Development Geography
Faculty of Social Sciences
University of Bergen

Is the "Mother Grain" feeding the world before her own children?

An examination of the impact of the global demand for quinoa on the lives and diets of Peruvian quinoa farmers

A Master's Thesis By:

M.J. Lovejoy

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Project carried out with the assistance of the Meltzer Foundation

ABSTRACT

This project examines factors the impact of the increasing global demand for quinoa (*Chenopodium quinoa*) on its production and local consumption in southern Peru through a methodological triangulation of semi-structured interviews, external data from national monitoring sources, and secondary sources collected from other researchers. This paper presents data collected through semi-structured interviews with 50 participants from 12 villages in the vicinity of Puno and Cuzco. Fieldwork took place from May to July 2014 and interviews were made possible with the help of key informants and interpreters.

This paper examines how the social, political, and economic value of quinoa has changed as the result of increased global demand and how those changes have affected local quinoa consumption among southern Peruvian quinoa farmers. The escalating monetary value of quinoa has induced farmers to produce more both for themselves and for the market, although they have yet to see significant financial gains. The social value of quinoa, inflated by vociferous promotion from Peruvian First Lady Nadine Heredia and the Food and Agriculture Organization of the United Nations (FAO), has resulted in increased consumption among more financially stable farmers, whereas poorer farmers lack the resources to produce more.

This study concentrates on the microlevel concerns of individuals and households associated with the commercialization and global demand for quinoa, a traditional food crop that has fluctuated in value due to external pressures that once discouraged but now encourage its local consumption. Although this study did not find evidence of dietary transition among the southern Peruvian informants, it was found that quinoa's social significance is increasing along with the global demand, thus leading the way for increased local consumption and production of quinoa.

EXECUTIVE SUMMARY

Background

South American smallholders have cultivated quinoa for approximately six millennia. Over the many years, quinoa has changed in popularity, cultivation methods, and level of local consumption. These changes are largely the result of external influences and this paper focuses on the most recent, and perhaps most significant, of those changes. Since its "discovery" in the 1980s by United States food scientists, quinoa has captivated the world's attention and it is now consumed more widely than at any other time in the history of its cultivation. Despite its adaptability to various agricultural conditions, the bulk of quinoa production still occurs in the *altiplano*, high plains, of southern Peru and northern Bolivia, so it is there that the pressure to produce the world's supply is concentrated. It is this pressure that serves as the focal point of this study.

Objectives

This paper identifies and examines the local level changes caused by the global demand for quinoa, including rising prices, alterations in its significance for Andean people, and the level of local consumption of quinoa in southern Peru.

Participants

Semi-structured interviews were conducted in 12 villages in the vicinity of Puno and Cuzco, the most productive quinoa areas in southern Peru, with fifty informants.

Methods

This study utilizes data triangulation through a literature review, semi-structured interviews with informants, and national monitoring data. Semi-structured interviews were conducted based on a questionnaire that included a dietary diversity survey. Informants were interviewed with the help of translators and key informants, who provided access to other informants using the snowballing technique. Data was coded and then analyzed using theories to explain the dietary and behavioral choices informed by the global demand for quinoa.

Results

The exponential increase in quinoa's global popularity has necessitated direct changes in production to meet the demand, as well as produced indirect changes in quinoa's social value in the societies where it is grown. All informants interviewed for this study have been growing quinoa for generations and the impact of the global demand is being felt by each of them; however, not all quinoa farmers are responding to, or benefitting from, the global demand in the same way. Those farmers with larger landholdings have greater capacity to increase quinoa production for the market, whereas farmers with less land produce quinoa purely for personal use. The majority of informants cited either the rising prices or promotional propaganda as their motivation for growing and consuming more quinoa. The global demand for quinoa has propelled farmers to be even more productive, thus influencing everything from soil quality to land use when farmers move from Inca-age terraces into flatter areas, displacing llama grazing and other crops.

Conclusions

During the Green Revolution of the 1970s, the focus of food security was on under-nutrition and lack of calories, which was addressed by increasing the amount of food produced through the development of more productive food varieties. More recently, that concern has shifted toward micronutrient malnutrition as the number of people suffering from 'hidden hunger' has surpassed those who simply do not have enough food (Smil 2002: 128). This shift in concerns has resulted in policies that favor dietary diversity as a way to ensure a balanced diet that provides the correct micronutrients, including the Big Four (vitamin A, zinc, iron, and iodine), to reduce deficiency-related disease and improve growth and cognitive outcomes (Welch & Graham 1998). This shift in major food system priorities from calorie acquisition to dietary diversity is coupled with another modern trend: toward sustainability.

Intensification of agricultural production to meet the demands of the growing global population has had twofold consequences that are driving the global

food system to shift toward sustainable production. The first consequence is the reduction in food nutrition as the result of soil degradation caused by intensified production. The second consequence is environmental damage caused by pollution from agricultural inputs like pesticides. These consequences have resulted a food system shift toward sustainable production, exemplified by the proliferation of organic products, the local food movement, and climate change concerns. The shifts in global food system priorities, from producing more to producing better, are proving to have significant impact on quinoa as a traditional food and as a commodity. Quinoa has been grown the same way by smallholders in South America for generations, but recent increases in global demand have resulted in massive shifts in the way quinoa is produced and in its significance in Andean society as a source of cultural pride, made all the more important by tourism, which serves as a primary industry.

Food systems changes are largely demand driven. Whether it is taste, affordability, ease of consumption, or nutrient content, what we find on grocery shelves is shaped by consumer demand and shapes the lives of those who grow our food. The smallholders interviewed for this study have only begun to feel the pressure of global demand and as a result, have altered their level of participation in the market in the past few years. As time goes on, these small-scale Peruvian farmers will need to continue to either escalate production or market their crop more efficiently if they are to compete with the larger-scale farms that are encroaching on the traditional.

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GLOSSARY

Altiplano: High plains

Arroba: Unit of measurement used for weight equal to 14.7 kilograms

*Aynuqa/*aynoka*:* Communally owned and individually worked plots

Campesinos: Peasant farmers

Mestizo: Mixed European and native

LIST OF ABBREVIATIONS

NUS: Neglected and Underutilized Species

FAO: Food and Agriculture Organization of the United Nations

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1. INTRODUCTION

Colloquially known as *chisiya mama*, or the mother grain, quinoa ("kwinn-OH-ah") is a South American seed crop skyrocketing in global popularity. In less than half a century it has risen from virtual obscurity to nurturing an increasing number of people worldwide. Quinoa was first cultivated for human consumption over six millennia ago in a region called the *altiplano*, or high plains, of the Andes, and has been grown ever since by subsistence farmers primarily in Bolivia and Peru. Quinoa's recent popularity is capturing the attention of health food advocates, NGOs, economists, and a growing number of mainstream retail outlets. It is now cultivated in over 70 countries, with the Andean region where it originated still producing more than 90 percent of the world's supply (FAO 2013). Its position as a traditional food crop has evolved into a transitional hybrid that maintains many traditional traits but is also being propelled into the future as a contender on the global economic stage and as a nutrient-rich food source with the potential to withstand changing climates.

Quinoa's popularity stems from its complete nutrition, quality protein, and its agricultural adaptability to harsh environments. Quinoa has the potential to grow at varying latitudes with very little water. These qualities have inspired the United Nations to deem 2013 the International Year of Quinoa as part of a campaign to herald its potential as a tool to reinforce global food security. Although it has expanded considerably in the last thirty years, quinoa production is concentrated in a small area of South America, approximately 100,000 hectares, roughly equal to the size of Hong Kong. As quinoa's popularity increases, so does the pressure for *altiplano* farmers to produce more or risk missing out on the boon.

This paper is an examination of the micro-level impacts of the global demand for quinoa on southern Peruvian quinoa farmers. The first part of this paper describes the study area and the informants, followed by an elucidation of quinoa's desirability as a nutrient-dense solution to malnutrition and how this has caused fluctuation in its significance in Peruvian society. A presentation of theories to shed

light on the effect that quinoa commercialization has had – and continues to have – on Peruvian life is followed by an explanation of how the local use and production methods of quinoa have changed with its economic and social value, followed by. Semi-structured interviews and dietary diversity surveys are utilized to examine farmers' dietary conditions and to explore changes that may have been caused by external pressures such as the increasing price of quinoa.

Appetites for the mother grain have transformed an obscure seed crop into a phenomenon mispronounced across the globe. This paper examines the impact of the demand and exportation of quinoa on southern Peruvian subsistence farmers' farms, on *their* food security, as well as other impacts that spread far beyond the dinner table.

1.1 Geographic Background

1.1.1 Physical Geography

The majority of the world's quinoa is grown in southern Peru. Puno, where 80 percent of Peru's quinoa is grown, is a region in southeastern Peru, bordered by Lake Titicaca and Bolivia. This field study took place in 12 villages around Puno and Cuzco, the historic capital of the Inca Empire. Hills, mountains, and high plains dominate much of the region, making it optimal for quinoa cultivation. The highlands are comprised of two ecological

Map 1: Study areas circled in red

zones: “cold plains of the vegetationally barren puna zone above about 3,700 m and the warmer, more fertile zone at lower elevations” (Baker 1964: 341). This field study took place in the northern *altiplano* in the highland valleys of southern Peru near the Bolivian border at altitudes between 3,000 and 4,000 meters. As this is a study of the impact of increased quinoa production resulting from global demand, the villages selected for this study are near the commercial centers where quinoa is sold. Some of the study areas are circled in red on Map 1 while others not shown are located in the vicinity.

1.1.2 Climatic Conditions During Study Period

Peru is situated below the equator, therefore this study, which occurred in May-July 2014, took place during the southern hemisphere’s winter. Quinoa harvest time in Puno falls between March and May, depending on the level of rainfall. This study occurred just after harvest when quinoa drying, processing, selection, and storage take place (FAO 2013). Following harvest, the months of June and July are the coldest, with average temperatures ranging from 16°C during the day to -5°C at night.

1.1.3 Ethnographic Background

The farmers interviewed for this study belong to the Amerindian, or indigenous, population, which makes up about 30 percent of Peru’s total population and is divided into two major groups, Quechua and Aymara. Outside of the major city centers, the dominating Spanish (84.1 percent) is less frequent and gives way to indigenous languages Quechua (13 percent) and Aymara (1.7 percent), making local interpreters essential to access peasant farmers (CIA 2014).

The informants interviewed for this study are smallholding peasant farmers, or *campesinos,* who survive primarily through subsistence farming and their limited participation in the local food and tourist markets. Although the term “smallholders” can refer to farmers holding anywhere from less than one hectare to 10 or more, its usage here is not constrained to land size but also refers to their “limited resource

endowments relative to other farmers in the sector" (FAO 2004). The informants for this study can be considered smallholders in that they own an average of 1.7 hectares. This is not unusual as 82 percent of Peruvian farms are 5 hectares or smaller (Nolte 2013).

Predictably, the Spanish conquest in 1532 and colonization until 1821 have had a lasting impact on every part of Peruvian life, from language to religion (81.3 percent are Roman Catholic) to indigenous rights to cuisine; including the locals' relationship with quinoa (CIA 2014). See section 4.2 for more on the Spanish historical influence on quinoa use.

1.1.4 Land Use

In this field study, farmers were asked to describe their farms using details such as land size, crop varieties, and farming techniques, with particular interest paid to the maintenance of the soil. Such questions help to reveal the relative economic security of the informants, potential nutritional deficits resulting from poor soil quality, and dietary diversity. Each of these topics will be expanded upon in their pertinent sections later in this paper.

In Peru, plots of collectively owned farmland are called *aynoka* or *aynuqa,* which is defined as "a collection of plots across several sectors in communally controlled lands where each family maintains individual plots, typically distant from the home and managed by the peasant communities" (Urdanivia 2014: 39 from Canahua et al. 2002). These *aynuqa* are considered to be a fundamental part of Andean agriculture, vital to the preservation of traditional knowledge and customs of communal land management. Additionally, this form of land ownership ensures that quinoa is not monocultured, or planted as a single crop across a large land area, which has been proven to degrade soil, make crops more susceptible to pests, and lower agrobiodiversity (Lal 2009). Hellin and Higman suggest that *aynuqas* are vanishing due to intensification of quinoa production for an individualized export market (Hellin & Higman 2001: 6).

International export is increasing the influence foreign consumers have on livelihoods and land use in developing regions. In southern Peru, land is shaped by foreign demand where farmers are converting or expanding their quinoa production either for personal use or for sale. The type of agriculture practiced by many of the informants can be described as semi-subsistent, in that they grow most of their own food and sell some of what they grow, which includes quinoa, potatoes, corn, wheat, and barley.

1.2 Quinoa (*Chenopodium quinoa*)

1.2.1 History and Local Use

Interpreter Kelly Fitzpatrick discusses quinoa cultivation in San Salvador with two informants. Photograph by MJ Lovejoy, 2014.

Quinoa has been cultivated in South America for millennia. Its seeds, often incorrectly classified as pseudo-cereal or grain, are closely related to spinach, renowned for their nutrient value, and have served as everything from a traditional staple to chicken food. The Inca army utilized quinoa to sustain their troops during strenuous marches through the Andes (Hellin and Higman 2001: 4 from the National Research Council 1989). Fast forward a few centuries and you find quinoa gracing the shelves of select health-food stores. Its growing popularity continues to make it even more available. This difficult-to-pronounce little seed is now a household name around the world. Quinoa's increasing popularity is central to this study's exploration of the seed's changing role among those who produce it in the South American *altiplano.*

Quinoa seeds grow in colorful clumps at the top of 1-2-meter-tall stalks. The high altitude, dry air, and sandy, saline soil make for less than ideal growing conditions for most crops, but quinoa has found a niche. These mostly inhospitable conditions make quinoa all the more valuable to farmers who can grow little else.

Varieties range in color, size, nutrient content, and ecological requirements (difference in maturation period, water, etc). On the stalk, the outer seed coating is colorful, but once it starts to dry the color fades and all the seeds are white beneath their protective husk. The many varieties have adapted to their environments, so some are more frost resistant while others have larger, more uniform seeds. The latter variety, *quinoa real,* is in the highest demand due to its large seeds and short maturation period. Scientists, researchers, and farmers are working to promote the less utilized types in an effort to protect the plant's agrobiodiversity.

