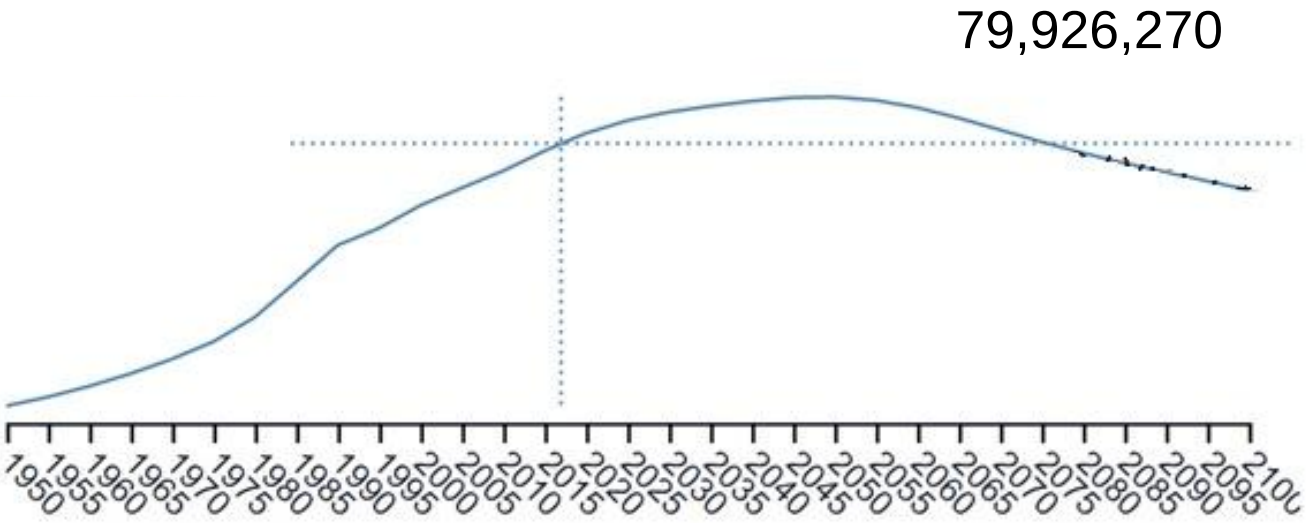
Population and population pyramid in 1980

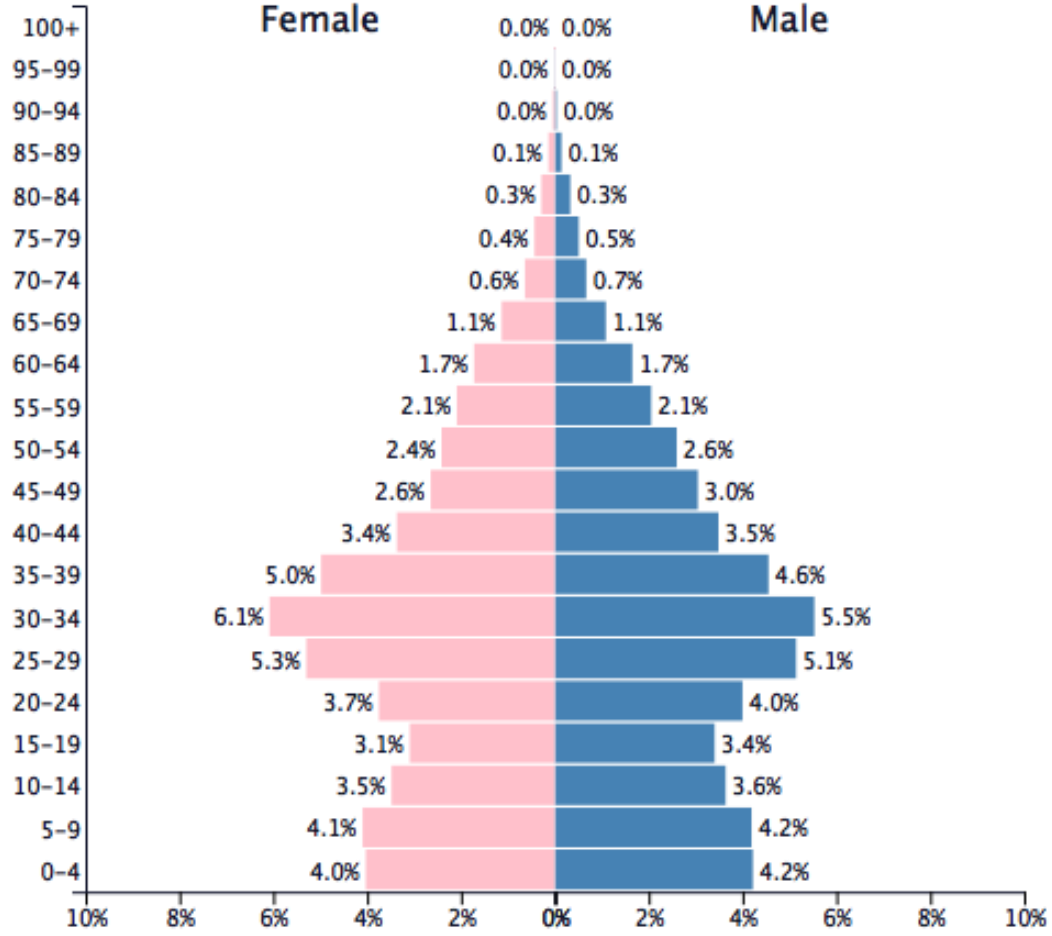




Source: PopulationPyramid.net

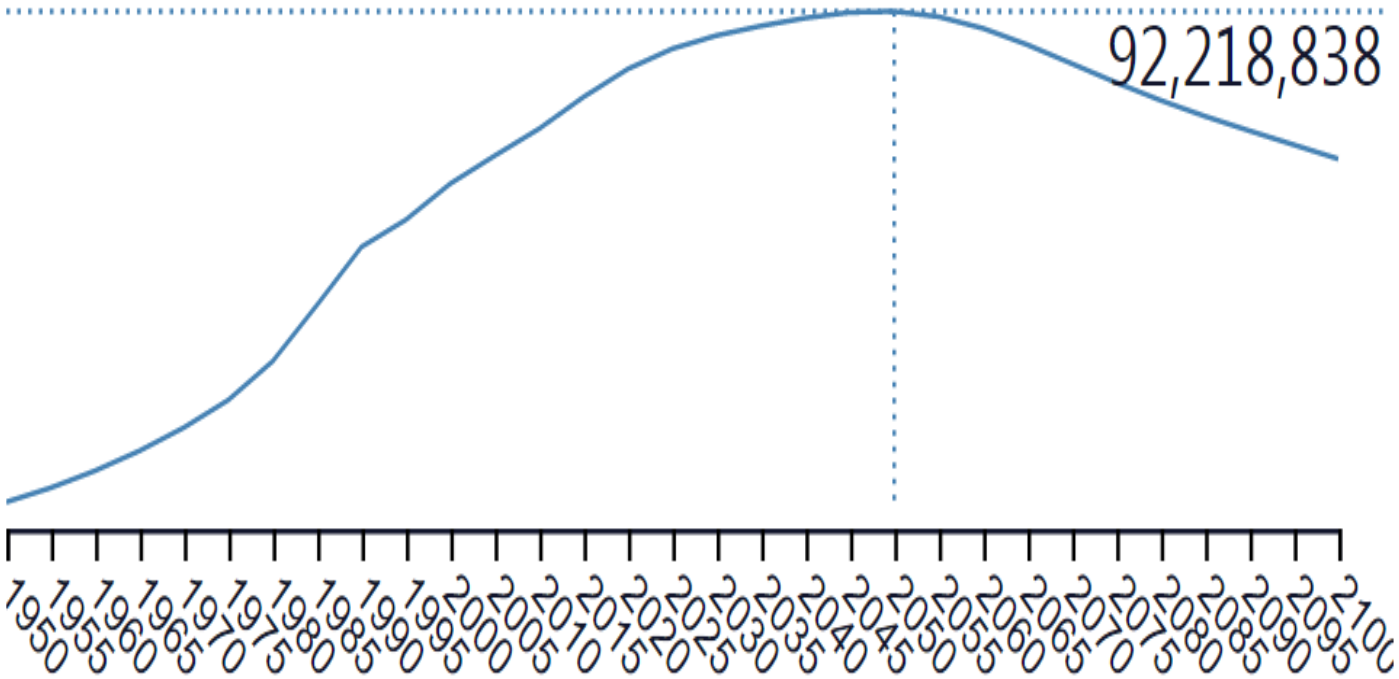
Population and population pyramid in 2017

