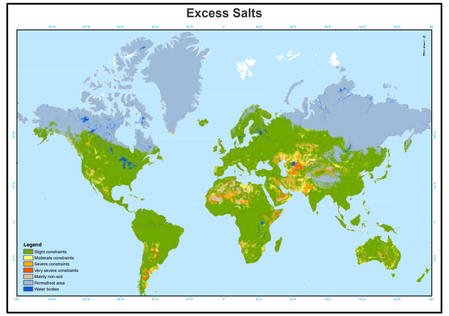
Salinity puts farming at risk

According to a study by UN University's Canadian-based Institute for Water, Environment and Health, the size of the salt-affected irrigated land in arid and semi-arid areas across 75 countries grew from 45.4 million hectares in 1990 to 62 million hectares in 2013.

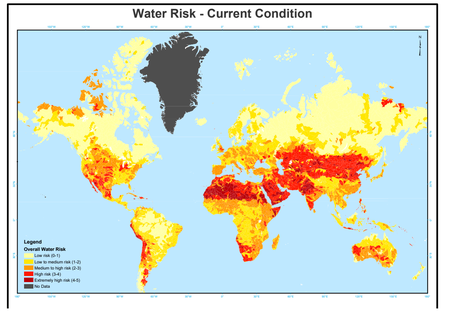
And Wicke et al. (2011) estimate that 1.128 billion hectares of soils are affected globally by salinity and sodicity to varying degrees.



Source: FAO and IIASA, 2008

Water is getting less

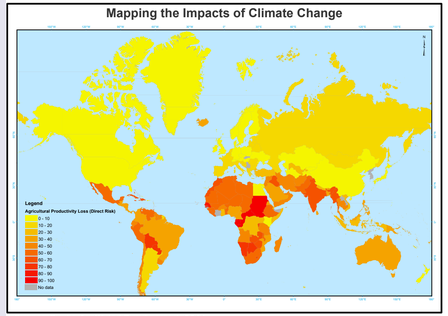
Water security is key to poverty alleviation. However, water scarcity already affects every continent. It is estimated that around 1.2 billion people live in areas of physical scarcity. Another 1.6 billion people face economic water shortage (where countries lack the necessary infrastructure to take water from rivers and aquifers).



Source: WRI Aqueduct, 2014

Climate change impacts on food security

Climate change will have increasingly negative impacts on agricultural production, especially in marginal environments characterized by, among other things, soil and water salinity, land degradation, lack of water, and unfavorable climatic conditions. This underlines the need to invest more in adaptation in addition to mitigation.



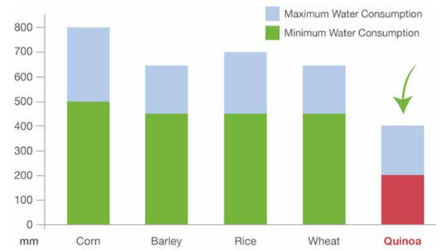
Source: Center for Global Development, 2011

Quinoa as a solution

People living in marginal environments are considered to be most vulnerable to impacts of climate change. Climate change is viewed as a current and future cause of hunger and poverty. Increasing drought, salinity, and changing climatic patterns require a shift in crops and farming practices.

Quinoa is one crop that has proven itself an excellent alternative with high nutritional value and considerable biodiversity, meaning it can be adapted to different environments.

Crop water needs and sensitivity to drought



Source: FAO, KSU, 2015

Quinoa: a super crop for nutrition

Unlike major crops like wheat, quinoa is a complete protein - containing all nine of the essential amino acids. It is packed with dietary fiber calcium, phosphorus, magnesium and iron. It is also gluten-free and easy to digest.

The International Center for Biosaline Agriculture (ICBA) has led a global quinoa program since 2007 in collaboration with national, regional and international research, government and donor organizations in the Middle East and North Africa region, as well as Central Asia, to evaluate and test the performance of several quinoa cultivars for their productivity when grown in marginal conditions.

To date ICBA has identified and developed five high-yielding salt-, heat- and drought-tolerant quinoa genotypes that are ready to be introduced and tested in other agro-ecological zones.

The program is under way in several regions, including the Middle East, North Africa and Central Asia.

Nutritional value of ICBA's quinoa genotypes per 100 g compared to wheat

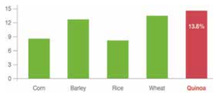
	ICBA Q1	ICBA Q2	ICBA Q3	ICBA Q4	ICBA Q5	Wheat *
Protein (g)	11.68	12.08	11.38	12.73	10.555	12.60
Total carbohydrates (g)	50.5	53.5	53.7	46.8	58.8	71.18
Ca (mg)	79	52.65	90.3	54.55	60.6	29.0
K (mg)	1505.55	1347.95	1159.65	1343.15	1270.75	363.0
Zn (mg)	2.605	1.985	2.65	1.82	1.885	2.65
Mg (mg)	198.7	215.3	192.35	184.55	183.45	126.0
Mn (mg)	1.245	0.85	1.48	1.095	6.99	3.99
P (mg)	538.6	505.3	514.85	490.3	479.05	288.0
Fe (mg)	4.2	2.585	6.91	3.34	3.355	3.19

Note: The quinoa data is averaged per genotype (ICBA, 2020).

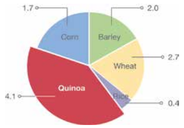
** Data from the Nutrient Data Laboratory, United States Department of Agriculture, 2020.*

Comparisons of nutritional quality (% dry weight)

Crude Protein



Fiber



Source: Eat well to live well, 2013

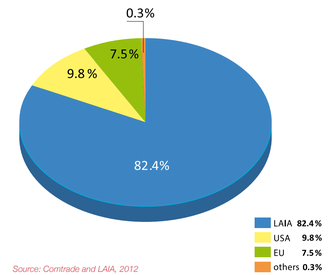
Global demand for quinoa grows

In recent years the global quinoa trade has gone up thanks to efforts by many organizations, including the FAO.