A plant with many uses, the stalk and leaves are often used as fodder and fuel, while the seeds are (now but have not always been) mostly reserved for human consumption. For pre-Colombian Andeans, quinoa was a staple food that sometimes even replaced animal protein in their diets (Brady et al. 2007: 1209 from Kozoil 1992). Its potential as a highly nutritious food has been recognized for years. The FAO, Brady et al., and others suggest that 'the shortage of provisions in needy countries can potentially be solved by cultivation of quinoa (or otherwise act as an ideal human food supplement) since it can survive the most barren farming conditions (potential for cultivation in marginal lands and temperate regions) while maintaining a high nutritive value and supplying a reasonable yield' (Brady et al. 2007: 1209 from Prakash, Nath & Pal 1993).

1.2.2 Nutrient Profile

According to Ruales & Nair (1993a), "quinoa could satisfy the requirement of most vitamins recommended by the Committee on Dietary Allowances" (Ruales & Nair 1993a: 134 from National Research Council 1989). In addition to being a source of quality protein, carbohydrates, and fat, quinoa is a good source of

thiamine, folic acid, and vitamin C (ibid.; Ruales & Nair 1993b: 137). It is the only food crop to provide all the essential amino acids as well as being gluten free (Krivonos 2013: 59).

Table 1: Nutrient density for some vitamins and minerals in Quinoa seeds

Nutrients	RDA[a]	Nutrient density[b]				
	Children between one and three years of age	Quinoa (332 g)	Wheat (351 g)	Rice (361 g)	Oat (333 g)	Maize (356 g)
Energy	1 300 kcal	1·0	1·0	1·0	1·0	1·0
Vitamin A	400 μg RE	1·4	0	0	0	0·2
Vitamin E	5 mg α-TE	2·1	1·2	0·5	0·5	0·8
Vitamin C	45 mg	1·4	0	0	0	—
Thiamin	0·7 mg	1·2	2·1	1·7	2·9	2·0
Riboflavin	0·8 mg	0·9	0·6	0·3	0·6	0·4
Folic acid	100 μg	2·2	1·7	1·6	1·7	1·4
Calcium (Ca)	800 mg	0·4	0·2	0·1	0·4	0·1
Phosphorus (P)	800 mg	2·1	1·5	1·3	1·4	1·2
Magnesium (Mg)	150 mg	4·9	3·2	4·0	2·8	3·0
Iron (Fe)	15 mg	1·1	1·0	0·4	1·2	1·1
Zinc (Zn)	10 mg	1·3	1·1	0·6	1·0	0·6
Copper (Cu)	1 mg	6·3	1·9	1·3	1·5	1·3

[a] RDA, Recommended dietary allowances (1989).
[b] Nutrient density: ratio between the amount of nutrients present in the material that is enough to provide 1300 kcal and the amount of nutrients recommended for children between one and three years based on the values for washed quinoa from Table 2 and Table 3, and the values for wheat, brown rice, oats, and maize from Kent (1984) and Statens Livsmedeksverk (1986).

(Ruales & Nair 1993a: 134)

1.2.3 Processing for Nutrient Bioavailability

Bioavailability refers to the level at which nutrients can be absorbed and/or utilized by the body (Welch & Graham 1999: 6). The bioavailability of nutrients is reduced by the presence of anti-nutrients, which can be found in 'relatively high levels' in whole cereal grains, whole legume seeds, and beans (ibid.: 7). The anti-nutrients present in quinoa are saponins and phytic acid, or phytin, which lower the bioavailability of zinc and iron (ibid.; Ruales & Nair 1993a: 131). Given that quinoa is a nutrient-rich food, processing is important to make those nutrients available. It is also important when promoting a food as a super-food to be aware of the bioavailability of those nutrients to best take advantage of them.

Quinoa seeds are covered with saponins, which are glucoside-triterpenoid compounds that are bitter or soapy to the taste. Several processing techniques are utilized in order to improve the palatability of the seeds, including de-hulling,

washing, and then boiling. Thermal processing degrades saponin molecules (Brady et al. 2007: 1209, 1210). Industrial processing involves wet and dry milling into flour (ibid.: 1210 from Becker & Hanners 1990). Brady et al. (2007) conclude that steaming had minimal impact on the chemical composition of the quinoa flour they tested, whereas extrusion and roasting produced significant changes (ibid.: 1215-16). These changes involve saponin degradation, which while reducing the bitter taste, could also reduce the nutraceutical properties of saponins (ibid.: 1216).

Interestingly, although saponins are anti-nutrients, the process of removing saponins can also reduce some of the vitamins and minerals found in quinoa, notably potassium, iron, and manganese (Ruales & Nair 1993a: 131). Ruales and Nair (1993a) found that washing and de-hulling served to significantly reduce saponin A (by 56 percent) and completely remove saponin B. Phytic acid (myoinositol hexaphosphoric acid) was reduced by 30 percent, which remains relatively high even after the outer layers of the seeds have been removed. This means that while saponins exist on the outside of the seeds, phytic acid is more evenly distributed throughout the seed (Ruales & Nair 1993a: 131; Ruales & Nair 1993b: 141). Phytic acid inhibits the absorption of zinc, calcium, magnesium, and iron, the latter through the formation of iron-phytate complexes of low solubility in the small intestine (Ruales & Nair 1993b: 137).

Other troublesome anti-nutrients are tannins, which are polyphenolic compounds that interfere with digestion and absorption of protein (ibid.: 138). While Ruales and Nair (1993) detected tannins in neither the raw whole quinoa nor raw polished and washed quinoa they tested, they cite Chauhan et al. (1992) as having detected tannins. They conclude that the presence of tannins may vary by variety and growing conditions (Ruales & Nair 1993: 141). This makes the protein in those varieties that do have tannins less bioavailable than those that do not.

Removing anti-nutrients is not the only way to make the nutrients in food more bioavailable. The presence of promoter substances in the diet can also improve nutrient bioavailability (Welch & Graham 1999: 8). The promoter

substances reported to enhance the bioavailability of some of the important micronutrients in quinoa (zinc, iron, and vitamin A) can be seen in the following chart.

Table 2: Promoter substances

Promoter substances in plant foods reported to enhance the bioavailability of iron, zinc, and/or vitamin a to humans eating meals containing complex diets under some, but not necessarily all circumstances (modified from Graham and Welch (1996)). Garcia-Casal et al. (1998)*

Substance	Micronutrient	Major dietary sources
Certain organic acids (e.g. ascorbic acid or vitamin C, fumarate, malate, citrate)	Fe and/or Zn	fresh fruits and vegetables
Phytoferritin (plant ferritin)	Fe	legume seeds and leafy vegetables
Certain amino acids (e.g. methionine, cysteine, histidine, and lysine)	Fe and/or Zn	animal meats (e.g. beef, pork, and fish)
Long-chain fatty acids (e.g. palmitic acid)	Zn	human breast milk
Fats and lipids	vitamin A	animal fats, vegetable oils
	vitamin E	animal fats, vegetable oils
beta-carotene	Fe, Zn	green and yellow vegetables*
Se	I	Sea foods, tropical nuts
Zn	vitamin A	Animal meats
Vitamin E	vitamin A	Vegetable oils, green leafy vegetables

(Welch & Graham 1999: 8)

1.3 Nutrition

1.3.1 Micronutrient Deficiency

One of the primary reasons the year 2013 was declared the International Year of Quinoa is quinoa's potential for improving food security. This study then asks the question: Whose food security? While examining the impact of the global demand for quinoa, the major concern of this study is the nutritional wellbeing of the quinoa farmers responding to its new popularity. It investigates the suggestion that as the demand for quinoa has increased, farmers have transitioned to eating less quinoa in order to make more of what they produce available for sale, thus potentially threatening their food security. Food security is defined by the 1996 World Food Summit as: "All people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (World Food Summit 1996). Food security refers to availability, access, and utilization (as in the biological ability to make

productive use of food) (Swindale & Bilinsky 2006). Governments and NGOs concerned with food insecurity promote the production and consumption of quinoa due to its capacity to provide nutrient-dense food in less than ideal growing conditions, yet it very producers may be in danger of a nutritional condition called "hidden hunger."

Nearly 1 billion people suffer from hunger, while nearly double that number worldwide suffer from "hidden hunger." Hunger is a broad term, which includes under-nutrition, insufficient food energy, and PEM (protein energy malnutrition) (Smil 2002: 128). In contrast, "hidden hunger," or micronutrient malnutrition, is a less visible but no less serious deficiency which is limiting productivity, permanently impairing cognitive function, causing disease, and ultimately preventing many communities in the Global South from developing (Welch & Graham 1998).

A diverse diet is required in order to best provide the macronutrients and micronutrients that the body needs to function. This study measures dietary diversity by asking informants to describe their meals and then charting the information into food groups, giving them a score of one for every food group that is represented. This method, called the Dietary Diversity Survey, culminates in a Dietary Diversity Score (DDS). Dietary diversity is a measure of food access, one of the dimensions of food security, making it an appropriate food security indicator. There will be more on the use of this measurement in the Methodology section of this paper.

1.3.2 Nutrition Transition

Processed foods are marketed as being desirable for their social value, long shelf life, and ease of consumption, so more of this kind of food is produced, displacing healthy food (Kearney 2010: 2801). This shift toward processed food is called nutrition transition. Unlike processed foods that are easier to prepare, quinoa is a labor-intensive food that requires thorough rinsing to remove the bitter saponin

coating. Reductions in local quinoa consumption may also be attributed to the increasing availability of food that is easier to prepare, such as rice or pasta. Scarce fuel supplies may also be a limiting factor because quinoa requires a longer cooking time than pasta.

Traditionally, quinoa only played a minor role in income generation, but now farmers sometimes decide that their quinoa is too valuable to eat. Instead, cultivators sell what they grow and switch to eating less-nutritious foods like rice and processed wheat pasta (Jacobsen 2011: 393). Although wheat is one of the crops that informants grow regularly, it is also imported from the United States, which subsidizes the production of wheat, making these imported products cheaper than what can be produced locally. This practice displaces traditional crops, including quinoa, due to low prices and ease of preparation. Also displacing many varieties of traditional crops is the impact of globalization, which has contributed to market pressures that dictate the consistency and quantity of exported products (Hellin and Higman 2002: 1-2; Urdanivia 2014: 35). These market pressures have induced many farmers to increase their production of quinoa.

Modern food processing has resulted in foods that contain fats, added chemicals, and high levels of salt and sugar (Popkin 2003). These foods, which are desirable for their taste, ease of consumption, and social status, are central to the nutrition transition trend. Nutrition transition is the shift from traditional staples to processed foods. This shift also illustrates the change in food security concerns from famine to nutrition-related non-communicable diseases like diabetes and obesity. Many of the additional calories come from sugared beverages. In one of the villages visited during this field study, Camicachi, the informants shared a 2-liter bottle of bright green soda with my interpreter and myself. After a lunch of potatoes cooked in a mud oven heated by burned quinoa stalks and a round of fresh cheese, the informants brought out one disposable plastic cup which was passed around for each person to pour a serving of soda, toast the group, and then drink before passing to the next person.

1.3.3 Meal Composition and Food Allocation

The way that each meal is patterned throughout the day, month, and year is based on a number of factors from preference to availability to traditions. Meal composition can be examined from a macro level by examining national trends using food balance sheets or on a micro level based on family meals, which, while perhaps following general larger patterns, can isolate the patterns within quinoa farmer households in particular. National monitoring data of quinoa consumption cannot provide information about which family members consume more quinoa, how frequently it is incorporated into meals, and whether or not the quinoa farmers themselves are using as much as they used to.

In Mary Douglas's work "Deciphering a Meal" (1972), she breaks meals into units decreasing in size from the daily menu to the meal down to the mouthful, all of which can be analyzed based on culture, age, gender, preference and so on (Douglas 1972: 63). Of course, this topic can become incredibly complex if examined from an anthropological perspective to include social rules (such as the strict food handling guidelines followed within the Indian caste system or what is determined to be polite behavior at mealtimes), gender roles (determining who prepares food, which family member gets the choicest parts, or who eats when), and choice (based on taste, health, religion, etc.). For the purposes of this study, meal composition was investigated with particular focus on the presence of quinoa, shifts that have resulted from the global demand for quinoa, and the gender roles of production and preparation.

Although the high price of quinoa has increased farmer incomes, the informants interviewed for this study had not yet significantly changed their diets from the traditional staples that they have enjoyed with their families for generations. Many of the informants can be considered subsistence farmers who grow the majority of their food, supplementing only with non-fresh items that they could not produce themselves including sugar, salt, and cooking oil.

2. PROBLEM ANALYSIS

In 2012, the United States, Canada, and the European Union imported 30,500 tonnes of quinoa, tripling the amount that they imported in 2007 (Krivonos 2013: 59). The rate and quantity of production has increased exponentially. Despite efforts to grow it elsewhere, 90 percent of the world's quinoa is grown in South America so the intensification of production puts additional pressure on a small region of the developing world. This pressure is exemplified by the nutrition transition observed by researchers like Sven-Erik Jacobsen, whose study of Bolivian quinoa farmers found that there were reductions in local quinoa consumption due to the transition to rice or wheat (Jacobsen 2011).

This study addresses the multifaceted effect of quinoa exportation on quinoa farmers in southern Peru. As a food that is increasing in its desirability abroad, particularly for the growing number of consumers with dietary restrictions like gluten intolerance, the pressure to meet the demand is growing. The impact of that demand is the subject of debate, however, about whether or not the effects of this demand are positive.

Information and inferences shape policies, which can have a drastic impact on people's lives. If data is misinterpreted, such as when environmental stewardship is mistaken for degradation, then both the environment and the concerned populations can be put at risk (Fairhead & Leach 1995). Outdated information is just as dangerous, as exhibited by Webb (2007) in the case of studies utilizing data from 1960 to 1982 which reports that vitamin A deficiency is up to 10 times more common in males than in females (Webb 2007: 234). In contrast, more recent information from 49 studies indicates lower vitamin A in boys than girls in less than one-third of those reports (ibid.). While the authors conclude that "recent empirical support for such a generalization is not strong," such "statements have served as a vital platform for informing policy targets and programming decisions through the late 20th century" (ibid.). The implication is that policies can be shaped by misinformation, so it is important to examine an issue from every angle, beginning,

as this study does, with interviews and observations of the people most impacted by such policies.