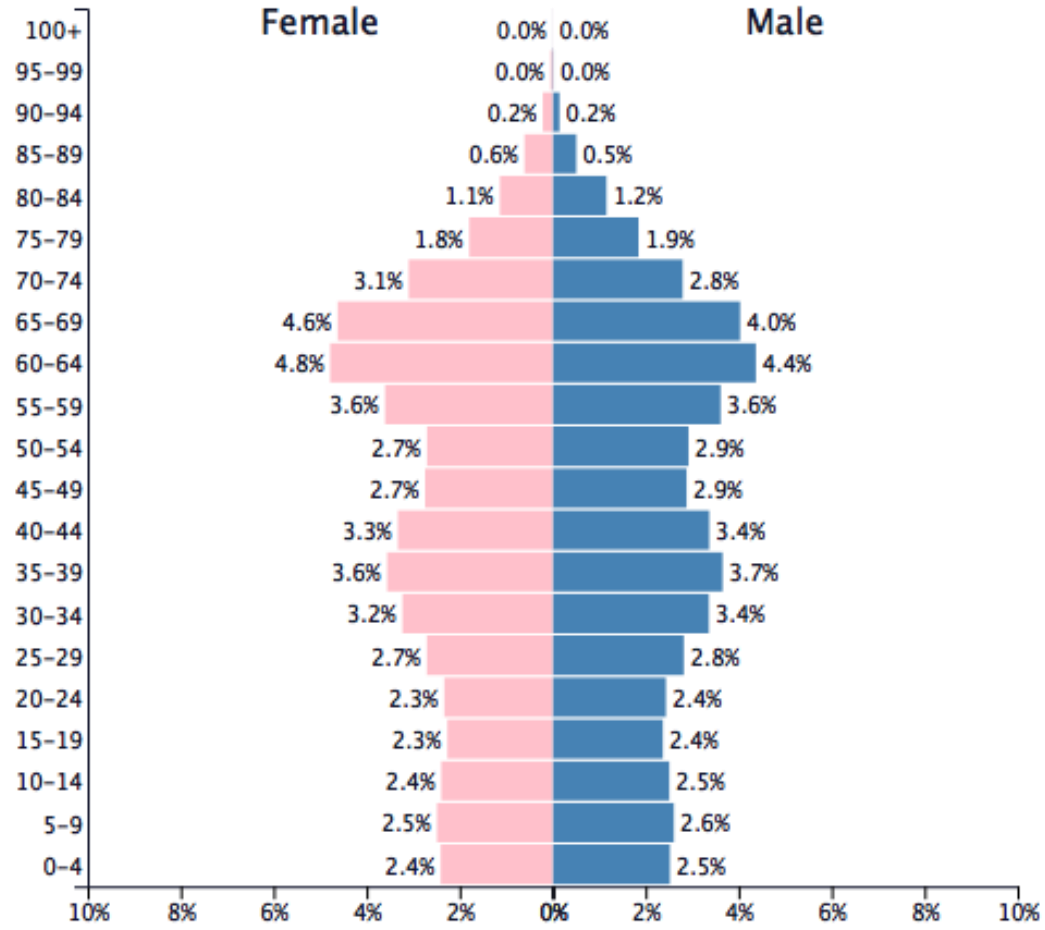




Source: PopulationPyramid.net

Population and population pyramid in 2050

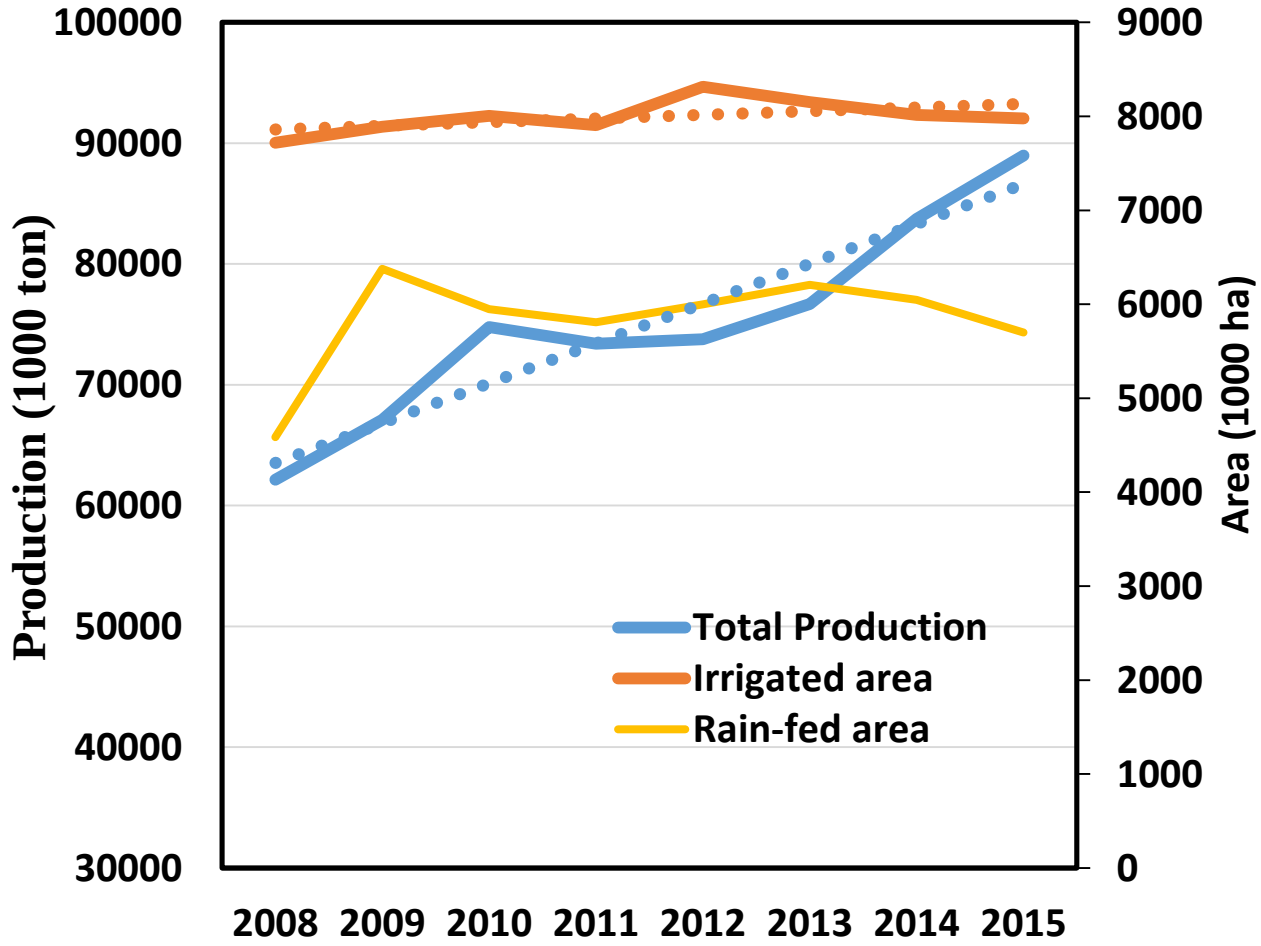




Source: PopulationPyramid.net

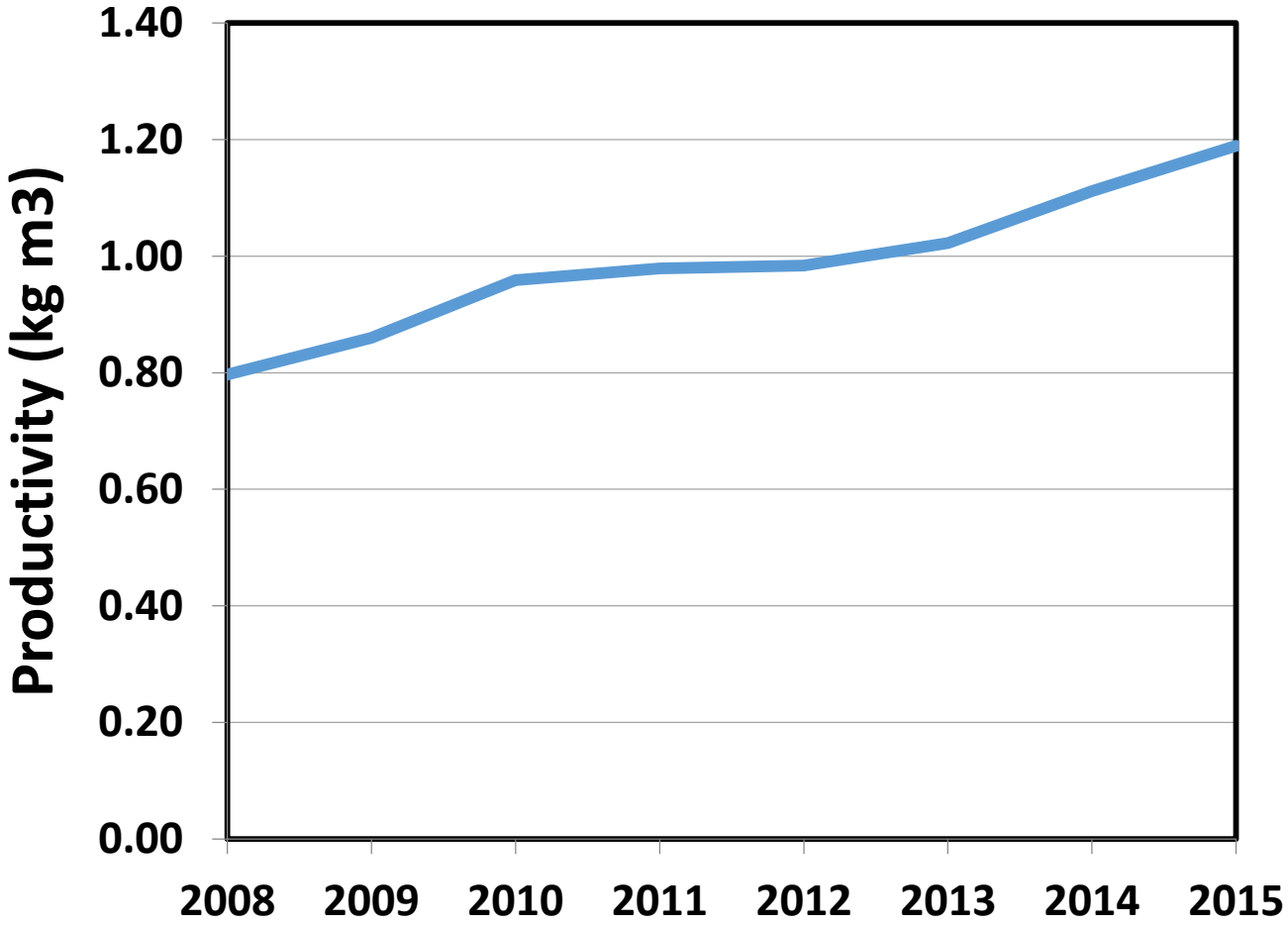
Temporal variation of Irrigated/rain-fed area and total crop production during 2008 to 2015.