Since 2006, there has been a sharp increase in exports from Latin America, the region of the three Andean countries that account for over 80% of the global exports. However, many countries around the world have also started cultivation.

More and more farmers are joining the ranks of quinoa producers. Smallholder farmers in marginal environments are likely to benefit most in economic and other terms from quinoa cultivation and growing demand as they have few or no other alternatives.

Global exports in quinoa



Source: Comtrade and LAIA, 2012

What next

There are still many constraints and issues to be addressed before quinoa becomes a crop of choice in marginal areas where other major crops have long been dominant but are now failing due to climate change and degradation of soil and water resources.

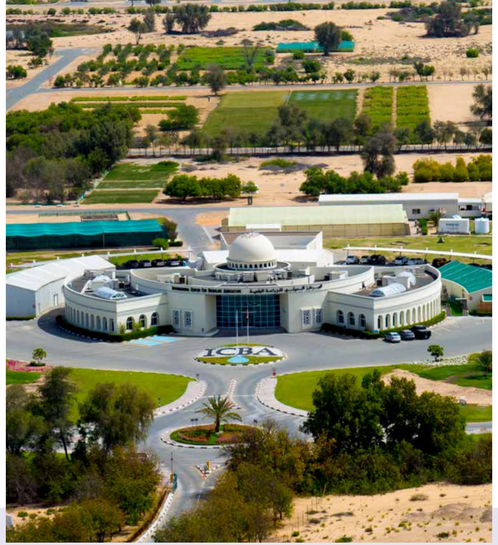
Some of the key challenges include limited availability of genetic material for cultivation and lack of knowledge of best management practices.

Therefore, more efforts should focus on providing smallholder farmers with incentives and cultivation technologies suited to specific environmental conditions.

More importantly, it is necessary to devise effective research-based strategies and tools to boost quinoa production in marginal environments.

Under its mandate, ICBA leads efforts to address these problems in marginal environments through research, innovation and partnership.

In collaboration with national partners, ICBA continues to implement programs to test, evaluate and introduce improved quinoa lines in Sub-Saharan Africa, the Middle East and North Africa region, and Central Asia.



About ICBA

The International Center for Biosaline Agriculture (ICBA) is a unique, not-for-profit applied agricultural research center in the world with a focus on marginal areas where an estimated 1.7 billion people live. It identifies, tests and introduces resource-efficient, climate-smart crops and technologies that are best suited to different regions affected by salinity, water scarcity and drought. Through its work, ICBA helps to improve food security and livelihoods for some of the poorest rural communities around the world.

www.biosaline.org ICBAAgriculture ICBAAgriculture ICBAAgriculture ICBAAgriculture

Quinoa:

A Future-Proof Crop for Food Security in Marginal Environments

ICBA
مركز الملك سلمان لأبحاث الزراعة في المناطق الجافة
AGRICULTURE FOR TOMORROW

Alternative crops and food security in marginal environments

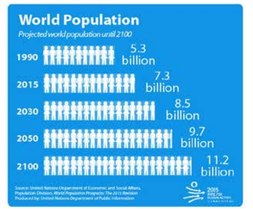
Major cereal crops like wheat, rice, barley and corn are progressively failing to withstand increasing salinity and lack of water in marginal areas, home to around 1.7 billion people by one estimate.

Therefore, there is an urgent need to identify and introduce alternative solutions (for example, use of saline or treated wastewater to grow non-traditional crops) to sustain, and, possibly, increase agricultural productivity in areas where growing traditional crops has become difficult and sometimes uneconomical. Alternative crops such as sorghum, pearl millet and quinoa are uniquely suited to do well in conditions where many other crops fail.

More people will need more food

The global population is expected to reach 9.7 billion in 2050. Africa is forecast to account for more than half of the additional 2.4 billion people projected to be added to the global population between 2015 and 2050. Asia is projected to be the second largest contributor to future global population growth, adding 0.9 billion people between 2015 and 2050.

The FAO forecasts it is necessary to produce 70% more food by 2050, including a 50% rise in annual cereal production to about 3 billion tons, to meet the future global demand for food.



Source: United Nations Department of Public Information, 2015

Millions still go to bed hungry

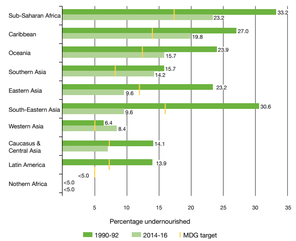
According to the World Bank, 702 million people still live in extreme poverty. An Oxfam study in 2009 showed that 45.9% of the poor in Sub-Saharan Africa and 25.3% in Asia live in marginal environments.

According to FAO's The State of Food Insecurity in the World 2015, 793 million people are undernourished globally.

Risks to food security

Industrial agriculture is not enough

According to a study by scientists at the University of Nebraska- Lincoln, prevalence of the declines and plateaus in production of major crops since the 1990s indicates that maximum potential yields under the industrial model of agribusiness have already occurred. The researchers argue that some of the causes include land and soil degradation, climate change, and inadequate or inappropriate investment. This raises concerns about whether traditional agricultural methods will be enough to sustain global food production targets as regions which already suffer from malnutrition, water scarcity and soil degradation are forecast to see the largest population growth.



Note: Data for 2014–16 refer to provisional estimates.
Source: FAO, 2015