There appears to be polarized views regarding the impact of quinoa exportation on farmers: on one side, there are researchers who assert that exportation is harming farmers by forcing them to sell rather than consume the quinoa they grow thus shifting to less-nutritious foods, and on the other side, that exportation is helping farmers to earn a good living (Jacobsen 2011; Winkel et al. 2012). This study intends to shed some light on this debate and to examine how the changing value (social and economic) of quinoa has shaped its use where it is produced in southern Peru. While the opportunity to grow quinoa for the export market is intended to provide economic gains to the farmers, resulting in improved dietary quality, the correlation between increased participation in the market and better diets has yet to be demonstrated among Peruvian and Bolivian farmers.

2.1 Research Questions

The research questions that this study addresses are as follows:

- What characterizes the impact of increased global demand for quinoa on quinoa farmers in and around Puno, Peru?
- Is a nutrition transition occurring in quinoa producing families, and to what extent?
- Are dietary preferences based on cost, taste, social value, advertising, or other factors?

2.2 Objectives

The general objective of this study is to identify the impact of the growing global demand for quinoa on quinoa farmers' lives, including their household nutrition and meal compositions. Specific objectives are 1) to identify how the demand for quinoa is affecting quinoa producers, and to determine if this demand is causing a transition from traditional foods to less nutritious foods; 2) examine

differences between diets and meal composition in varying quinoa-producing areas; and 3) study relevant policies to promote the consumption of quinoa. Another of this study's objectives is to examine the impact of the growing demand on local consumption of quinoa as well as its value/role in Peruvian society.

This study examines the micro-level concerns of southern Peruvian farmers whose production of quinoa is once again influenced by foreign pressures. Quinoa was once used to feed Inca armies, then it was suppressed by the Spanish conquistadores who wanted to erase indigenous culture, and now foreigners buy it from health food stores, and NGOs herald it as a potential fix to malnutrition. Such external pressure has drastically changed the way quinoa is valued, both economically and socially. The objectives of this study are to determine how global demand, and subsequent agricultural commercialization, has impacted the farmers who produce the majority of the world's quinoa. These impacts include farm reorganization, dietary changes, labor alteration, and familial nutritional status. Inquiry into these changes at the household level also informs the researcher about larger structural changes that may be occurring to shape that behavior. This behavior is often shaped by macro-level forces, as well as having an impact on the macro-level. Trends observed at the household level can indicate shifts such as an increase in the use of tractors, influences on the way land is used, as well as crop variety, which in turn affects local ecology and soil quality, thus impacting family nutrition. It is not the objective of this report to derive widely generalizable findings, however such interconnectedness cannot be ignored.

3. METHODOLOGY AND DATA

3.1 Data Sources

To answer the primary research question of this study, "What characterizes the impact of increased global demand for quinoa on farmers in and around Puno, Peru?", we first must ask how to measure that impact. A field study of this nature must go to the source, talk to the farmers themselves and hear what they have to say

about the global demand for their crop. In addition to examining the changing value of quinoa over time through interviews and external data collection, this project focuses on what impacts the intensity, methods, and level of participation in quinoa production in Peru. This data was collected from 50 informants from 12 pueblos in the vicinity of Peru's primary quinoa producing areas, Puno and Cuzco. Entry was gained into the community through the use of key informants, who tended to be women encountered during travel or selling their wares at the market. After initial contact with the key informant's family, access to other informants came through snowballing as the key informants introduced us to their neighbors.

The qualitative data utilized for this project includes personal observations, semi-structured interviews, and group conversations. Interviews were conducted with the help of a translator/interpreter and based on a pre-written questionnaire. External sources include relevant research, articles, and case studies conducted by other researchers. The quantitative data that this study collected includes farm size, family size/ages, and dietary diversity score. The Dietary Diversity Score (DDS) is a measure of household food access impact indicators. This study utilizes dietary diversity surveys, which measure of the number of unique food groups consumed, as a proxy for food security. It has been suggested that the exportation of quinoa is causing a reduction in local quinoa consumption, which in areas where staples including quinoa make up the majority of the diet could result in malnutrition or food insecurity. Interviews with quinoa farmers regarding their current and past food intake included dietary diversity surveys because they are not only easier to conduct and less invasive, but also have been determined to be a good indicator of food security, specifically "per capita consumption and per capita caloric acquisition, [which are] both 'access' measures of household food security" (Hoddinott and Yohannes 2002: 39).

Hoddinott and Yohannes (2002) found dietary diversity to be associated with alterations in consumption of staples as well as nonstaples, though the magnitude was higher for nonstaples. This determination applied to all seasons and was

apparent in both rural and urban settings (ibid.). As dietary diversity increases, so does the consumption of staples and nonstaples. Correspondingly, decreases in dietary diversity indicate low caloric availability and consumption (ibid.). Dietary diversity positively correlates to caloric consumption and availability; therefore, it is an indicator of food security.

Hoddinott and Yohannes (2002) found that "a 1 percent increase in dietary diversity is associated with households experiencing between a 0.65-1.11 percent increase in per capita consumption, a 0.37-0.73 percent increase in per capita caloric availability, a 0.31-0.76 percent increase in caloric availability from staples, and a 1.17-1.57 percent increase in caloric availability from nonstaples" (Hoddinott and Yohannes 2002: 39). In other words, an increase in dietary diversity corresponds to overall increases in consumption from both staples and nonstaples. These estimates relate to the mean level of caloric availability, so lower or higher estimates would be more applicable for lower or higher caloric availability (ibid.: 40).

3.2 Data Collection

Data was collected with the assistance of key informants who acted as interpreters, as translators from Quechua or Aymara to Spanish, and as gatekeepers to the community. On several occasions, potential informants were approached without the use of a key informant and those farmers declined invitations to participate in the study. Their reaction made it perfectly clear that the farmers are more likely to engage in dialogue with a familiar person, a representative of their community, rather than an outsider. My positionality as a foreigner, and the impact of that positionality, is discussed later in the data analysis section. Key informants were enlisted primarily serendipitously as they were people met by chance who provided invaluable assistance in putting participants at ease. Key informants introduced us to their families, community leaders, and neighbors so data could be collected using the snowballing technique to approach farmers. The risk of this approach is that results may not be representative of the population. However, it did

allow conversations to occur, and greater access was achieved within communities where people were especially wary of outsiders. Compensated for their efforts, key informants convinced farmers to talk to us and translated those replies into Spanish from Quechua or Aymara.

One of the concerns of this study is the reliability of the data. Food is incredibly intimate, so encouraging people to share information about what they eat can be challenging. Although there was the chance that informants would provide the answers that they think the researcher wants to hear, this risk was alleviated by using key informants to interview a large number of informants and comparing their answers. Along with reliability comes the question of informant memory and the limitations of asking someone to recall everything they have eaten over a given period. Observations of meals helped to determine if what the informants said matched the relative amounts and compositions of meals.

Although originally this study intended to utilize 24-hour recall data to extrapolate food security status, inexact values and the technical expertise required to analyze such data resulted in the use of an alternative food security indicator instead. Originally, it was intended to examine dietary intake by weighing meal components using a digital kitchen scale. However, it soon became clear that this method would be too time-consuming and invasive. USAID states that, by contrast, "field experience indicates questions on dietary diversity are relatively straightforward for respondents to answer, are not considered intrusive, and do not impose burdensome demands on time or recall" (Hoddinott & Yohannes 2002: 1). Defined as "the number of different foods or food groups consumed over a given reference period," dietary diversity predicts "improved birth weight, child anthropometric status, improved hemoglobin concentrations, reduced incidence of hypertension, reduced risk of mortality from cardiovascular disease and cancer" (ibid.: 3-4).

Dietary diversity, the number of food groups represented in a given period, has been determined to be a promising proxy for determining food security,

particularly when measurement resources are scarce (Hoddinott and Yohannes 2002: iii). The relative ease of use coupled with the limited commitment on the part of the informants made dietary diversity surveys appealing for this study, particularly due to the distrust of outsiders experienced in this study (more on this in the data analysis section).

3.2.1 Semi-Structured Interview Questionnaire

The purpose of the semi-structured interview based on a questionnaire is to create a set of easily coded categories of data while not limiting interviews to the pre-written questions. Using a skilled translator and my limited understanding of Spanish, conversations expanding upon the questionnaire paint a more vivid picture. The questionnaire (which can be viewed in full in the Appendix) focuses first on the make-up of the family and farm, and then is followed by questions regarding meal composition and quinoa's position on the family farm and plates.

The collection and analysis of the Dietary Diversity Score for this study was based on the guidelines produced by the FAO and USAID (Hoddinott and Yisehac 2002; Swindale and Bilinsky 2006 respectively). Although other researchers have conducted similar studies using eight or ten food groups, this study is based on the twelve food groups determined by the FAO Food Composition Table for Africa: cereals, root and tubers, vegetables, fruits, meat/poultry/offal, eggs, fish/seafood, pulses/legumes/nuts, milk/milk products, oil/fats, sugar/honey, and miscellaneous (Swindale & Bilinsky 2006: 2). The dietary diversity survey included in this study also includes the presence or absence of quinoa.

3.2.2 Data Collection Issues

This study overcame a number of data collection challenges that all stemmed from being foreign researchers, such as a language barrier, misinterpretation of purpose, and difficulty connecting with potential informants. The language barrier presented an issue in rural areas where the Quechua or Aymara informants did not understand my translator's Spanish. Fortunately, bilingual key informants were able

to translate from the indigenous languages to Spanish. The misinterpretation of purpose was not simply a language issue but was the result either of the locals' mistrust of foreigners or desire to sell to them. At markets especially, we had to convince people that we were not there to buy.

A change in strategy using more direct diction and alterations in approach put potential informants more at ease. The fear of foreign exploitation was made clear at a market where fierce competition to sell potentially caused resentment. When attempts to approach potential informants alone were met with dismissal, a change in approach was needed. The utilization of key informants, who were members of the community, aided in the establishment of trust and enabled dialogues that were impossible when initiated by myself or by my translator as we were immediately read as outsiders.

3.3 Data Analysis Theories

3.3.1 Behavioral Theory - Reasons behind production decisions

Addressing the research questions from a behavioral theory perspective sheds light on the elements of perception and personal choice. While the focus of this project is to examine the impact of external forces, the way that impact materializes has much to do with choices at an individual level. As a disaggregate discipline that focuses on the individual, behavioral theory is used to evaluate what a person knows about the world and how that knowledge shapes that person's choices, which in turn shapes their world. For instance, quinoa farmers interviewed for this study used their perception of quinoa's value to shape their level of production. Environmental perception can also shape land use. For instance, two people can look at the same plot of land and see two different things based on their own interests, values, and culture. One person could see land that needs preserving and the other could see a property development opportunity- these disparate views would shape the individuals' relationship with the environment and their use of that land.

On one occasion during the field study at the Juliaca market an informant was incredibly distressed that after many minutes of negotiations he was only able to sell his product for a fraction of what he felt it was worth. The intermediary, who buys quinoa from farmers to sell elsewhere, claimed that the amount was fair considering the low quality of quinoa that this particular informant brought to sell. For the farmers interviewed, the sale of quinoa supplements their livelihood and while they may not completely depend on it to survive, the additional income may be slated for regular expenditures such as school fees or food purchased at the market. The risk of earning less at the market is mitigated by association membership or in the production of less variable varieties, that is, the uniform varieties that produce a more consistently profitable product are favored over those that do not. One important aspect of behavioral theory is the examination of cognitive perception. Of interest to this study is the perceived gain of quinoa production and the decision to participate in the market by selling a particular variety of quinoa. Minimizing risk is something to consider, as farmers must consistently produce high-quality product in order to sell their crops.

People who have few other options are less likely to take many risks, such as transitioning to mechanized production, which can result in lowered yields and soil degradation (Walsh-Dilley 2013: 676). Most farmers we talked with had no external income so they depended entirely on sales of their crops – increasingly quinoa crops – for their income. Shifting production away from other staples such as corn/wheat/potatoes in order to grow quinoa is a calculated decision based on a farmer's knowledge of market trends and their own level of commitment to making their venture succeed.

3.3.2 Humanist Theory

According to the Dictionary of Human Geography, humanism is "a philosophical tradition that places human faculties (reason, consciousness and the like) at the centre of human action in order to account for and inform conduct" (Gregory et al. 2009: 356). This theory is applied here in order to analyze the

element of informed reasoning in the farmers' decision making, primarily in their decisions to grow a particular amount of quinoa, to consume a particular amount of quinoa, and to sell a particular amount of quinoa. Whereas behavioral theory analyzes these decisions based on perception, humanist theory has a more internal focus. There are certainly external forces at play as well, so the focus is on the farmers and what shapes their meals, including reasoning regarding dietary diversity, income allotment, and food allocation to each family member. If, for example, a nutrition transition is taking place, it reflects choices made by each family based on their understanding of what is healthy, cost-effective, tasty, and worth the energy to prepare.

Of interest to this study are the household allocation decisions, namely what to produce and what to eat. The forces that shaped the decision to produce more and to eat more quinoa could be one and the same for many informants who learned at the market that the price of quinoa was going up or heard on the radio from First Lady Nadine Heredia that quinoa is nutritious.

In the context of this study, who has agency? The means of production are in the *altiplano* farmer's hands (for now) but agency is the capacity to act in the world and production is heavily influenced by the consumers. The farmers can choose to participate in the market or not, but in a region where little else grows, they may have few other options. Free will, and the capacity for the individual to make choices, still exists despite what may seem like extraordinary external pressure to the contrary.

3.3.3 Feminist Theory

The subjugation of women and minorities is an issue that cannot be overlooked. This is essentially a study of daily life, particularly surrounding food, preparation of which has become naturalized as a woman's domain in many cultures. In Peru, it was observed that while men and women work in the fields together, albeit with clearly defined tasks, it is the women who are responsible for

the food preparation and cooking. One informant demonstrated the traditional method of sowing seeds with the men utilizing rough wooden spades like pick axes to break up the hard soil and the women softening the loosened clods of earth and dropping in the seeds, which are then covered up by the men. The more physically taxing elements of soil preparation are assigned to men due to their perceived physicality but the gender roles that dictate kitchen chores are constrained by more arbitrary conditions. Perhaps women are assigned to food preparation and cooking due to their culturally recognized role as providers of nourishment from their bodies and from their kitchens. As the primary food preparers in Peruvian families, women traditionally have been responsible for the removal of saponin from quinoa; some spend at least six hours daily on this task (Rojas 2009: 105).