- There is 8.4% increase in population of Iran during 2008 to 2015.
- The average crop area increased by the 3.3% .
- Total crop production increased by 43.2% during this period.



Temporal variation in mean water productivity over the period of 2008 to 2015.

years	total production	water use in agriculture	productivity	Percentage change
	Million ton	MCM	kg/m^3	
2008	62.14	78	0.8	-
2009	67.09	78	0.86	8
2010	74.79	78	0.96	11
2011	73.41	75	0.98	2
2012	73.77	75	0.98	0
2013	76.67	75	1.02	4
2014	83.38	75	1.11	9
2015	89.2	75	1.19	7

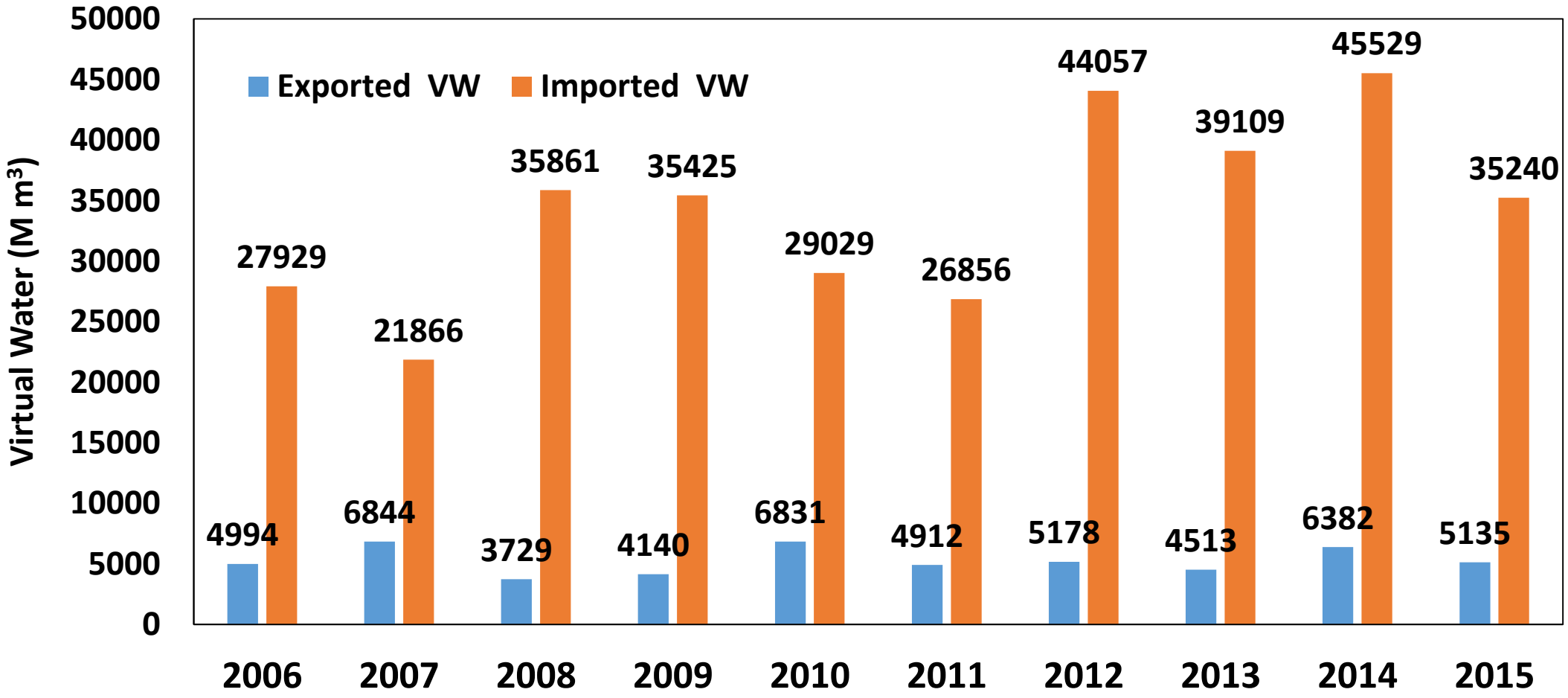


Virtual water import play an important role in achieving food security in Iran.

VW trade can reduce the pressure of the importer and ensure food security, and save water resources in the global level.

The VW Trade in Iran

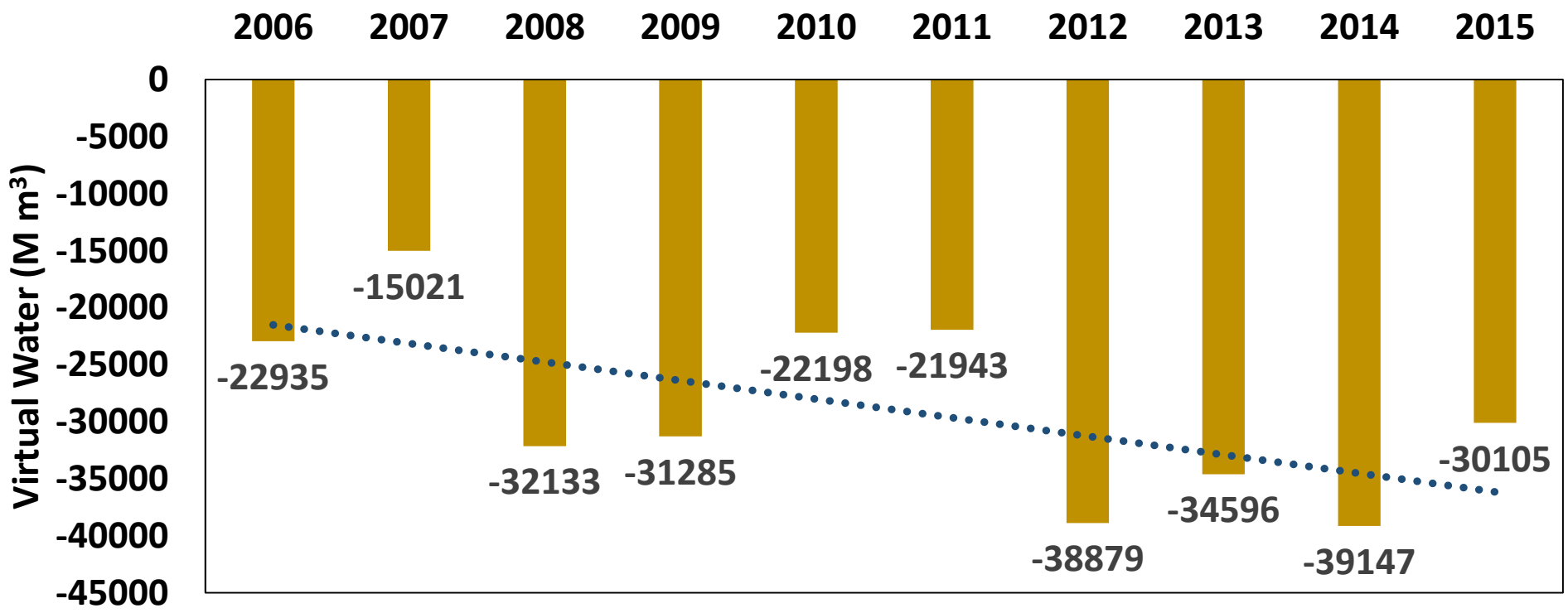
Agricultural Virtual Water Balance in Iran



Note: Food manufactured, Livestock, poultry and aquatic products are not considered.

