



Introduction

In order to ensure stability, sustaining food security has always been one of the most important goals of the Chinese government. Unfortunately, suitable agricultural land and fresh water are becoming increasingly scarce. In dry periods, some rivers run completely dry due to excessive irrigation. In addition, food prices experienced a steep increase in 2007 which negatively affected many households, especially those with a low income. In reaction to this, the Chinese government has placed potato production at the centre of its food security agenda.

Why the Potato?

When compared to wheat and rice, the crops that currently form the largest part of the Chinese diet, the potato has important advantages. The potato stands out for its productive water use, yielding more calories of dietary energy per unit of water than any other major crop. The potato also yields more nutrients: for each m³ of water, potatoes yield 150 g of protein, which is double that of wheat, and 540 mg of calcium, which is double that of wheat and four times that of rice. Therefore, potatoes provide more calories and nutrients per hectare and per litre of water than rice or wheat. For China, growing more efficient crops such as the potato could increase food production and consequently improve food security.

Aim

Our research aims to determine which areas in China are most suitable for the production of potatoes in regard to soil and climate characteristics.

Data sources

Monthly temperature and precipitation data:

<http://www.worldclim.org/current>

Metadata:

<http://www.worldclim.org/methods>

<http://www.worldclim.org/formats>

Soil data:

<http://www.isric.org/data/soil-and-terrain-database-china>

Metadata:

<http://85.214.194.220/geonetwork/srv/en/main.home?uuiid=2919b1e3-6a79-4162-9d3a-e640a1dc5aef>

Methods

First, we determined which soil and climate conditions are most suitable for potato production. Potato growth is largely dependent on four factors: temperature, precipitation, drainage and soil type. Based on several sources we determined the following climate boundaries:

Used boundaries	Optimal	Acceptable
Precipitation (mm/month)	100-170	70-250
Temperature (°C)	16-21	14-24

The potato can be grown almost on any type of soil, except salty or lime-rich soils. Potatoes also need fairly deep soils in order to grow the tubers. As steep slopes tend to have thin soils they are unfit for potato production as well. Lastly, the potato plant needs well-drained and loose soil, because stagnating water can cause the tubers to rot and the loose soil will not impede the expansion of the tubers.

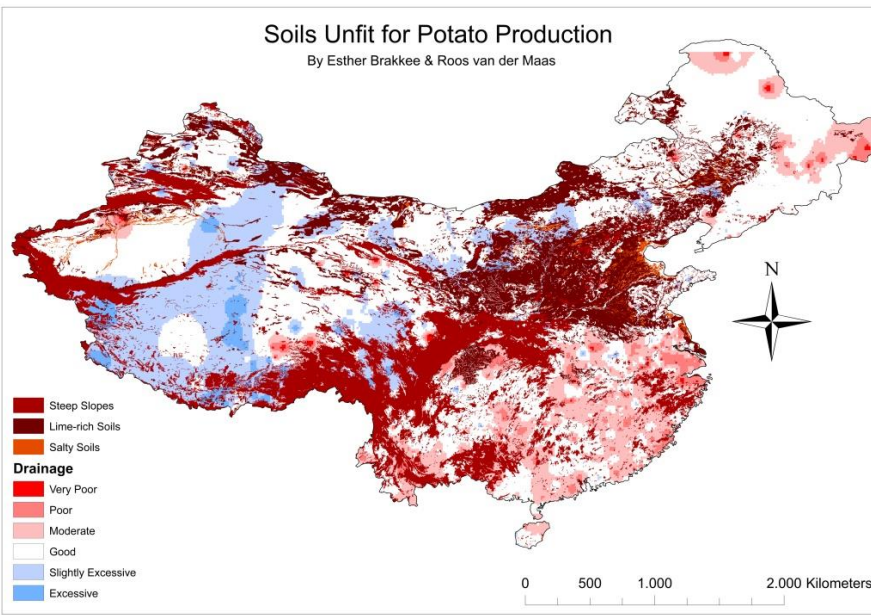
Creating maps

We have created one map displaying soils that are unfit for potato growth and four maps displaying the most suitable areas for potato production per season in regard to climate.