3.3.4 Post-development Theory

Post-development theory questions the linear directionality of development, which tends to favor Western industrialized capitalism as the end goal of development. This theory questions what has been seen by development discourse as a natural evolution from underdeveloped to developing to developed, in which presumably 'developed' narrators emphasize the 'desirability of movement in that direction' (Agrawal & Gibson 1999: 630). By utilizing this theory, this study examines if and how traditional ways of life have changed for quinoa farmers in Puno since entering the export market, particularly in regard to the presence or absence of traditional staple foods. Spanish conquistadores spurned traditional staple foods like quinoa as primitive, so it was excluded from their efforts to shape Peruvian culture to be more like the civilized Spain. Authors like Arturo Escobar use post-development theory to critique development efforts that marginalize the poor and that celebrate "dog-eat-dog" globalized consumerism while ignoring the experience of the supposed beneficiaries of those efforts.

3.3.5 Post-Structuralist Theory

Post-structuralism is concerned with outside, peripheral, socially constructed institutions, discourse, and subjects. After exploring the extent that external demand for quinoa exportation has impacted farmer dietary choices, next is to identify what information (knowledge) has shaped those decisions and where that knowledge came from. To do so, this study utilizes post-structuralist theory to analyze quinoa farmer responses to semi-structured interview questions. For example, do government dietary interventions, like those discussed in section 4, influence farmer dietary choices? The informants interviewed cited two reasons shaping their decision to increase the amount of quinoa they grow: the increasing price, which they learn about at the market, and quinoa's nutrient value, which they learned from informational radio/television advertisements.

When exploring the multifaceted causes and effects of the change in quinoa's value and level of cultivation, post-structuralist theory calls for an examination of power. That is, who has power, what are the forces of domination, and what power struggles exist. In this situation, it may appear that quinoa farmers have power due to their control over the means of production. However, that power is dependent upon their access to a hungry consumer base. The consumer has the power to influence what is grown, how much, and what quality. The growing demand for organic and fair trade food has driven the need for expansion of organic cultivation, which has increased the supply and in turn reduced the price. To pull back the focus on the consumer as an individual and consider the source of the demand it becomes clearer that it is the developed world that has the greatest hunger for quinoa. Superpowers the United States, Canada, the European Union, and China are super hungry for this superfood.

3.4 ETHICS

Conducting fieldwork is very different from doing research in a library and many ethical elements must be considered when entering into someone elses' environment in order to do research. The first consideration is how to conduct research in an informative, yet respectful and responsible way. The second consideration is how to collect meaningful data from a population that the researcher has never encountered before in such a way that the approach is informed by adequate knowledge of the environment and communities. The third consideration is how the researchers themselves shape the outcomes of the study through the influence of their own background, appearance, representing institution(s) and other factors. Correctly managed, each consideration can contribute to research studies that are informative, non-invasive, and expand a body of knowledge without taking anything away from the subject of the study.

3.4.1 Working in Different Cultures

Working in another culture takes the researcher out of their comfort zone and often exposes them to unforeseen situations. It is important to be flexible, curious, non-judgmental, and humble when working in an unfamiliar environment and with people who adhere to a different set of cultural norms. As part of being sensitive to one's new surroundings, a researcher must also be aware of environmental factors that could impact the study like weather, temperature, air quality, and soil quality and prepare accordingly. Things to consider are wearing clothing that is appropriate for the climate as well as for the community. Prior to leaving for fieldwork, one must explore cultural rules of dress and conduct in order to be respectful while still maintaining one's own comfort.

As an outsider, and a researcher, it is important not to partake in tourist activities like visiting relics and buying souvenirs in order to not appear exploitative or superficial. Yet, in Peru, traditional woven alpaca garments are popular souvenirs due to their beauty. Many tourists (and researchers) forget that summertime in the

northern hemisphere is winter in the southern hemisphere and is therefore quite cold. As such, both end up buying knitted sweaters and hats – which create an opportunity for the latter. While complimenting the garments during our transactions, my translator and I were able to ask about handcrafting techniques, and then seamlessly enter into conversations with persons who eventually became future informants. In this case, typical souvenirs became an avenue to access the community. Measured enthusiasm was determined to be charming rather than over-the-top or disingenuous. Note: When purchasing handmade items in the market it is important to haggle responsibly to neither be taken advantage of, nor to insult the vendor, who is often the person who created the piece.

3.4.2 Language Barrier

In addition to a Spanish interpreter, it was necessary to also utilize key informants who could translate from either Quechua or Aymara to Spanish. I speak English and a small smattering of Spanish (with about 70 percent understanding) so the assistance of a translator/interpreter was necessary to complete this fieldwork. As an outsider, even disastrous attempts at the local language have the potential to open doors because it signifies the researcher's aspiration to bridge the divide between cultures and between people.

3.4.3 Researcher Role/Status

The researcher's "role" embodies the duties that constitute one's status as a researcher (Linton 1936: 114). The role must be as respectful and non-intrusive as possible so as to establish/maintain a "rapport" with the informants (Berreman 1962). To that end, the researcher must take tremendous care not to be overly intrusive, particularly when discussing personal food intake, and inquisitive without being paternalistic. This researcher's status as an outsider, an English speaker, a student from the United States studying at a Norwegian university, and a visibly alternative person were all factors in the way I related to informants and the way that they related back.

In order to obtain data, one must have access to intended informants and maintain good relations with them. As such, the researcher must be aware of their social status and positionality as a researcher. For this study, the researcher had a number of statuses to be aware of whilst in the field that shaped relations with informants, including United States nationality, youth, limited Spanish, queer identity, masculine attire/haircut, and vegetarianism. In some cultures, refusal to adhere to traditional gender roles may make it difficult to fit into known social systems and thus be understood by informants (Berreman 1962: 9). Mullings (1999) suggests that some statuses that conflict with the cultural norms of the informants can be downplayed while others are emphasized, such as emphasizing affiliation with the Norwegian university while downplaying the more controversial US citizenship. Berreman (1962) admits that some secrecy and dissimulation is necessary if you want to see the 'back region' (Berreman 1962: 11 cited from Goffman 1959: 238).

This, of course, may pose an ethical dilemma by not being completely transparent with the informants regarding status or purpose (Mullings 1999: 347), but Berreman (1962: 12) suggests that this kind of purposeful "impression management" exists in all social interactions to express oneself in a calculated way so as to be received in the desired way. As a queer, gender-neutral person, issues of identity and presentation are a daily concern, so this researcher is familiar with the concept of revealing/hiding parts of personal identity as suit the potential safety threat or understanding of the people involved. Ultimately, transparency regarding one's status requires consideration of the ethical teleological principle (what are the consequences?) and deontological principle (what is right in itself?) (Hay from Clifford et al 2010: 40-44).

The quality of data obtained is influenced by the researcher's status, the interpreter's status, and the status of the informant. For this study, the interpreter was the researcher's partner, who is fluent in Spanish, studies Latin American culture, and has visited Peru before. While her status is similar, and may result in

similar issues, her clear understanding of this project's intentions were deemed more valuable than what could be lost by employing a different interpreter. Using her as an interpreter prevented problems of indirect translation and limited transmission of information, which can sometimes happen if the interpreter wants to convey the population in a particular light. To combat issues that could have arisen from utilizing an interpreter with a similar social status to myself, it was necessary to enlist the assistance of a secondary "gatekeeper" interpreter. Like Berreman (1962) did in his study of the Himalayan village Sirkanda with a Brahmin and then a Muslim interpreter, which he "found to be methodologically instructive and substantively advantageous" (Berreman 1962: 21), this study enlisted the help of key informants who were representative of the community and could translate from the indigenous languages to Spanish.

4. RESULTS

Quinoa farmers, regardless of their level of participation in the export market, are impacted by the global demand for quinoa in some way. Even those farmers who are subsistence producers who only grow enough quinoa for personal use are growing more because they know its value is increasing. The 50 informants interviewed for this study grew varying amounts of quinoa based on the size of their landholdings and those with more land had greater participation in the export market (Field Study 2014). Not all informants had the resources to produce surplus for the market, but all informants grow quinoa as well as share close proximity, common growing environments, and cultural background.

Pisaq, one of the villages visited for this study, is a small artist community outside of Cuzco, home to a community of expat "hippies" and to one of the most helpful key informants of this study, 60-year-old farmer and craft merchant Beatriz[1]. On one of the many treks she led to nearby farms, she explained that the land is community owned and managed in individual family plots using a blend of

[1] All informants have been assigned pseudonyms. Actual names are given for organizations, places, and other individuals.

traditional and modern methods. She has a few plots herself, which are half an hour's walk outside of town in either direction. In addition to acting as a tour guide and key informant, Beatriz claimed that she could give access to the weekly farming association meeting. Although the meeting was canceled due to rain, she introduced the association's president and a few prominent members.

The informants' participation in farmer associations is of significance to this study because membership influences the decisions farmers make regarding how they organize their farms and gives them access to the market that they may not have as individuals. Of the farmers interviewed, a surprisingly small 16 percent said that they are members of a farmer association. This is surprising given the benefits of membership but may reflect either the absence of such associations where the farmers live or the informal, almost matter of course, nature of community assistance that renders formal membership unnecessary.

Despite the low farmer association membership exhibited in this study, multiple informants confirmed that that land is often communally owned and family maintained. Produce is then brought to the market collectively, which results in individual families reaping the benefit of the crops that they grow while still benefitting from the safety of numbers. This protects the farmer by ensuring that everyone gets the same price. Farmers who enter the market alone must instead haggle with intermediaries for a price.

4.1 Cultivation and Harvesting Methods

This field study was conducted from May 7th to July 20th, which is generally when the harvest season is wrapping up. Fortunately, the weather this year made it possible for this study to observe a few weeks of harvesting using hand scythes through the end of May (see cover page for a photo of a harvesting team in San Salvador, 2014). Farmers cited a reduction in rainfall as a reason why agricultural production was late and reduced this year. The first harvesters interviewed, in San Salvador, were a group of young men. Subsequent encounters were with middle-

aged couples working together. Work was not restricted by age, but gender roles were strictly enforced.

When asked who is responsible for cultivation and harvesting, informants repeatedly answered that they work together as neighbors. This concept of reciprocity enables farmers to share their workload and to get the help they need to finish the job. When you help your neighbor, that neighbor owes you a debt to return the favor. How many people, that is, how many debts, are required to complete work on a field depends on how the work will be done. Traditional methods require more hands, time and effort whereas mechanized plowing, planting and harvesting save on effort.

4.1.1 Plowing

When it is time to till the fields to prepare the soil for the next planting season, some farmers can choose between "traditional" animal yokes or "modern" tractors. Pairs of bulls pull the simple plow through the hard soil. Farmers who can rent tractors to till the soil to prepare for planting will then either use an animal-pulled plow or a tractor to plant their seeds, depending on the size of their farm. In Pisaq, farmers rent a tractor that will be used to till everyone's plots, so the community contributes to the cost and the labor. The use of a tractor for just plowing and not planting constitutes the partial mechanization of quinoa production, which often reduces producer labor needs, potentially enabling farmers to expand production (Walsh-Dilley 2013: 669).

Many of this study's informants were subsistence farmers who did not have any sort of external income, even from selling their crops at local markets, so unless they were members of a farmer association they did not have access to tractors because they could not afford to rent/buy one. Walsh-Dilley writes that in San Juan, Bolivia, work parties used to expedite labor were given refreshments by the owner, and that 'planting by tractor is actually cheaper than planting by hand since the farmer only needs to provide refreshments for one tractor operator, and only for the

portion of the day that he is working that field' (Walsh-Dilley 2013: 669). While this may be true, the informants observed for this field study managed their land using family labor so the payment of extra-familial labor, in cash or in favors, was unnecessary.

Although tractors can improve the lives of the farmers, they can also cause significant damage to the land. Tractors exacerbate wind erosion by breaking up the topsoil as well as contributing to changes in land use. Inca and pre-Inca people grew quinoa in hillside terraces to conserve water. Many of the stone terraces are either tourist attractions or are still in use today. With the advent of tractors, though, quinoa has pushed other crops like corn and wheat off the flat valleys, which are more accessible to the tractor. Land that was not previously utilized is made usable thanks to the tractor, which also has mixed results. Marginal lands, "where soils are more sandy and salty and less protected from the harsh winds that parch and erode the soils and lower the temperature… are much more susceptible to the loss of moisture and erosion that is exacerbated by the use of tractors during planting" (Walsh-Dilley 2013: 670).

Tractors are machines that are not ideally suited for quinoa production, which has meant that quinoa production has had to change in order to accommodate the tractor until better sorts of equipment are devised. Another risk of the use of machines is the selection of varieties that are more "machine-friendly," resulting in the erosion of genetic diversity. This means that varieties are selected based on uniformity, desirability, and their ease of mechanized intervention.

4.1.2 Planting

The quinoa variety that is planted is based on a number of factors, including farmers choosing to grow types that fetch a good price at market, seed availability, and the presence of efforts to promote the cultivation of particular varieties. Alipio Murillo, formerly of the FAO, has spent the past decade championing "orphaned" varieties that are not as popular due to their smaller size or inconsistent seeds. The

informants of this study obtained their seeds by saving them from their previous crop, thus maintaining traditional varieties. When the quinoa is cut and left to dry in the field, it drops seeds that will sprout where they are. When it is time to plant the quinoa, the sprouts are uprooted and put into rows. The seeds are also planted when the field is plowed. Using traditional hand tools, the men will break the earth and expose a furrow into which the women then drop seeds and then cover with the broken softer soil.

Crop rotation is required for healthy soil, crop and dietary diversity, environmental risk management, and food security. Cultivating numerous varieties of quinoa contributes to the farmers' security as each variety has particular resistance to environmental risks such as frost, salinity, and drought (Hellin & Higman 2001: 6). Hellin and Higman describe a crop rotation that was confirmed by the farmers in this field study, which alternates potato, followed by quinoa and then followed by a cereal (ibid.). In the case of the northern *altiplano* where this study took place, the cereal in the rotation was barley (*cebada).* This rotation system often includes a fallow period lasting from four to eight years, but interviews indicated that this is only possible if the farmer has enough land available to grow what they need and still leave a fallow patch, which is often used for livestock grazing. This resulted in reduced fallow times or their elimination altogether, which can be problematic. For example, one informant claimed that she could only utilize half of her land because the other half was "dead."