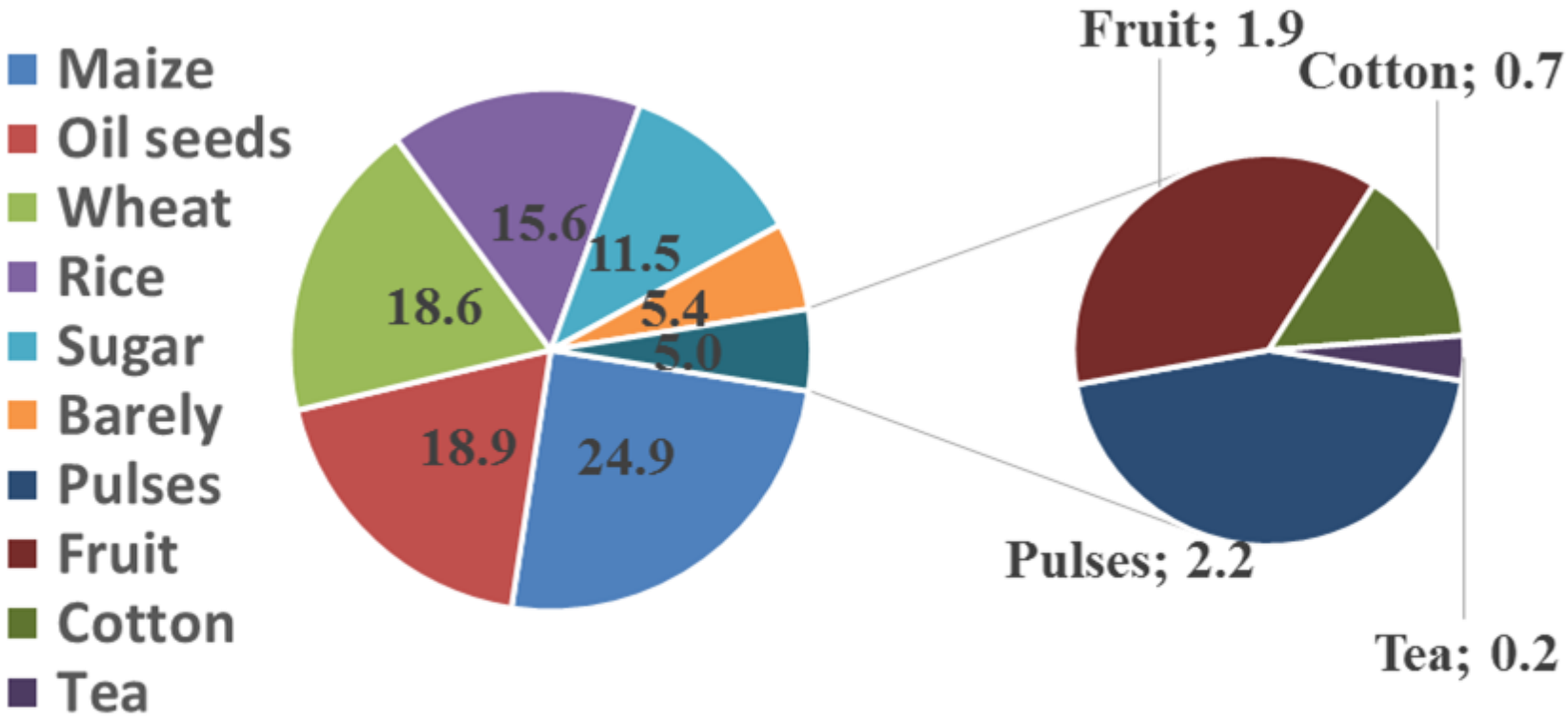
Net import of agricultural VW per year during 2006-2015

The net VW is negative which means Iran is the virtual water importer.



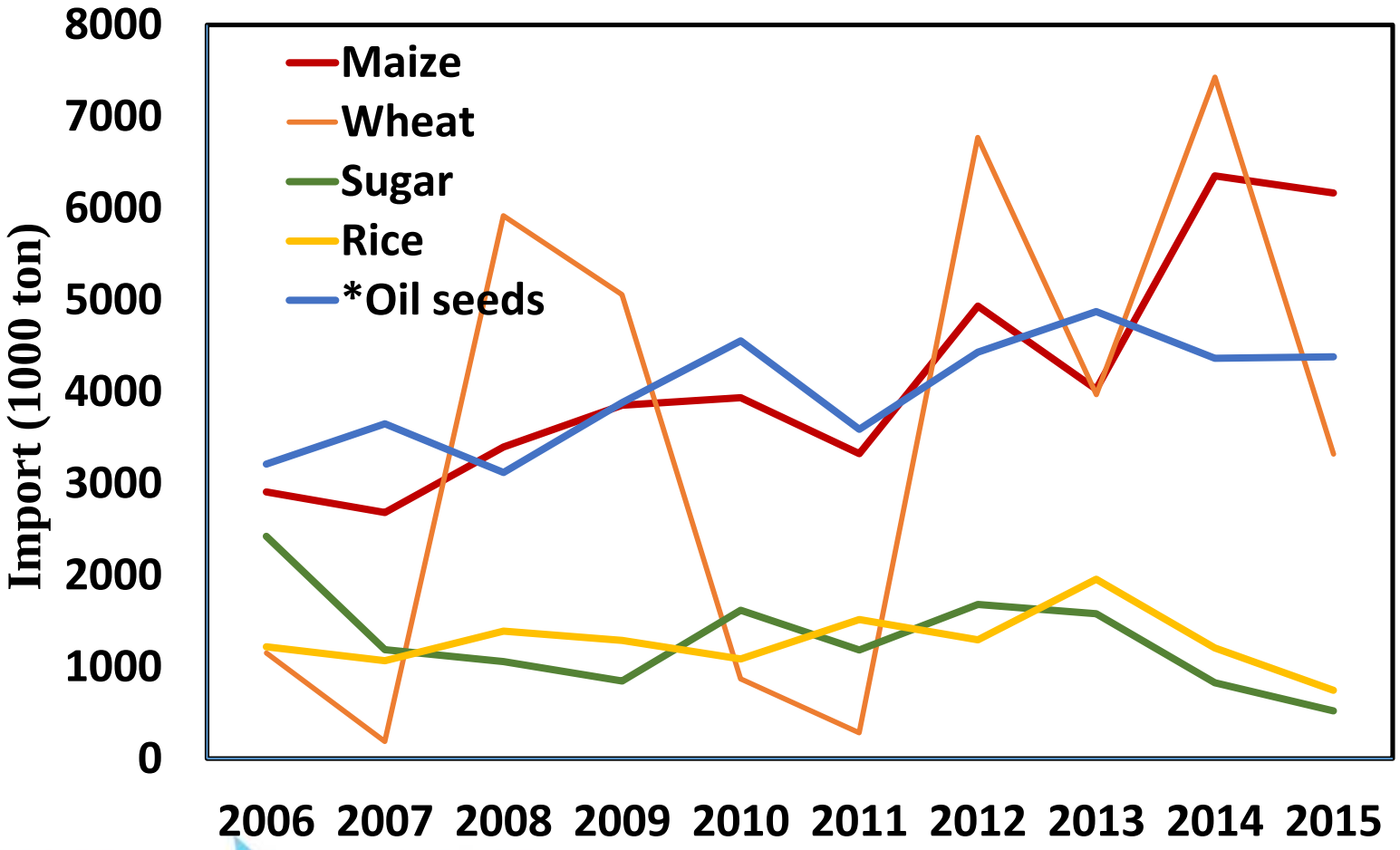
Note: Food manufactured, Livestock, poultry and aquatic products are not considered.

Share of different crops in VW import during 2006-2015



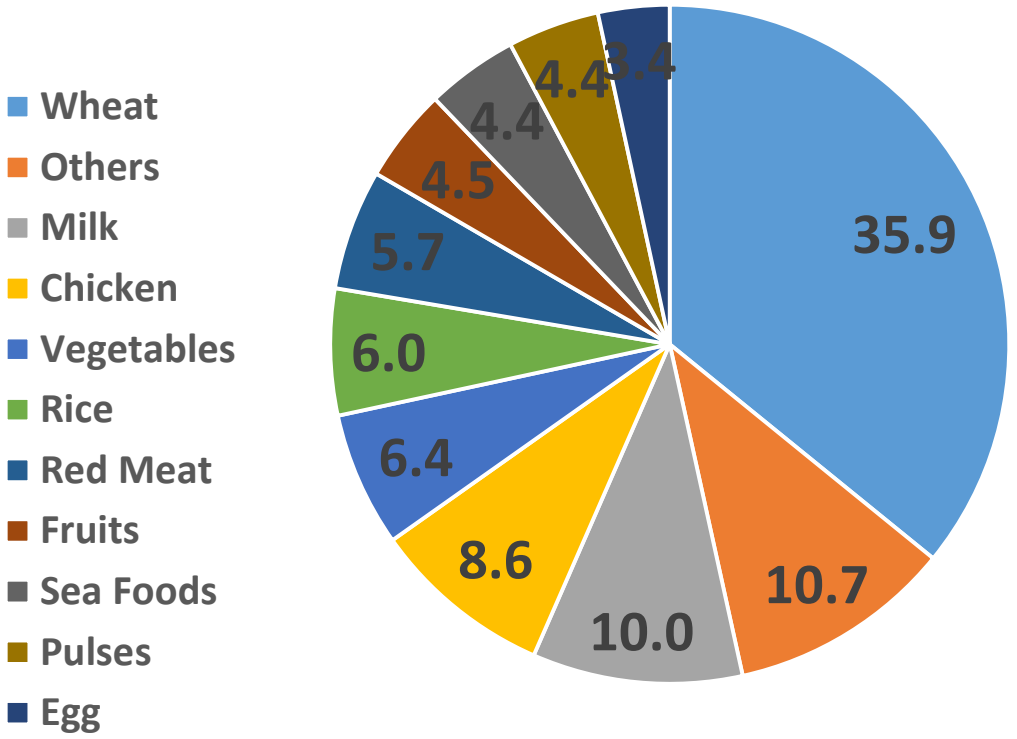
Note: Food manufactured, Livestock, poultry and aquatic products are not considered.