To this end we gathered the necessary data and excluded all the redundant information through clipping, masking and selecting by attributes. We used interpolation to create the drainage layer for the soils map. For the climate maps, we used intersection to display where the right conditions overlap.

The created maps visualize which areas in China are most suitable for the production of potatoes in regard to respectively soil and climate characteristics.

Results Soils



<http://www.fao.org/potato-2008>

<http://www.netafim.com/crop/potato/best-practice>

http://www.depi.vic.gov.au/_data/assets/image/0008/197783/AG0861_graph.jpg

<http://www.washingtonpost.com/wp-dyn/content/article/2010/05/30/AR2010053003751.html>

<http://www.eco-business.com/news/can-potato-help-feed-china-cut-pollution-and-alleviate-drought/>

Discussion of Results

In summer, the mountain areas of central China and the north eastern part of the country are the most suitable areas to grow potatoes. Production on the plains of northern China is also possible, if irrigation is applied. In winter, an advantageous climate occurs only in the very south east of China. The right rainfall and temperature conditions hardly overlap, but in the very south, winter potatoes can probably be grown when some irrigation is applied. For production in spring or autumn, a large area in central and south eastern China has a promising climate.

Most of these production regions remain suitable when soil factors are taken into account. In the southern summer production region, thin soils and poor drainage may form an impediment, while high-pH soils occur in the north. For winter potato production, poorly draining soils are the most important problem. When irrigation is practised on these soils, poor infiltration may cause them to become saline. In the spring and autumn production areas, base-rich soils, thin soils and poor drainage will locally constrain production.

Conclusion

Our results show that expanding potato production is feasible in many regions in China. The climate maps display that for each growing season the area with the most potential is different. Within these areas, production will locally be impeded by adverse soil conditions. Our results are only an approximation, as we have simplified the situation especially for climate. We have used, for example, the same precipitation boundaries for the whole of China, even though the amount of rainfall needed is highly dependent on local soil conditions and evaporation. Still, our maps are useful. They display the areas that the Chinese government should focus on when conducting further research and mapping soil and climate characteristics more precisely. As potatoes are significantly more water and area efficient than other major crops and China seems to have a fairly large surface area that is fit for growing them, we believe expanding potato production in China is a promising strategy to increase food security.

Literature

<http://www.unwins.co.uk/potato-growing-guide-ggid9.html>

<http://www.seedsavers.org/Potatoes-guide.html>

<http://www.environment.nsw.gov.au/salinity/solutions/irrigation.html>

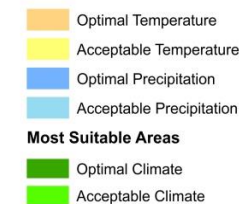
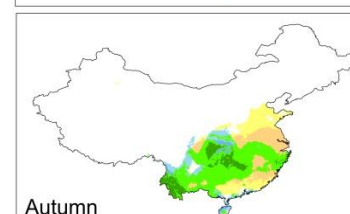
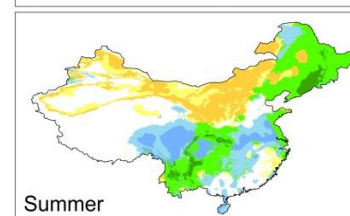
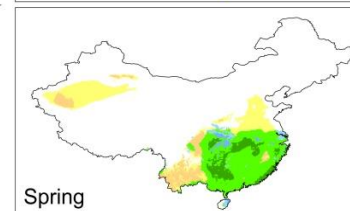
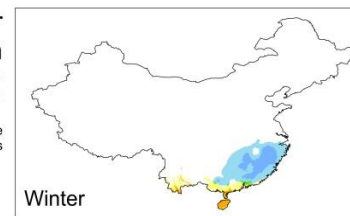
Jansky, S. H., Jin, L. P., Xie, K. Y., Xie, C. H., & Spooner, D. M. (2009). Potato production and breeding in China. *Potato Research*, 52(1), 57-65.

You, L., Spoor, M., Ulimwengu, J., & Zhang, S. (2011). Land use change and environmental stress of wheat, rice and corn production in China. *China Economic Review*, 22(4), 461-473.

Results climate

Suitable Areas for Potato Production with regard to climate conditions in every season

By Esther Brakkee & Roos van der Maas



0 1,500 3,000 6,000 Kilometers