4.1.3 Cultivation

As the demand for quinoa has continued to rise, so has the pressure to produce more. This has also contributed to supplementation with commercial strategies to increase yields, like adding pesticides and modern cultivation practices like monoculture, which is practiced more in Bolivia than Peru. While touring with us, key informant Beatriz from Pisaq demonstrated the way that she removes weeds from her quinoa fields by unraveling troublesome tendrils which wrap around and

strangle the quinoa stalks. It is a delicate and time consuming process and must be done for each individual afflicted stalk.

Plants are irrigated using drainage canals, in some areas the same canals have been used since the Incas. Smaller plots of quinoa are grown on terraces, which allow for the most benefit from the limited rainwater but are inaccessible to tractors. Thirty-two percent of the farmers interviewed in this study said that they utilize traditional crop rotation techniques because these methods help to sustain the soil.

4.1.4 Crop Loss

Much of the quinoa grown by smallholders is produced using traditional methods, which have the potential to result in losses. For example, the farmers interviewed did not utilize pesticide or herbicide, so their crops, while being less toxic to human health and the environment, were at risk of loss from tendril-like weeds that strangle the quinoa stalks if not carefully disentangled by the farmer. Another risk, particularly for sweet varieties, is from birds which have the potential to consume and shake off up to 25 percent of the crop (Hellin & Higman 2001: 5).

Once the quinoa is harvested it is laid in stacks to dry in the field for up to a week before it is collected. During this time it is at risk of predation by birds as well as mildew caused by dampness. In one of the study areas, Pisaq, the farmer association was forced to cancel their weekly meeting because rain threatened the quinoa that lay in the fields so the farmers scrambled to cover it with plastic sheets. The commercial value of quinoa is steadily increasing, validating the extraordinary efforts that the farmers take to ensure a bountiful harvest. Although there are a number of notable threats, quinoa is otherwise a resilient crop that can survive extreme weather and inhospitable conditions, making it of special interest to climate scientists. Despite only being actively cultivated on a small fraction of the planet, the plant can survive humidity between 40 percent and 88 percent and temperatures ranging from -4°C to 38°C (FAO 2011). This remarkable hardiness and

ability to produce nutritious food in harsh conditions makes quinoa a crop worth paying attention to into the future.

Agrobiodiversity Loss

A preference for uniform varieties is already a reality in the quinoa market, as the large white *quinoa real* is the most commonly found on supermarket shelves. This preference for commercially standardized varieties is already prevalent in Bolivia, where large-scale commercial enterprises utilize monoculture and industrial processes that favor large uniform seeds. In Peru, this is happening to a lesser degree but has already necessitated efforts, including those by Alipio Canahua Murillo, to promote lesser-used varieties. The underutilized varieties offer tolerance to different conditions and have different nutrient content. This adaptability is an asset that will be beneficial as the climate continues to change.

4.1.5 Processing

Farmers know that the quinoa is ready to be harvested when the clusters of seeds at the top of the stalk start to droop and the seeds can be dented with a fingernail. Traditionally, the quinoa is cut by hand using a small curved scythe, as pictured on the front cover of this report. The top 45cm or so is cut and then arranged in small piles to dry in the fields for about 5 days, depending on the weather. It is then collected to separate the seeds from the rest of the plant and de-hulled. What is left of the quinoa stalks is left in the fields to dry, to be collected and used as fuel or eaten by the cattle that will graze the field, fertilizing it with their manure.

The dried quinoa seeds once taken from the field must be separated for use. This process, when done by hand, is time consuming and labor intensive, and dependent upon the weather. As shown in the photo to the right, the quinoa is scooped up in a plate and then slowly poured out, allowing the wind to separate the quinoa seeds from the chaff. It is then sifted until all that is left is clean, white seeds. This woman, who was interviewed while conducting this process, stated that although it takes a long time, it is more effective to do by hand than by machine because it is done with so much care, ensuring near-perfect cleanliness.

Photo by MJ Lovejoy, 2014

After this is completed, the quinoa is stored for personal use or put in woven plastic sacks to be sold to intermediaries at the local market. This is not the end of the processing, however. Quinoa has a protective coating that makes it bitter to predators, which must be removed to be palatable and also allow the nutrients to be absorbed.

Quinoa seeds are used whole (like rice) or powdered into a flour to make bread, baked goods, and *pesque*, a thick porridge of quinoa flour, which was served for breakfast during one of the interviews. A two-day stay with the president of Caritamaya near Puno allowed for an intimate look of the quinoa preparation process from harvest to table. The families interviewed in this village were members of an organic farming community that operated under the auspices of the president. At his home, his elderly father made breakfast of porridge made from

quinoa flour, water, and a touch of salt. Lunch was a heaping bowl of boiled quinoa seasoned with salt. Dinner: roasted potatoes, oca (a sweet tuber), and about 3 ounces of seasoned chicken per person. The quinoa was repeatedly rinsed with water pulled up from the hole in the ground well in a metal bucket on a rope. Each time it is rinsed, more of the bitter saponin coating is rinsed away, leaving the water frothy. When the water runs clear it is ready to cook. The quinoa was cooked in a large pot over a fire of dried quinoa stalks and dried cow dung, which is collected and stacked along the top of the adobe walls that surround each home's inner courtyard.

4.2 From Obscurity to Delicacy: Quinoa Suppression to Promotion Programs

In what Hellin and Higman (2001) call "a culinary colonialism," the Spanish conquest of the Incas included the deliberate suppression of quinoa and other crops in an effort to spurn Inca traditions and replace them with European ones. This was accomplished in part by the marginalization of quinoa by urban European and *mestizo* (mixed European and native) populations (Walsh-Dilley 2013: 665). Since then, wheat, barley, and broad beans have been part of the Andean agricultural spectrum (Hellin & Higman 2001: 6; Hellin and Higman 2002). "Further, Spaniards demanded taxes in the form of wheat (for human consumption) and barley (for horses and mules), crops that overlap with the agrarian cycle of quinoa and thus displaced it" (Cuéllar 2013: 151 from Gade 1975; Zimmerer 1996). Another factor that has displaced quinoa from its position as a staple is the intrusion of easier foods.

Quinoa has earned the title of "orphan crop" or "neglected and underutilized species (NUS)" which means that it has not had significant investment for research and development (Rojas et al. 2009: 87). As its popularity increases, however, so is investment in developing strains of quinoa that can adapt to a wider variety of climates. Quinoa's position as a staple has been challenged by commodity cereal crops, which are cheaper, trendier, and less energy intensive to prepare. Quinoa is a fairly labor intensive crop to grow and to prepare, whereas wheat and barley

products require less effort to produce and to eat. The greater labor output required by quinoa has made less nutritious European grains more desirable (Gade 1992). Despite the many forces that are pushing and pulling quinoa off of Andean plates, there are national and international programs attempting to keep the mother grain at home.

Recent promotion of quinoa consumption, exemplified by the FAO naming 2013 the International Year of Quinoa, is not the first attempt to encourage the use of quinoa to improve inadequate diets. The Peruvian government began its involvement in improving its citizens' nutrition in the 1970s and took a more prominent role in food assistance in the 1980s (Acosta & Haddad 2013: 28). These early plans were favored by the government at that time due to their visibility and political capital, particularly during election years (ibid.: 29). Despite reported inefficiencies in the targeting and use of these programs, powerful political lobbying kept these programs in play. It was not until 2000, when reportedly corrupt President Alberto Fujimori was removed from office and replaced by interim president Valentín Paniagua, that a shift was initiated from food assistance programs to poverty reduction efforts, starting with the creation of the Roundtable for Poverty Reduction (*Mesa de Concertación para la Lucha Contra le Pobreza-MCLCP*) in January 2001 (ibid.).

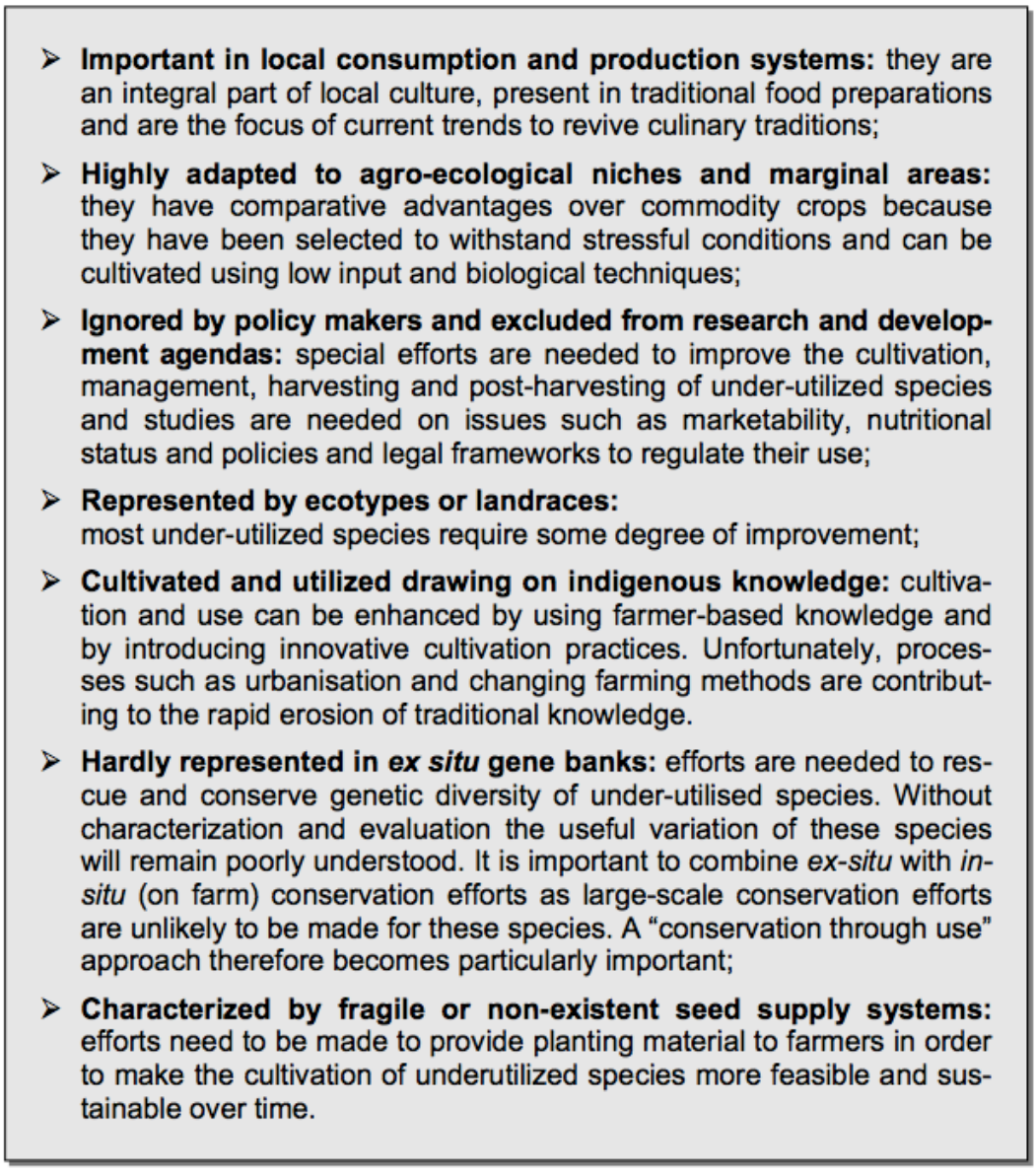
Later that year, elected President Alejandro Toledo took up the cause by prioritizing poverty reduction and social justice through government collaboration with "civil society, the private sector, and international donor agencies around the MCLCP" (ibid.). The resulting shifts in "program design, decision-making and financial planning of social policy" ultimately contributed to the creation of the national Strategy for Poverty Reduction (CRECER) in 2007, enabling the coordination of concerned offices from government (national, regional, and local) to international NGO and private sector toward the goals of poverty reduction and human development (ibid.). Shifts in program design included a transition from food assistance to interventions involving health, hygiene, water, and economic

support, effectively treating malnutrition as a comprehensive problem rather than simply a food access issue.

The coordination between relevant facets and concerned stakeholders resulted in a more complimentary set of policies. This unification around a common narrative was expressed by the creation of the Child Malnutrition Initiative (CMI) in 2005. The Initiative was an "advocacy coalition integrated by government and non-government agencies that organized to promote and influence effective government action" (Acosta & Haddad 2013: 29). According to Acosta and Haddad, the period between 1996 and 2005 saw strong economic growth and poverty reduction but a decline of only 6 percent in stunting rates, as compared to 2005-2011 which had a 39 percent decline, which they attributed to the conversion of increased national income into improved nutrition programs due to pressure that "provided an enabling environment for stunting reduction" (ibid.: 28). Although income grew more during the second period than the first, there was more improvement in civil and political rights during the first period. The authors 'argue that the design and implementation of effective nutrition policies after 2005 helps to explain the significant reduction in malnutrition rates in Peru' (ibid.).

Another program to encourage the use of quinoa was the UN-supported IFAD-NUS (International Fund for Agricultural Development - Neglected and Underutilized Species) project launched in 2001. The project is a global initiative to promote neglected and underutilized species, including quinoa. It consists of four phases: phases one and two are the Holistic Value Chain Approach (2001-2010) and phases three and four are Climate Change Adaptation (2011-present) (Bioversity International 2014). Species that are considered NUS lack competitiveness in the market, which is the most common constraint in their promotion (Rojas 2009: 104).

Figure 2: Description of Neglected and Underutilized Species (NUS)



- **Important in local consumption and production systems:** they are an integral part of local culture, present in traditional food preparations and are the focus of current trends to revive culinary traditions;
- **Highly adapted to agro-ecological niches and marginal areas:** they have comparative advantages over commodity crops because they have been selected to withstand stressful conditions and can be cultivated using low input and biological techniques;
- **Ignored by policy makers and excluded from research and development agendas:** special efforts are needed to improve the cultivation, management, harvesting and post-harvesting of under-utilized species and studies are needed on issues such as marketability, nutritional status and policies and legal frameworks to regulate their use;
- **Represented by ecotypes or landraces:** most under-utilized species require some degree of improvement;
- **Cultivated and utilized drawing on indigenous knowledge:** cultivation and use can be enhanced by using farmer-based knowledge and by introducing innovative cultivation practices. Unfortunately, processes such as urbanisation and changing farming methods are contributing to the rapid erosion of traditional knowledge.
- **Hardly represented in *ex situ* gene banks:** efforts are needed to rescue and conserve genetic diversity of under-utilised species. Without characterization and evaluation the useful variation of these species will remain poorly understood. It is important to combine *ex-situ* with *in-situ* (on farm) conservation efforts as large-scale conservation efforts are unlikely to be made for these species. A "conservation through use" approach therefore becomes particularly important;
- **Characterized by fragile or non-existent seed supply systems:** efforts need to be made to provide planting material to farmers in order to make the cultivation of underutilized species more feasible and sustainable over time.