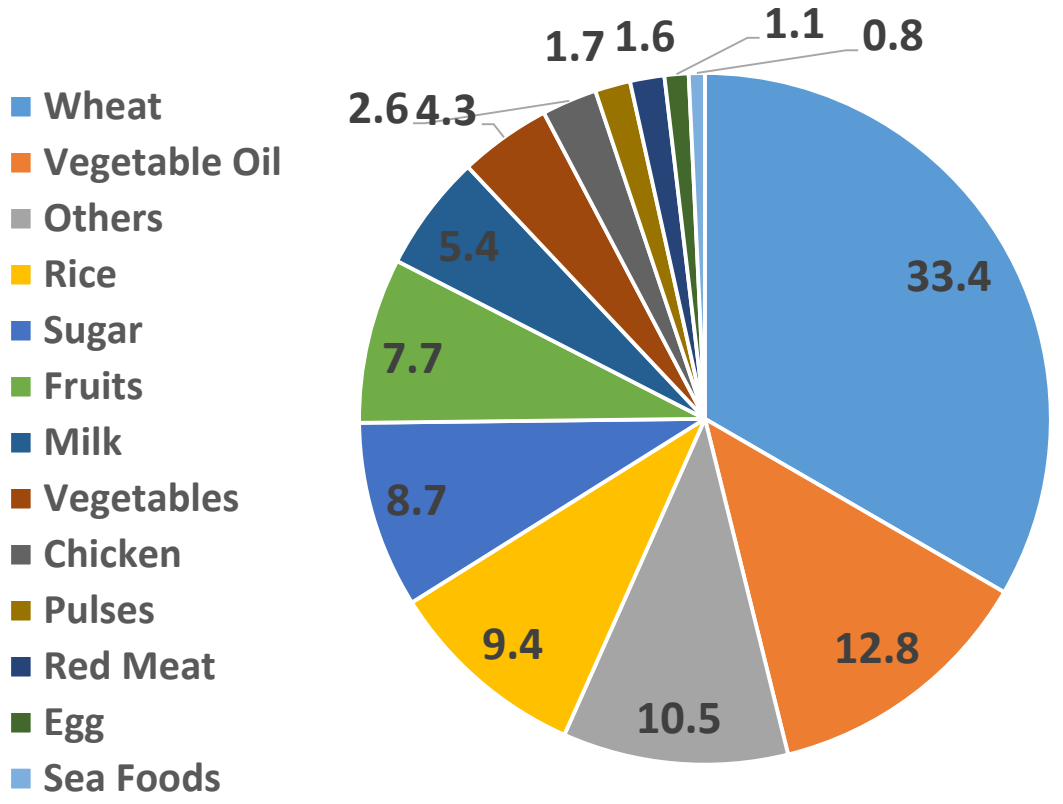
Temporal variation of import for top-5 crops during 2006-2015.



* Soybean meal and vegetable oil

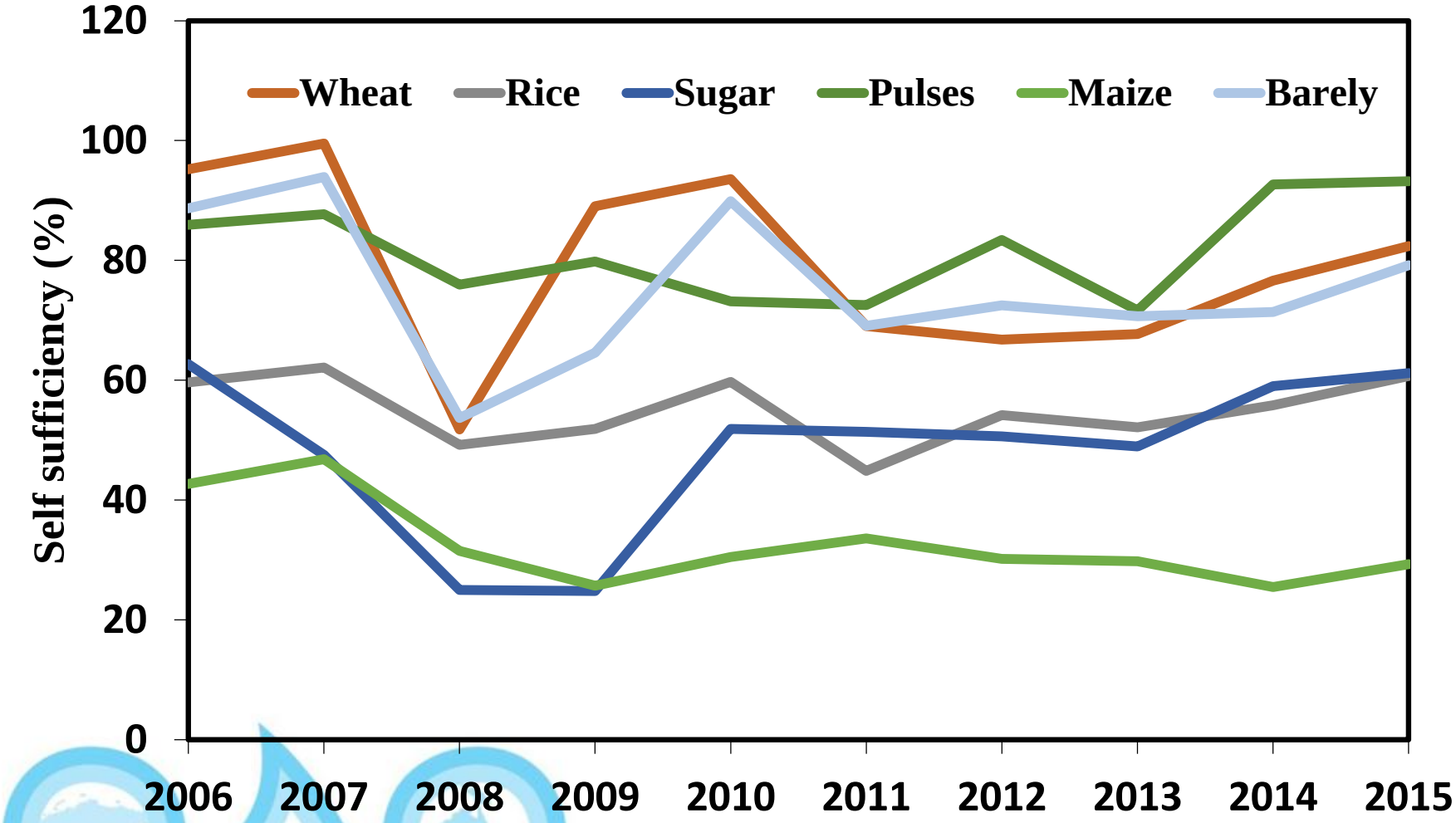
Share of products in the supply of daily protein per capita (%)



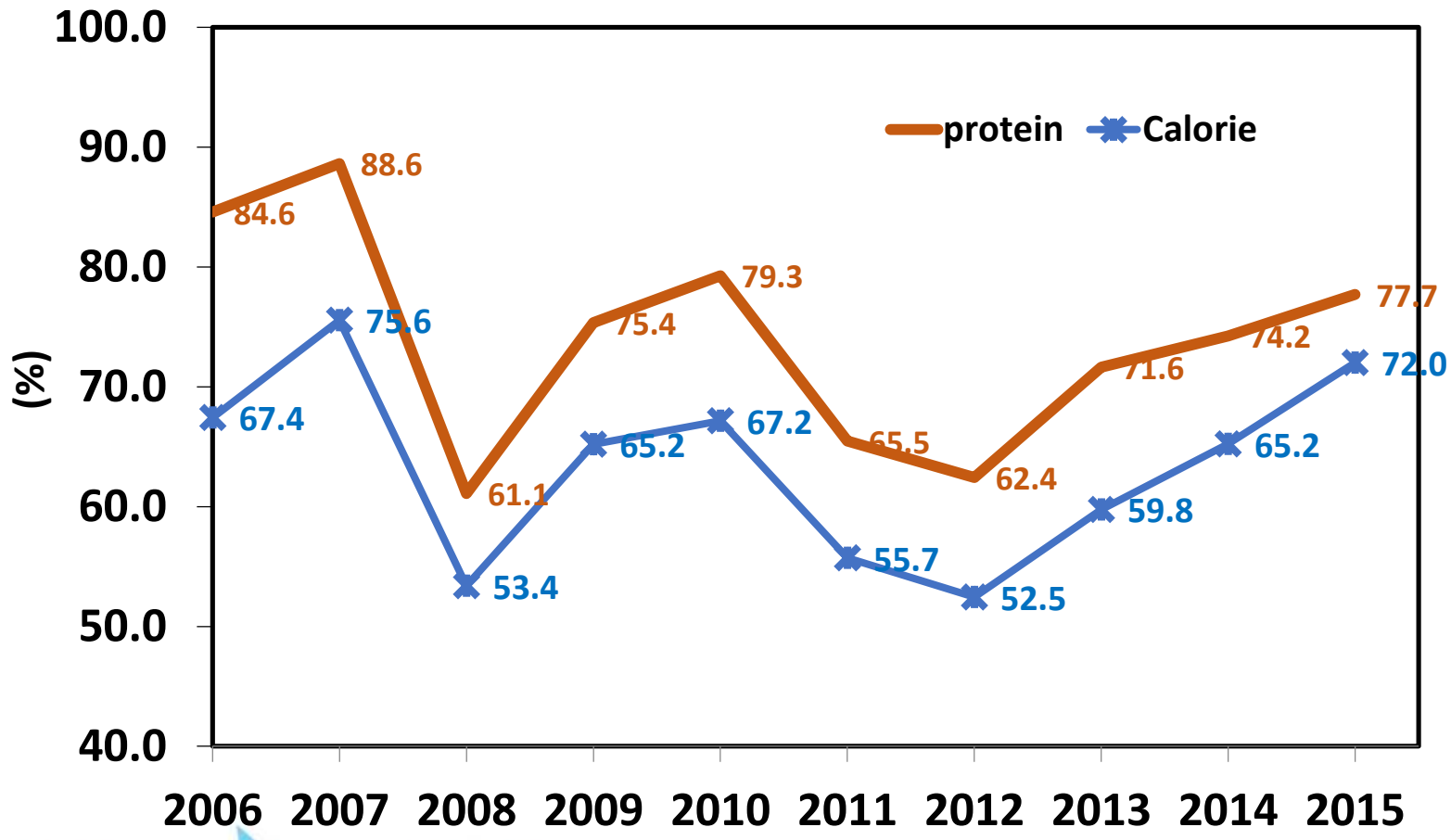


Share of products in the supply of daily Calorie per capita (%)

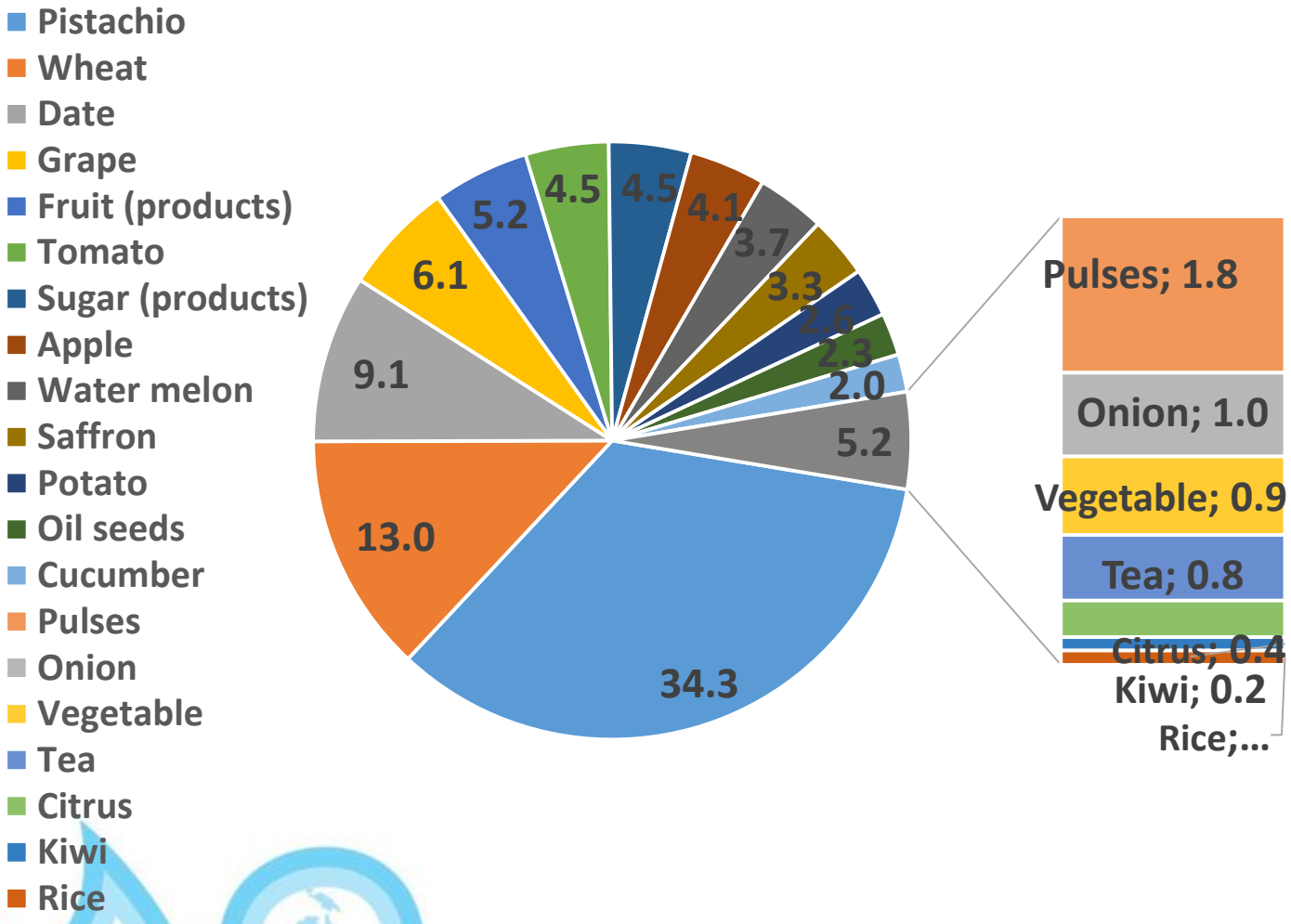
Temporal variation of self-sufficiency of main agricultural crops during 2006-2015



Temporal variation of Self-sufficiency in supply of energy and Protein during 2006-2015

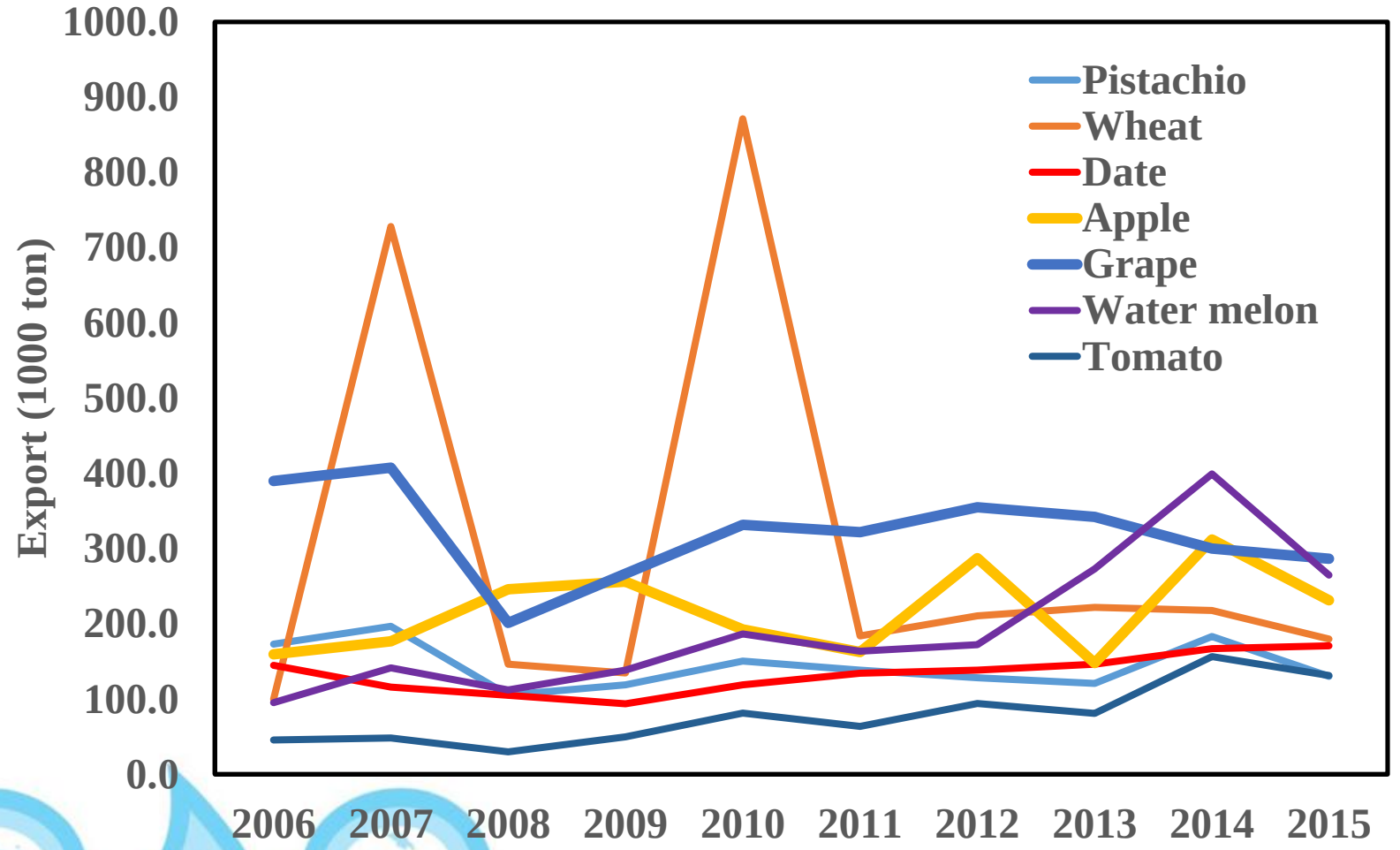


Share of crops in VW export (%)