(Rojas et al. 2009: 89 from Padulosi and Hoeschle-Zeledon 2004)

Interestingly, the resolution to name 2013 the International Year of Quinoa came from Bolivia, quinoa's number one exporter. The initiative could be seen either as a promising proposal by a Southern country that benefits the South or as a marketing scheme that is aiding in the transformation of a traditional crop into a commercial commodity.

4.3 Expansion of Quinoa Production

Interviews throughout southern Peru found that 40 percent of informants are already growing more quinoa than before and that most intensified their production just in the past few years. This intensification is the result of both the global demand and the local propaganda encouraging Peruvians to consume more quinoa. Although Peru and Bolivia are basically neck and neck in quinoa production, Bolivia exports roughly double the amount of the quinoa that Peru does. Bolivia exports about half of the quinoa it produces while in 2012 Peru exported 23.2 percent of what was produced. In contrast to Bolivia, most Peruvian quinoa is "consumed in the domestic market" (Krivonos 2013: 60).

Quinoa production in Peru has expanded at a rate greater than 7 percent per year since the mid-1990s (Krivonos 2013: 60). This steady rate of increase in production skyrocketed in 2008 and has continued to increase. In 2013, Peru produced 74.5 percent more quinoa than it did in 2008 (FAOSTAT 2015). From 2002-2013, Peru's quinoa exportation grew 47.8 percent (Urdanivia 2014: 35 from INEI 2014). This leaves an almost 24 percent increase in the amount of quinoa remaining for domestic consumption. This dramatic expansion into the global market has revolutionized Peru's, and the world's, relationship to this food that has been a constant presence in the region for millennia. At the local level, implications of the growing demand for quinoa spreads beyond the dinner table. Food is embedded in systems of meaning and value in society, and quinoa is especially significant to the South American *altiplano*.

Intensification of production can be achieved either by expanding into new land or, for smallholders who cannot increase the size of their holding, converting land previously used for other crops (Urdanivia 2014: 39). Of the 50 informants interviewed for this study, 14 said that they are expanding their quinoa production by converting land previously used for other crops, such as corn or potatoes, or for grazing. More than a quarter of the farmers interviewed said that they have already expanded their quinoa production in order to produce more for the market.

Informants sell their product at local markets on the small to intermediate scales, on average a few *arrobas,* a 14.7-kilogram unit of measurement, to intermediaries who turn a profit by selling to other intermediaries and export companies. Many of the farmers sold at the local market only the surplus that was left over from home consumption while others produced more specifically for the market.

The recent expansion of quinoa production has been market-dictated, meaning that the most dramatic increases in quinoa production can be attributed to an attempt to meet market demands. Where do these demands stem from and why has quinoa become the global "flavor of the month"?

4.3.1 Why is the Global Hunger for Quinoa Increasing?

Quinoa has had a roller coaster ride of reputations, from peasant food to expensive super-food promoted everywhere from health food stores to the United Nations. The consumption of quinoa became a matter of international interest in the 1980s, when quinoa entered the export market, and since then its popularity, and price, has escalated dramatically. Although quinoa has been cultivated in South America for millennia, it has only recently entered the global sphere. In the 1980s, quinoa research and cultivation began in Colorado, igniting its popularity in the United States and beyond. At that time, production in the US amounted to 37 percent of the global supply but has since tapered to around 2 percent today (Flores 2013).

Quinoa became a vegetarian staple because it provides nutrients usually attributed to meat, namely protein and amino acids. Despite its popularity among meat abstainers and gluten intolerants, quinoa is a complicated food because of the potential for quinoa farmers to have to pay the price for the global hunger for quinoa. The quandary of whether or not to purchase quinoa as a conscious consumer is also a tricky one. On one hand, if consumers stop buying quinoa then the farmers will lose the benefit of increased sales. On the other hand, if consumers buy less quinoa then there is less pressure on farmers to produce for the market, so

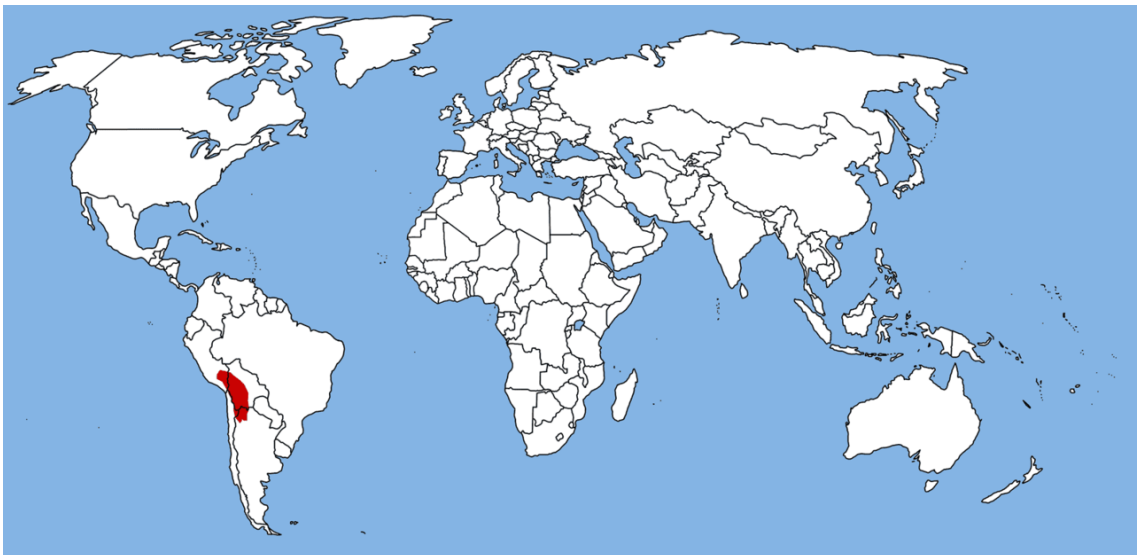
farmers will not feel obligated to sell all the quinoa they produce. Quinoa production may put pressure on Andean farmers, but environmental constraints mean that there are few opportunities beyond quinoa for farmers because not much else grows (Walsh-Dilley 2013: 676).

Blame for the hardships suffered by quinoa farmers is often laid thick in the wrong places. One incendiary headline from the Guardian blames vegans for the plight of quinoa farmers because of the vegan community's insatiable appetite for a nutritious plant-based protein source (Blythman 2013). Although this finger pointing is clearly misplaced, and should rather be directed instead to the lack of development in agriculture as well as income inequality, it sends an interesting message to readers. It suggests that external sources are putting pressure on farmers and the pressure is from a minority community with seemingly outrageous demands. More threatening than those demands, however, are the food miles incurred by shipping specialty foods across the globe so health-conscious people can supplement their diets. Interestingly, in the United Kingdom, the greatest consumers of quinoa are not human, but fowl. Its main application there is as a game-cover crop to feed game birds like pheasants and partridges (Jacobsen 2003: 169).

The global community is ravenous for the next big thing. Underutilized translates to exotic and rare, increasing its value among the elite. Retail prices soar when these exotic foods supplement sports drinks and packaged dinners. Quinoa burgers in the frozen food aisle and gluten free quinoa cookies in the bakery give a store the edge. As underutilized crops flood the market, everyday grocery chains supply the average person with goods that were once relegated to specialty stores. This popularity has resulted in near-normalcy, for better or for worse.

4.3.2 Increasing Demands on People and the Planet

Quinoa is currently grown in a very small part of the globe. Although there are successful quinoa operations outside of the *altiplano*, primarily in the United States and Canada, quinoa is still almost exclusively a South American contribution. Over 90 percent of the world's quinoa is grown in Bolivia and Peru (Krivonos 2013: 59). For some perspective, see the map below. The vast majority of the world's quinoa comes from within that red kidney-shaped strip of land.



Map 2: The Altiplano (Wikipedia 2015).

According to the FAO, quinoa has the potential to grow in other countries as well. The red dots on the map below signify countries with the greatest quinoa production (Peru, Bolivia, and Ecuador) and the yellow dots are the countries with the potential for quinoa production (Canada, United States, Mexico Colombia, Brazil, Chile, Argentina, Sweden, United Kingdom, France, Germany, Denmark, Greece, Somalia, India, and Australia).

Map 3: Quinoa Production and Potential, FAO 2013a

Expansion of production into other countries would potentially take pressure off of the *altiplano,* but competition could also harm their bottom line. Because it is grown in a small area, quinoa is a niche crop and its scarcity makes it lucrative (Walsh-Dilley 2013: 676). Growing quinoa in a small area keeps the price high, but at what cost? This pressure to produce more – increasing as demand increases – takes its toll on the environment and the people. Soil degradation is one of the greatest dangers in a place with limited soil fertility and it can be degraded in a number of ways. First, the expansion of quinoa into greater territories means the removal of bushes that once acted as wind blocks, their roots holding the soil in place. This causes wind erosion as well as a shift in land use (Lal 2009). These bushes were used to feed the llamas that provide Peruvians with wool, meat, and fertilizer. Now that the symbiotic relationship between llamas and the land has been broken, the llamas are relegated to pastures visible to tourists and the fields are tended by hand, using cattle, or with tractors. All this work is strenuous and made all the more difficult by the recent reduction in the labor force.

4.3.3 More Work for Fewer People: Reduced Labor Force

The reduction in labor force was discussed at length with an informant who runs a small farm with the help of his wife and a few hired hands. His children, like most local children, participated in the farm work when school was not in session until they moved away to begin their adult lives elsewhere. He said that they are well-educated thanks to ex-president Fujimuri, who many informants praised for working to help the common people by providing schools, school supplies, and electricity for their homes. This informant's children were able to get good jobs, so now they live in Lima and abroad. This trend of out-migration by young adults seeking their fortunes elsewhere has likely contributed to the fact that the average age of an agricultural producer in Peru is now 49.4 (Nolte 2013).

The out-migration of young adults was attributed by many of the informants to pressure from propaganda that encouraged people to move to the city. People moved to urban areas in search of work, which resulted in reduced agricultural production and more land lying unused for lack of workers. With the increased attention and money paid to traditional indigenous crops in recent years, however, people can potentially make a better living from farming than from the urban sector. Now, reverse-migration is bringing people back to the fields.

Although reductions in the labor force are alleviated somewhat by reverse-migration, farmers have had to utilize new and old strategies to cope with increasing demand, like using modern technology that requires fewer workers and working cooperatively with neighbors. Walsh-Dilley (2013) claims that reciprocity practices are "an available and culturally relevant resource for people in the rural Andes, particularly within the contemporary political climate" (Walsh-Dilley 2013: 676). This practice is applauded by organizations like ANAPQUI, the Bolivian Association of Quinoa Producers, which encourages its members to move away from mechanized cultivation back to manual production. In doing so, farmers will turn back to the traditional forms of production, potentially resulting in a "regional resurgence of cooperative livelihood mechanisms like reciprocal labour sharing"

(ibid.: 678 from Hellin and Higman 2001). There is money to be earned in quinoa production, but as is often the trend in the agricultural field, those with the ability to produce do not always benefit from the means of production.

4.3.4 Crop diversity

Quinoa, as a crop that is gaining popularity in the global market, is at risk of losing agrobiodiversity in favor of a more uniform product. Conservation farmers maintain traditional varieties using traditional methods, as opposed to commercial farmers who produce 'a homogenous final product of only a few commercial varieties' (Urdanivia 2014: 35). Such alterations could also be the result of globalization, which advertises the desirability of and then provides popular 'Western' products like Coca Cola. While it is tempting to blame globalization for this trend, it is not the only culprit. Declines in quinoa agrobiodiversity can also be attributed to the promotion of improved varieties, changing climate, and alterations in dietary habits (Urdanivia 2014: 36 from Canahua et al. 2002).

Although outside pressure is warping quinoa production, there are forces that are pushing back. Alipio Canahua Murillo is one of those forces. The FAO and the quinoa community at large have recognized his vociferous promotion of underutilized traditional varieties of quinoa. During an interview with him in his home, he explained the differences between the major types. The larger grained *quinoa real* is widely cultivated due to its shorter maturation periods, which has the potential to displace smaller grained varieties that germinate and grow more slowly. However, the smaller grained varieties tend to be sweeter and contain positive qualities such as greater frost resistance and nutrients (Interview with Sr. Murillo 2014; Hellin & Higman 2001: 5). These positive qualities have the potential to be neglected and underutilized in place of more market-friendly varieties.

A major obstacle to promoting agrobiodiversity is the disconnection between conservationists and user communities, which can be addressed through informative trips by farmers to gene banks (Rojas 2009: 100). Such gene banks

collect crop seeds and germplasm in an effort to study, save, and promote plant genetic diversity. Projects like IFAD-NUS drive research on "the identification and selection of promising varieties of quinoa to address abiotic stresses such as frost and drought but also to search for specific economically important market traits" (Ibid.: 101). The IFAD-NUS project was also concerned with the recuperation of indigenous knowledge regarding traditional cultivation and use.

Seed fairs share information about commercialization, agronomic characteristics, and more between farmers and "value chain actors" that can aid in the promotion of improved agrobiodiversity. These seed fairs are also valuable for promoting NUS and traditions that are potentially threatened by globalization and social trends. Although seed fairs stemmed from the intervention of projects like IFAD-NUS, efforts have been made to make them self-sustainable through institutionalization into national and local agencies (Rojas 2009: 103). During the fieldwork conducted for this project, such a fair was put on by the Ministry of Tourism in Cuzco, where tourist restaurants advertised traditional quinoa dishes in an effort to raise awareness among visitors.