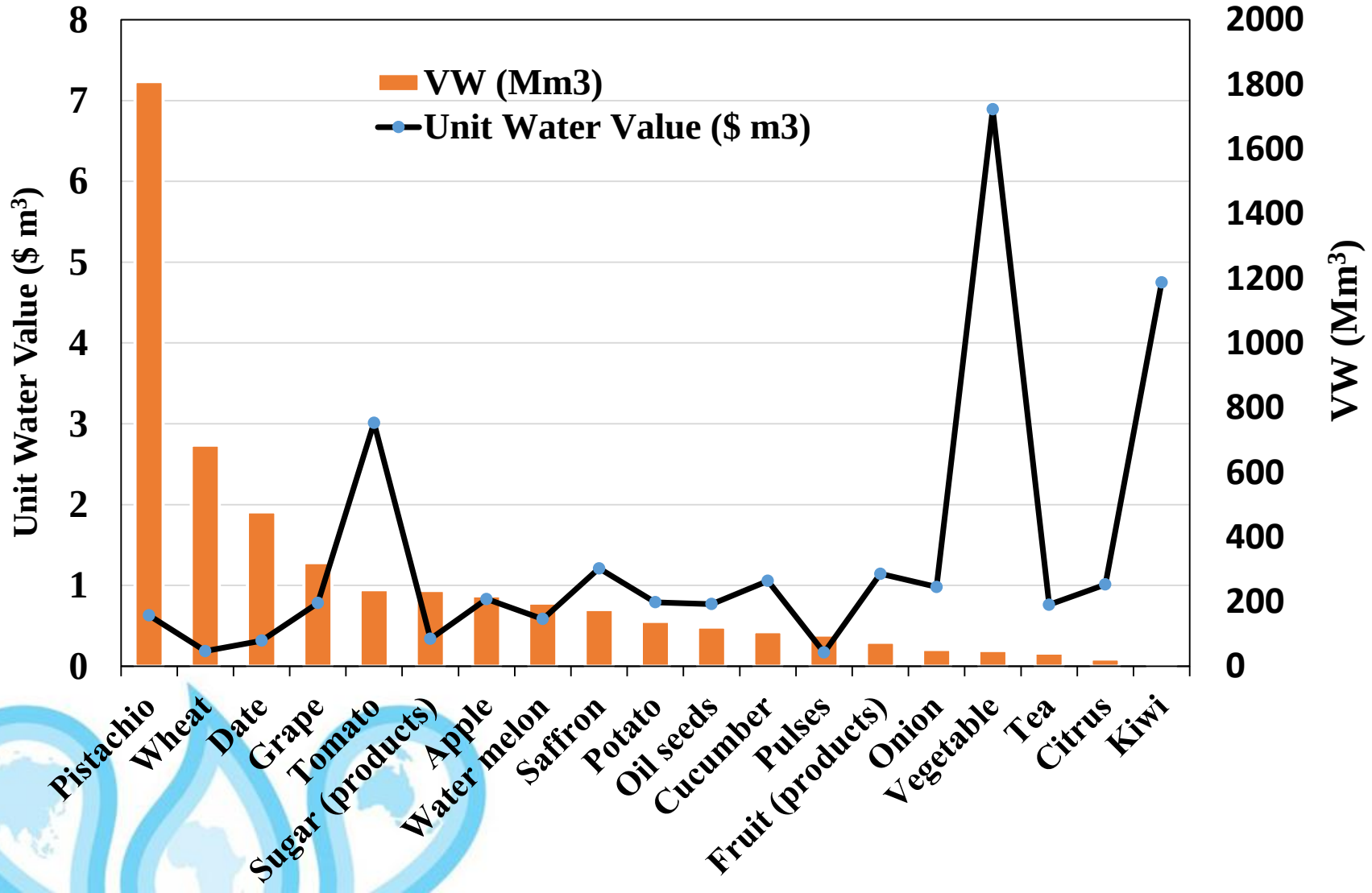


Note: Food manufactured, Livestock, poultry and aquatic products is not considered.

The temporal variation of export of some crops (have high contribution in export) during 2006-2015.



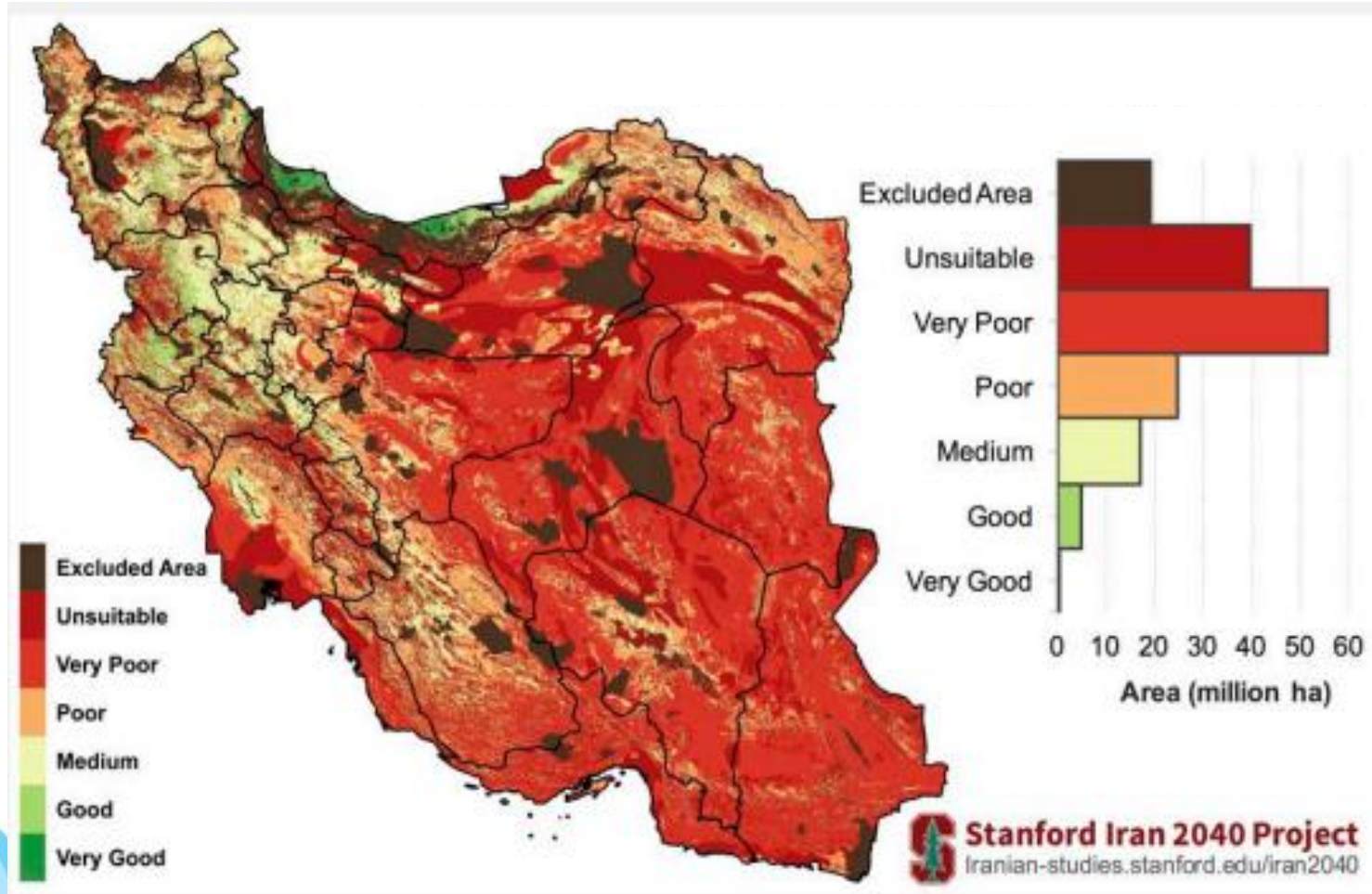
Average of the unit water value and exported virtual water of crops during 2006-2015



Land Resources of Iran

Iran's land suitability for agriculture based on soil and topographic variables.

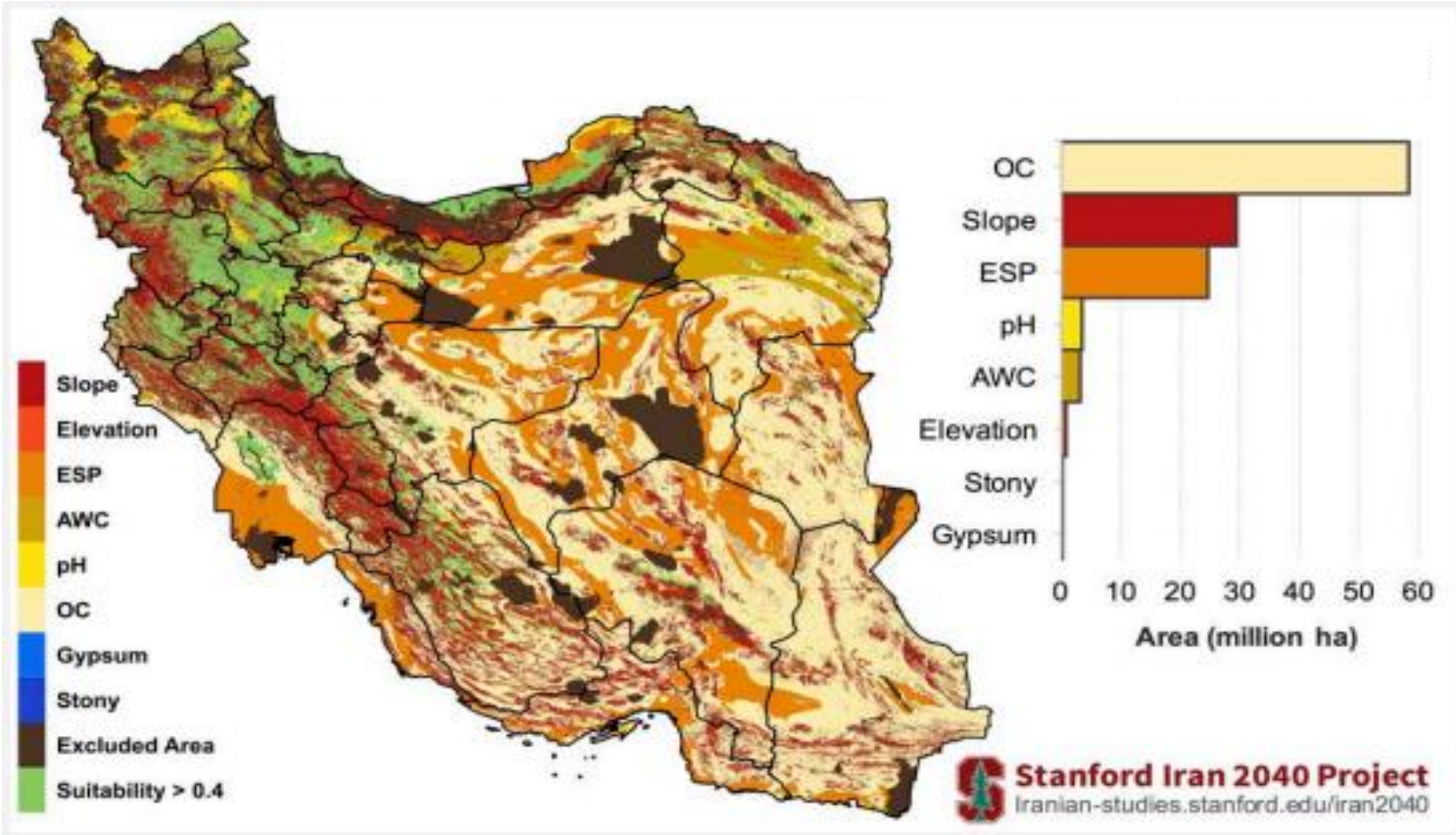
74% **poor or lower suitability**
11% **medium suitability cover**
4% **high quality lands**



Mesgaran et al. in 2016. Stanford Iran 2040 project.