4.3.5 The Changing Landscape of Quinoa Production

To address how quinoa production has changed physically, there are many factors to consider that are not physical. The field of geography is concerned with the human relationships with the environment and 'while we are concerned with energetic exchange between human populations and their supporting environment, we emphasize how that relationship is mediated and continually transformed by changing political and economic organization' (Wernke and Whitmore 2009: 422 from Gelles 2000).

Some of the changes in the landscape of quinoa production are caused by the pressure for farmers to produce more quinoa so they make a series of adjustments, including moving from terrace production to lower valleys in order to accommodate the use of tractors. The change from traditional to a hybrid system that includes

tractors is another shift that can be attributed to a response to increased demand. These changes represent alterations in the land use, the way quinoa is grown, who grows it, and who eats it, even though these changes in the study area are only in their infancy, they have the potential to become even more significant.

The field research for this study corresponds with the findings from Claudia Urdanivia's 2012 field study in Puno that 'farmers do not appear to have altered their land-use practices dramatically' (Urdanivia 2014: 39). This was due to the fact that the informants interviewed for this study claim to have only recently changed their land use to accommodate increased quinoa production, so dramatic changes were not observed. Large landholders typically occupied the flatter, more desirable terrain while marginal farmers occupied smaller, disassociated plots on hillside terraces. Modern conveniences like tractors are available to those farmers who can afford to rent them, for preparing land and/or for planting.

The way that quinoa is grown has the potential to not only shape the landscape but also the ecosystems it touches. The use of chemical intervention for pest and weed control has traditionally been limited in quinoa's production. Commercialization is often accompanied by the introduction of such controls, but food system trends are leaning toward organic production, particularly in niche foods that are marketed toward the health-conscious. "Over the past decade, groups of farmers in Puno have shifted towards, or are transitioning to, organically certified quinoa production with the support of NGOs such as CIRNMA and the quinoa cooperative in Puno" (Urdanivia 2014: 40). The farmers interviewed for this study asserted that their production is natural and ecological, but they understand that they can earn higher prices for organically certified products. Organic certification is a costly and lengthy process, however, so the organic label and its accompanying price bump is out of reach for small independent farmers. Farmers operating in cooperatives and associations, however, have greater access to resources that would enable organic certification to occur, like in the organic quinoa community of Caritamaya, visited during this field study.

Perhaps the most troubling and imminent of alterations to the landscape of Peruvian quinoa production is climate change. Changing climate patterns in the Andes have already resulted in production losses and threaten to parch an already dry environment. For example, the IFAD NUS project recorded a 23 percent average increase in production losses during participatory workshops with farmers (Rojas et al 2009: 112).

4.3.6 Farmers Are Not Reaping the Full Benefit of Exploding Demand

For those informants who said that they are increasing quinoa production, the reasons are mixed. The primary arguments for increasing production provided by the informants are because it is perceived to be more lucrative or because the farmers had learned from the First Lady that quinoa is nutritious.

During this field study, informants who sell their quinoa were asked whether it was destined for domestic or international plates. Most of the informants replied that they were unsure. Quinoa farmers who sell their crop (or a fraction of their crop) sell to intermediaries who then sell to other intermediaries. The intermediaries have access to markets that the farmers themselves do not. While the farmers interviewed for this study were unsure of where their quinoa goes after they sell it to an intermediary, the Foreign Agricultural Service of the USDA reports that 90 percent of Peru's quinoa is produced for the export market (USDA 2014 from FAOSTAT). This high percentage conflicts, however, with this study where the percent of farmers selling quinoa to any market, local or export, was 69 percent.

The farmers interviewed during this field study were unaware of the final destination of their quinoa and some of the intermediaries claimed that the crop they were buying was destined for international plates. One intermediary at the market in Juli claimed that all the quinoa he was buying that day was slated for a Japanese buyer. Urdanivia (2014) corroborates that the farmers do not know if or where their quinoa will travel: "at times, farmers only sell to the local market where the product will most likely circulate locally or regionally but may ultimately travel

further. In this instance, farmers will never know their harvest's destination in the global market" (Urdanivia 2014: 41).

4.3.7 Peruvians in it Together: Collective Labor to Deal with Demand

Earlier in this paper there was a discussion of cooperative land that is managed by families. Collective labor is also utilized, as evidenced by the system of reciprocity where members of a community help one another (Walsh-Dilley 2013). Work parties are utilized to complete work in small windows of time. For example, before the rain started, farmers belonging to the farming association in Pisaq cut short one of their weekly meetings, which take place during labor-intensive times of year (planting and harvesting), in order to cover the harvested quinoa with plastic sheets to keep it from rotting in the field. Another example from Pisaq involved the plowing of fields with a tractor that was collectively rented and then used to plow everyone's fields. Timing is everything during these critical periods when quinoa is planted to make the best use of the moisture that remains in the soil as well as when it is harvested to ensure perfect ripeness and prevent over-drying which results in loss.

The first part of the harvest, the *arrancada*, involves cutting the quinoa from the stalk and bundling it to dry. The second part is the *trilla* when the quinoa is threshed. Timing is important when planting and harvesting, so having the assistance of one's neighbors can be critical to a successful season for a farmer (Walsh-Dilley 2013: 668). In San Salvador, a crew of young men worked together in the field to cut the quinoa from the stalks using hand-scythes, a process that can take from days to weeks, depending how many people work in the crew.

4.3.8 Traditional Hand-Labor Vs. Modern Mechanized Labor

The first interview conducted for this study was in San Salvador with a young man and his in-laws. Beginning fieldwork for this study early in May enabled the interview to take place during a tour of the fields to see the harvesting in action. The quinoa, standing boldly on browning stalks, their multicolored heads bowed heavy

with seeds, rattled as the team of young men skillfully hacked off the top half meter from the plant and made small piles so the quinoa could dry in the sun for four or five days. Then, it would be collected, threshed and de-hulled. While this process is conducted entirely by hand, other parts of quinoa production are starting to be mechanized. The utilization of tractors signals a shift not only from "traditional" toward "modern," but also in the transition from subsistence crop production to production for the market where tractors aid in the production of greater volumes of quinoa destined for others' plates. It has been suggested that this shift impacts farmer self-sufficiency and food security. Additionally, mechanized production tends to push women out of the fields (Carney & Watts 1991; Escobar 1995: 175), further contributing to their invisibility in food production.

The transition toward mechanized production is significant for many reasons. Altering the way that quinoa has been produced for thousands of years undoubtedly has an impact on local cultures. Arturo Escobar (1995) suggests that maintaining cultural traditions is counter-hegemonic and getting pride and esteem from cultural traditions is a way of resisting modernizing institutions (Escobar 1995: 220). Despite reasons to resist, threshing machines have been tested in Bolivia that were found to have "a performance of 95 kg/h of threshed grain, compared to 100 kg/day as achieved by a farmer manually" (Rojas 2009: 104-5 from Pacosillo 2003 and Quispe 2004). The two prototypes "designed, built and validated by community members" also addressed the farmers' primary concern of "contamination by stones and grit, reduced loss of grain, suitability for small and medium operations and easily transported field equipment at accessible prices" (ibid.).

It was observed in this study that almost half (20 of 50) of the informants said that they use mechanized as well as traditional farming methods. Farmers who utilize both traditional hand tools and mechanized tractors in their production challenge the opposition between tradition and modernity. Bridging the gap between new and old is an element of hybrid societies, which will be explained later

(Escobar 1995: 51). It is important to note that although some farmers are transitioning to include mechanized plowing in their production, the variability of quinoa maturation makes full mechanization impossible.

Traditional methods of agriculture are characterized by the use of manual and animal labor rather than modern machines like tractors or threshers. Plowing with yoke and cattle-pulled plow, harvesting with hand scythes, threshing by hand and winnowing using the wind are part of these agricultural traditions. The use of mechanized production has the potential to force a decline in traditional knowledge but also reduces labor requirements, potentially freeing people to devote their time to other tasks. Farmers were interviewed about their farming methods and why they operate in that fashion. The following tables include the advantages and disadvantages of traditional cultivation and tractors as described by informants in this study.

Table 2: Pros and Cons of "traditional" cultivation

Pro	**Con**
Rotation encourages soil fertility	Limit to production
Cultural heritage	Human energy and time intensive
Dietary diversity for farmers	Less precise, more waste
Animal fertilizer (cheaper, symbiotic)	
Less costly	
Dignity, livelihood, self-employed	

(Source: In-person interview with farmers in Southern Peru)

Table 3: Pros and Cons of tractors as told by Peruvian quinoa farmers

Pro	**Con**
Less time required to plow a field	Costly (to rent and fuel)
Fewer people required to work	Fewer opportunities to obtain debts (reciprocal labor)

More efficient	Availability constraint
Less waste	Unable to use on uneven terrain
	Loss of cultural practice

(Source: In-person interview with farmers in Southern Peru)

The incorporation of modern tools into traditional spaces is partly the result of market demand. Also in play are the modernizing influences of globalization, which can perhaps also influence out-migration from the fields. The formation of hybrid cultures in Peru can be attributed in part to quinoa. Quinoa production had no other reason to expand other than to meet global demand and to do so more farmers are turning to tractors to enable them to complete their production tasks with less time and effort. While some may suggest that tractors have the potential to raze traditional cultural practices, others 'believe that peasants have learned to use the instruments of modernity without losing much of their vision of the world' (Escobar 1995: 169). Modernization is of course not available to everyone. Farmers who can afford to use a tractor can also afford to take the risks involved with mechanized farming (Walsh-Dilley 2013: 671).

A disadvantage of mechanized farming is that tractors are making production less effective by degrading the soil. Lower quality lands are being converted to quinoa because the best land is already in use. Tractors often degrade the land, making soil even less fertile and more prone to erosion, susceptible to climate change and drought (Walsh-Dilley 2013: 671). There is also a heightened risk of crop failure with industrial methods, as well as lower yields (ibid.: 670-671).

4.3.9 Quinoa as a Cash Crop

Deliberate quinoa cultivation began for the same reason that every other crop did, to provide a reliable food source for people living permanently in one location. Quinoa cultivation did not change much for the six millennia that it has sustained Andean farmers. It is only in the past half century, when quinoa was "discovered" by US scientists that everything about quinoa changed. Changes in the

way that quinoa is valued, monetarily and socially, have resulted in a ripple effect, influencing many aspects of a plant that has been cultivated for thousands of years and continues to be cultivated by small peasant farmers, who for now bear the brunt of the impact. The demand for quinoa from beyond the *altiplano* has resulted in its transformation into a cash crop, grown for profit as well as or instead of sustenance. The primary changes, mechanization and marketization, have "proceeded hand in hand and tractorisation has promoted the expansion of quinoa as a cash crop" (Walsh-Dilley 2013: 669 from Healy 2001, 163).

The transformation from traditional to trendy is the result of a combination of push and pull forces – from financial gain (economic development) for the exporter and a highly nutritious, sought after commodity for the consumer. However, the benefit is not always mutual. Critics of conventional economic development have found that pushing cash crops as a means for 'economic development through foreign exchange harmed domestic consumption' (Escobar 1995: 43). Whether or not their efforts are resulting in economic development is still unclear to the informants interviewed for this study, who have not yet witnessed significant developments, at least not personally.

Commercialization of agriculture has been widely considered to be essential to economic development (Bouis and Haddad 1990: xi). Commercialization implies intraregional and international trade as well as technological advancement. Although economic development is viewed as a linear progression toward capitalistic gains, the benefits of commercialization are often unevenly distributed. As elucidated by interviews with informants, it is the intermediaries, processors, and retailers, rather than the farmers, who reap the high price of quinoa. Similarly, as part of a case study in Mindanao, Philippines, Bouis and Haddad (1990) describe the impact of the introduction of a sugar mill to the region, resulting in the conversion of more lands to sugarcane production as well as the conversion from family labor to hired labor on land that was increasingly difficult to access (ibid.: xii).

Quinoa is a vehicle for economic growth, particularly in regions that cannot or are not yet benefiting from the tourist trade, which is a major source of income in the vicinity of the field study area. In Peru, the booming tourist trade draws international visitors to the big cities and villages near important historical monuments like Machu Picchu or the floating islands of Lake Titicaca. Those who cannot rely on Inca ruins for their livelihood must make other arrangements. In order to make a profit as a quinoa farmer, quinoa as a commodity must have access to interested buyers. Economic growth depends on commercialization, characterized by "specialization, the development of markets, and trade" (Bouis and Haddad 1990: 1).

The introduction of export cropping to Peru has stimulated the increase of quinoa production through intensification and expansion. The expansion of production of quinoa onto land that was previously dedicated to other crops like corn is a common occurrence. Unlike the situation described by Bouis and Haddad (1990) in Mindanao where farmers replaced their maize with sugarcane, quinoa is not only a traditional crop that has been grown in the same area for centuries but it also offers health benefits, so its increased production is not displacing healthier food but is itself a healthy food.

Competition between commercialization and local consumption is a valid concern as farmers often decide to reduce their own consumption in order to sell more of their crop. Although it is a frequent assumption that 'expansion of cash cropping necessarily means a decline in food crop production' (Bouis and Haddad 1990: 2), it could be argued that quinoa is both a cash crop and a food crop. While some food crops may have to make way for quinoa as a cash crop, initiatives to stimulate local consumption blur the line between quinoa's classification as a cash crop and a food crop even more.

4.4 Quinoa as Representation

The photo to the right is of one of the many roadside political mural advertisements that lined the road between Puno and Ilave, a market town nearby. The sign promotes a mayoral candidate, Carmelo Alcalde, who was running for mayor of the province of El Collao, one of Puno's 13 provinces. Alcalde represents the recently established regional political party Poder Andino, which uses as its sigil the vivid image of a quinoa stalk in a clenched fist above the words *Poder Andino,* Andean Power. The use of quinoa as the symbolic representation of this particular party sends a very powerful message about the significance of quinoa to indigenous culture. It also suggests that quinoa is the source of strength for the Andeans. Any number of symbols could have been used in this advertisement, but the decision to use quinoa as a representation of Andean Power is significant. Quinoa's increasing social value is evidenced by its use for this purpose, the essence of which is the revaluation of indigenous culture.

Photo by Kelly Fitzpatrick, 2014

In addition to quinoa's historical significance as a staple food as well as having medicinal and spiritual uses, there is a sense of pride that comes from the widespread newfound appreciation for something that is not only a commonplace part of many generations of family labor, but also used to be considered of low value. Quinoa used to be considered to be a low-class peasant food by elites, but now, with quinoa sold in health-food stores across the world and prices rising exponentially, the opposite is true (Ballvé 2007).