Geographic distribution of the limiting soil and topographic factors for lands.

67% of the land area in Iran estimated to have less than 1% OC.



Mesgaran et al. in 2016. Stanford Iran 2040 project.

Strategies to mitigate soil degradation in Iran:

- Adoption of certain modern agricultural practices (e.g. greenhouse farming)
- International food trade

The average of virtual land of main imported crops during 2010 to 2014

Imported Virtual land (1000 ha)	Crop
1549	Wheat
732	Maize
511	Rice
518	Barely
189	Sugar

The average virtual land of imported crops is equivalent to 25% of the average of agricultural land in Iran (during 2010 to 2014).

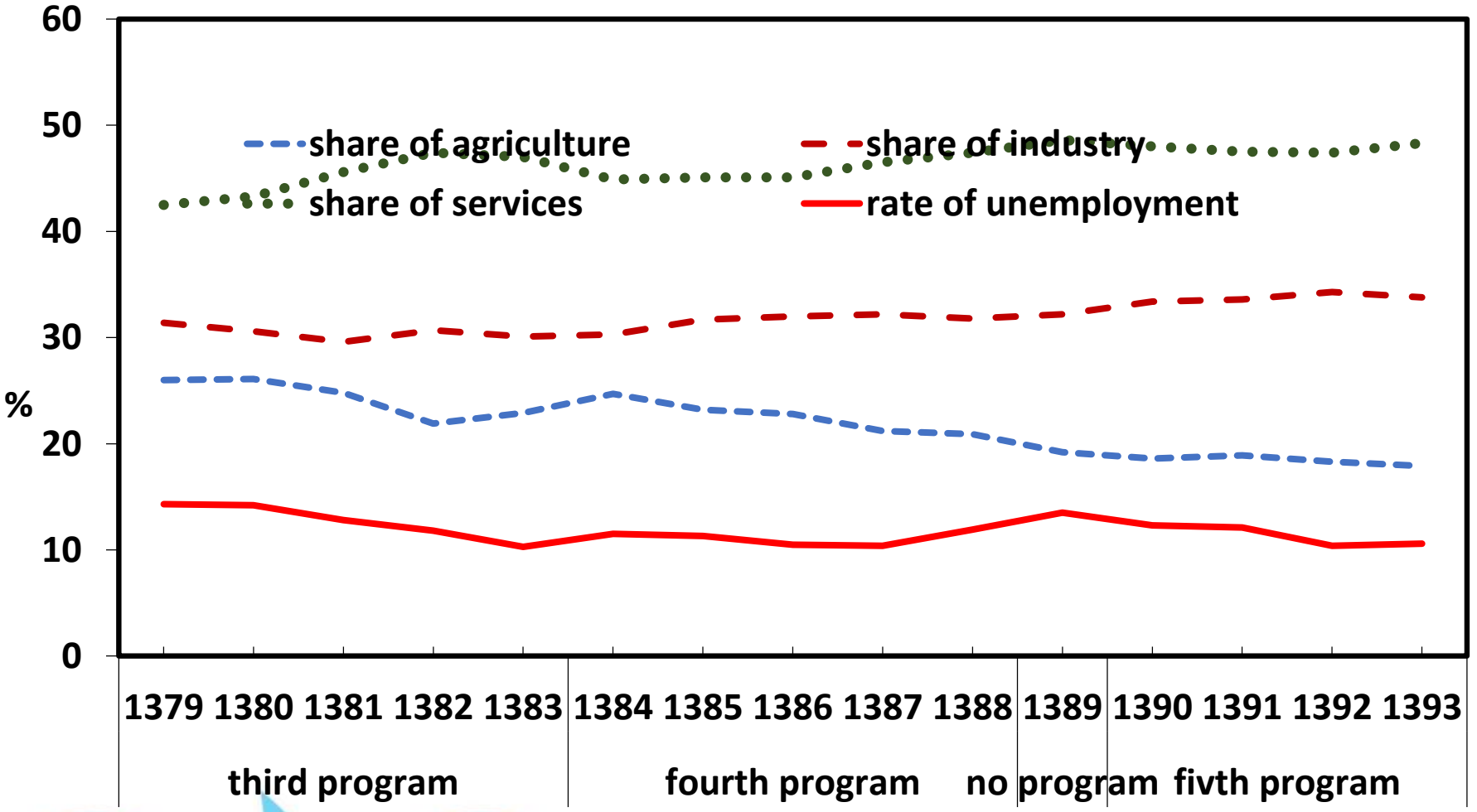
The average virtual land of imported crops is equivalent to 2.8% of the average of agricultural land in Iran (during 2010 to 2014).

The average of virtual land of main exported crops during 2010 to 2014

Exported virtual land (1000 ha)	Crop
207.2	Pistachio
28.2	Date
19.6	Apple
2.8	Kiwi
15.2	Potato
5.5	Onion
20.9	Water melon
38.6	Saffron
30.2	Grape

Agricultural Labor Force in Iran

Unemployment rate and Share of different sectors in Iranian active population



The average of virtual labor of main imported crops during 2010 to 2014

virtual labor (1000 h day)	Crop
27895	Wheat
13183	Maize
35790	Rice
8281	Barely
24610	Sugar
109759	Total

The average of virtual labor of main exported crops during 2010 to 2014

Exported virtual labor (1000 h day)	Crop
35227	Pistachio
2731	Date
3022	Apple
250	Kiwi
990	Potato
463	Onion
831	Water melon
10409	Saffron
3259	Grape
57182	Total

Import/Export Regulations in Iran

Import Regulations

- The list of agri-products for imports and their tariffs shall be subject to approbation of Ministry of Jihad Agriculture.
- Tariffs on essential food products is at least 5%.
- Tariffs on other agricultural products is 10-45%.
- The volume of agri-products for import shall be approved by Ministry of Jihad Agriculture.
- Imports of agri-products especially during the harvesting season is banned in order to help local production.

Import Regulations

- Imports of all agri-products shall be subject to certificate obtained from the Ministry of Jihad Agriculture and to compliance with the quarantine regulations.

- The importation of seeds and saplings on a commercial scale shall be subject to international certificates (ISTA).

Export Regulations

- No limitations are placed on agri-products.
- In some cases, export subsidies on agri-products were permitted.
- Export of subsidized agri-products (wheat, chemical fertilizer) is prohibited.

Suggestions!

- **In this study, main agricultural crops have been considered. Calculation of virtual water trade of all agricultural products as well as livestock, poultry, and aquatic crops is recommended.**

- **Determination of the virtual water trade by industrial goods (e.g. paper and paper products, wood products and furniture, leather industries, metal and chemical products, …) should be carried out in Iran.**

-

- **Quantifying and mapping at a high resolution the green, blue and gray WF within Iran associated with agricultural production, industrial production, and domestic water supply is suggested. Then WF benchmarks within each region should be determined based on best available technology and agriculture practice.**
- **About 90% of energy supply of Iran comes from fossil fuel and 10% is obtained from water (About 6-8 BMC is used in producing energy from water). Since future energy supply will depend on the availability of land, wind, and water (Hoekstra, 2017), the understanding of WF of all different forms of energy covering both fossil and renewable resources in Iran is necessary.**

- **Evaluation of the sustainable utilization of water resources based on the WF calculation is suggested. Also, establishing the location-specific environmental flow standards and blue WF caps per basin is recommended.**
- **Evaluation of fairness of water use in different regions by comparing the WFs related to the consumption level and determining which type of water use (and for which crop) are responsible for that is suggested.**
- **Determination of the relation of WFs to the overexploitation of groundwater in critical plains of Iran for understanding to what degree water use would need to be adapted is recommended.**

- **Evaluation of current food consumption and its trend and also the relation between WF, food consumption and water scarcity in Iran is necessary.**

- **The strategy of proper application of green water in rain-fed farming for protecting blue water and reducing pressure on it needs to be considered.**

- **Managing domestic virtual water trade between regions: transferring virtual water in the form of food between regions can be considered as an alternative instead of physically transferring large quantities of water.**

The VW trade strategy should be accompanied by some other strategies in order to prevent its negative consequences for the society (especially for agri-business in rural area).

The success in virtual water trade cannot be satisfied at the flick of the switch by any country. An iterative process over the long term needs to be applied.

Thank You for your attention!