4.5 Representation of quinoa

Quinoa's significance to the Peruvian people is demonstrated by its pseudonym, the mother grain. Attributing nurturing, motherly qualities to this food illustrates its role as an important caretaker. This title could be homage to the spiritual mother earth, *Pachamama*, which plays an important role in indigenous religious practices and exemplifies the significance of the natural world to Andean people.

As illustrated earlier in this paper, quinoa's popularity has fluctuated to the extremes. It went from being a chicken food to a peasant food to a high-end specialty food. Of course, the seed itself has not changed; it is only the seemingly arbitrary significance that has been placed upon it that has impacted the intensity of its cultivation. This change in representation has a huge impact on farmers who grow it because now quinoa has commercial value. Although the farmers had always grown quinoa, as had their parents before them, many informants claimed that they grow more quinoa now that the prices have increased and also because of propaganda efforts to promote local consumption that represent quinoa as a desirable, nutritious food source. Despite early efforts by the invading Spanish to dissuade farmers from producing indigenous crops, the resilient quinoa stayed rooted firm in Andean society. Its popularity may ebb due to external influence, but Andean family farmers have continued to value its "nutritional importance, medicinal and ritual uses and historic connections to agrarian traditions in the Peruvian Andes" (Urdanivia 2014: 36).

4.5.1 Is Quinoa a Traditional and a Modern Food?

Considering the social value of quinoa is critical to understanding why its level of cultivation has changed, signaling a shift in economic outlook for the peasant farmers who produce it, among other outcomes. As a recently re-discovered delicacy, quinoa is part of a commercial trend that celebrates the exotic, the unconventional, the exclusive, and the healthy. This trend among the health

conscious is for the next miracle food that will provide the body with nutrients that cannot be provided by the boring ingredients of an average diet. Now is quinoa's time to shine because incorporating nutrient-dense super foods to one's diet is extremely popular.

Quinoa is not the only South American superstar as chia, maca, and acai have all had their chance in the spotlight. It could be that now, at a time when quinoa is consumed in larger quantities across a larger geographical distance, is the pinnacle of quinoa's popularity; greater than any other time in its history. Whether quinoa has staying power, or whenever it is at the height of its popularity, are questions that only the future can answer. It could be that quinoa will be like the acai berry, which skyrocketed to the tip of everyone's tongues until about 2009 when it was eclipsed by yet other impressive super foods including quinoa (Spiegel 2014).

More people eat quinoa now than ever before. As it continues to spread, is cultivated over broader areas, and captivates the imaginations of NGOs worldwide, quinoa demonstrates that it is just as applicable to modern needs as it was to feeding Incan armies. The term 'modern' food does not only refer to the present time but also is defined as 'fully commodified and industrially produced food products of remarkable uniformity' (Escobar 1995: 163). Using this definition, quinoa cannot yet be considered a completely modern food because it has yet to be fully industrially produced.

The methods of quinoa production span the divide between traditional and modern, as well as traditional and commercial. Quinoa is not consumed exclusively by one group of people or limited by socio-economic status, despite its increasing price. Quinoa feeds peasant families as well as foreign elites who have the luxury to pay high prices for specialty imports. Traditional foods are produced and consumed by peasants, whereas commercial crops are produced by capitalist farmers for urban/industrial/luxury consumption (Escobar 1995: 127). Therefore, quinoa is a traditional food and a modern/commercial food depending on who is intended to eat it. This divide that separates the rich from the poor, the traditional from the

modern, is illustrative of a socially constructed divide (Escobar 1995: 170). The product does not change no matter who is consuming it, only its value changes. This raises the question of whether or not quinoa's status as a traditional food can be overpowered by the demand from the commercial foreign market. Programs that encourage local consumption of quinoa, that raise its social value through cultural esteem initiatives, are keeping quinoa from being exclusively a cash crop produced for foreign markets.

The vast majority of quinoa production is concentrated in the South American *altiplano* and produced by small-scale farmers. It essentially acts as a bridge between this small area and the rest of the world. An indigenous crop that has been cultivated for millennia, quinoa is now an emerging commodity poised to make the leap into the future. Can quinoa be both a traditional and a modern food? The smallholders who produce most of Peru's quinoa are farmers, not businesspeople or shrewd marketers. Efforts to continue producing this sought-after super-food for the world while still maintaining cultural heritage will take education and dedication to sustainable production. Entrance into the modern commodity market typically means that large amounts are produced, laborers are considered cheap, and quality is sacrificed for quantity. It has yet to be determined if this is Peru's destiny, if it is going to follow in Bolivia's footsteps toward large-scale industrialized commercial production, or if programs like Alipio Canahua Murillo's will promote agrobiodiversity and local consumption.

As a hybrid crop, one that bridges the divide between traditional and modern, quinoa has the advantage of added significance for being in both categories. As a traditional crop, it holds cultural significance and a kind of nostalgia. There is an intrinsic reverence for the known. Additionally, having the staying power to remain in cultivation for so long gives it power as a reliable food source. As a modern crop, its novelty and exoticism have contributed to its elevated status beyond the *altiplano*. In essence, it is more desirable internally because it is

desirable externally. The fact that it could fit easily in both worlds adds to its potential as a historical and future food source.

4.6 Decreased Local Consumption

Although its popularity has yo-yoed over time, modern reductions in the local use of quinoa, as indicated by Figure 5, have been attributed to a number of factors, including higher prices, energy intensive preparation, and the desirability of imported foods. A project by IFAD NUS in the central *altiplano* in Bolivia found that locals, tired of the toil of removing quinoa's bitter saponin coating, lost their appetite for quinoa, resulting in a decline both in its consumption overall and in the genetic diversity of varieties they did use (Rojas 2009: 105). This suggests a preference for the larger seed varieties, which yield greater reward for less effort than the smaller seed varieties.

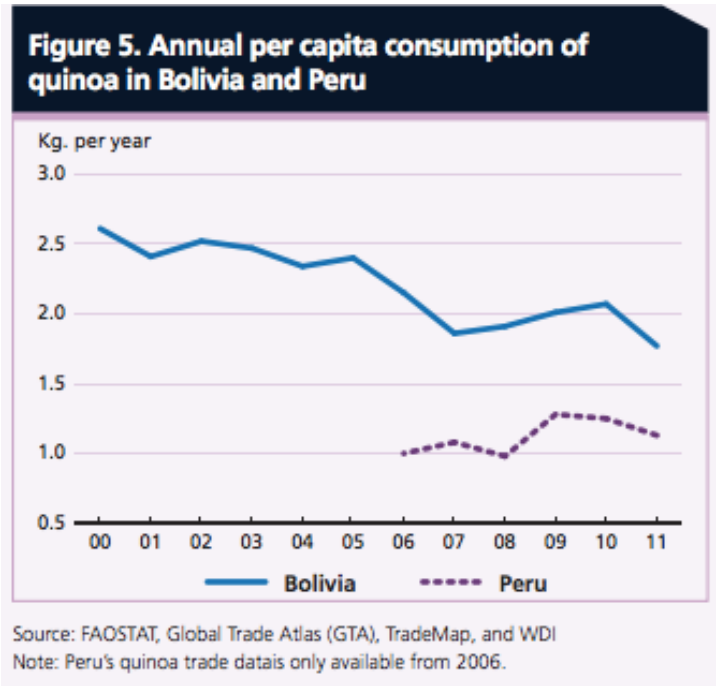


Figure 5: Annual Per Capita Consumption of Quinoa in Bolivia and Peru (Krivonos 2013: 63)

Sven-Erik Jacobsen's prolific work on quinoa has brought some interesting insights, including the suggestion that despite increases in production, local consumption has decreased as a result of export. Figure 6 illustrates the inverse relationship between consumption and export in Bolivia (Jacobsen 2001: 392). The level of participation in the export market, and its influence on the need to meet the export market's demands, is greater in Bolivia than Peru, at least for now. Bolivia is the world's largest supplier of quinoa while Peru is the largest producer. According

to Jacobsen, the shift from sustainable, small-scale production to larger enterprises has resulted in cultural and environmental detriment due to expansion into virgin areas, reduction in natural grazing which in turn reduces the availability of natural fertilizer, and soil degradation due to the use of industrial machinery and inadequate soil management. These impacts can be mitigated through improved planning and education in the proper use of manure. Despite its fertilizing properties, if used improperly, the application of manure can actually cause further degradation, particularly fresh manure, which in its decomposition draws moisture from the already parched soil (ibid.). The reduced yields that occur from environmental limitations results in reduced availability, thus compounding the difficult decision that farmers make regarding whether to keep or sell their quinoa. This decision appears to be more difficult in Bolivia than Peru: in Bolivia quinoa consumption is 2 kg per person per year and 25 kg of rice and pasta, in contrast in Peru quinoa consumption is more than 20 kg per person per year (Jacobsen 2011: 396).

Figure 6: Domestic consumption and export of quinoa in Bolivia (Jacobsen 2011: 392)

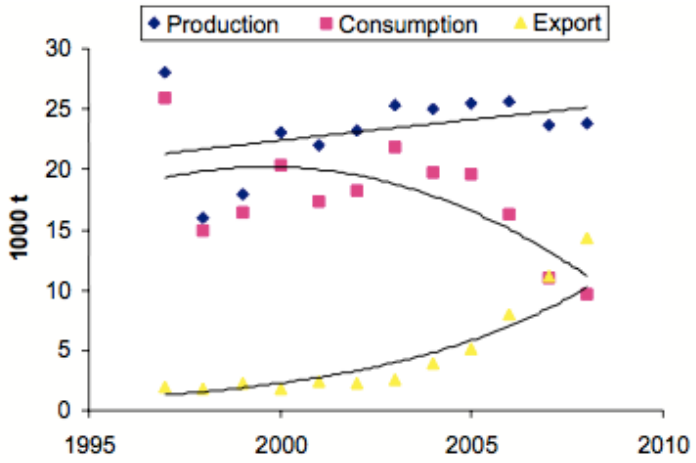


Fig. 2 Domestic consumption and export of quinoa in Bolivia, 1000 t (elaborated from MDRyT 2009). Lines are polynomic (production and consumption) and exponential (export).

4.7 Policy interventions to increase consumption

4.7.1 Local and International Development Efforts

Quinoa's high protein content has piqued the interests of development specialists who speculate that its promotion would improve nutrition levels amongst farmers and urbanites alike. In addition to providing nutrition, the promotion of quinoa encourages farmers to remain productively on the land.

Policies promoted by projects such as the UN-supported IFAD NUS encourage greater consumption of quinoa by families and children by introducing attractive recipes like cookies, cakes, and juices (Rojas et al 2009: 108). During fieldwork it was discovered that quinoa juice is a popular breakfast item, especially when seasoned with cinnamon and combined with fruit like apple or mango. The photo below shows one of the many quinoa juice vendors selling a drink with quinoa and apple. While many of these interventions propose using quinoa production to propel rural development, they risk excluding marginal communities. This risk compounds the struggle of marginal farmers who already have few resources, including smaller landholdings (Urdanivia 2014: 42).

Photograph by Kelly Fitzpatrick, 2014

4.8 Data Analysis

The intention of this field study was to hear from farmers first hand to determine how the global demand for quinoa has shaped their diets, production methods, and way of life. As demand has grown, so has production to meet that

demand. The question of the impact of export on nutrition in southern Peru can be examined by asking what livelihoods and diets would be like if the quinoa export market were to disappear. If the global demand were to dry up, how would these farmers survive? The farmers interviewed for this study indicated that by and large, they entered the commercial market only recently so they do not depend on market earnings. Many of the farmers interviewed (38 percent) claimed that they were growing more quinoa either for personal use or for the market as well as household use. Interestingly, the majority of the farmers who are growing more quinoa live in Caritamaya, the organic quinoa-producing village.

In addition to questions pertaining to dietary diversity and participation in the market, the printed questionnaire for the semi-structured interviews contained questions about family demographics, including ages, pregnancy/lactation status, and gender roles in food production/preparation as well as questions regarding farm size, farming methods, and crop types. Fifty interviews were conducted, via translator and often with the assistance of a key informant, at 12 villages in the Puno and Cuzco regions of Southern Peru. The villages and the number of informants (I) from each are as follows: San Salvador (I=2), Cuyo Grande (I=4), Pisaq (I=3), Camicachi (I=2), Atunkolla (I=5), Ilave (I=5), Juli (I=7), Amantani Island (I=1), Juliaca (I=6), Caritamaya (I=7), Chawitiri (I=4), and Pampayata (I=4).

4.8.1 Farm and Farmer Figures

- Average farm size: The informants interviewed for this field study had an average farm size of 1.7 hectares.
- Typical crops grown were quinoa, corn, lima beans, potato, oca, wheat, barley, kaniwa (closely related to quinoa) and kiwicha (amaranth).
- Use of tractors: 20 of 50 farmers (40 percent) interviewed utilize tractors to cultivate their fields.
- Sell quinoa: 33 of 50 (66 percent) farmers interviewed sell their quinoa.

- The average price the farmers were selling their quinoa to intermediaries was 8.5 soles/kilo ($2.91 USD or 19.71 NOK). The farmers sold their quinoa either by the kilo or by the *arroba* (a unit of weight equal to 14.7 kg).
- Income Diversification: The questionnaire also asked if the informants, or their families, had any sources of income outside of farming. Of the 50 informants interviewed, ten had other sources of income. These range from working as a waiter at a pizza restaurant to managing a stall at a tourist craft market to weaving.
- The majority of families interviewed had fewer than 6 members.
- Number of people in family (number of families with that number of people): 1 (4), 2 (7), 3 (8), 4 (13), 5 (8), 6 (1), 7 (4), 8 (1), 9 (0), 10 (2).
- Of 50 informants asked, nine had nursing children (18 percent).

4.8.2 Farmer associations

Of the fifty informants interviewed, only 16% (8 of 50) families participated in farmer associations. These associations act as social safety nets that help protect those who have had a bad harvest or who didn't plant enough due to lack of ideal environmental conditions (Walsh-Dilley 2013: 675). Though it may seem like an alarmingly small number of informants had the security that farmer associations can provide, their lack of participation could be explained by their small land size, limited participation in the market, and neighborly reciprocity that makes formal associations less of a critical need. Farmer associations enable producers to earn more stable prices for their crops.

4.8.3 Average Household Dietary Diversity Score

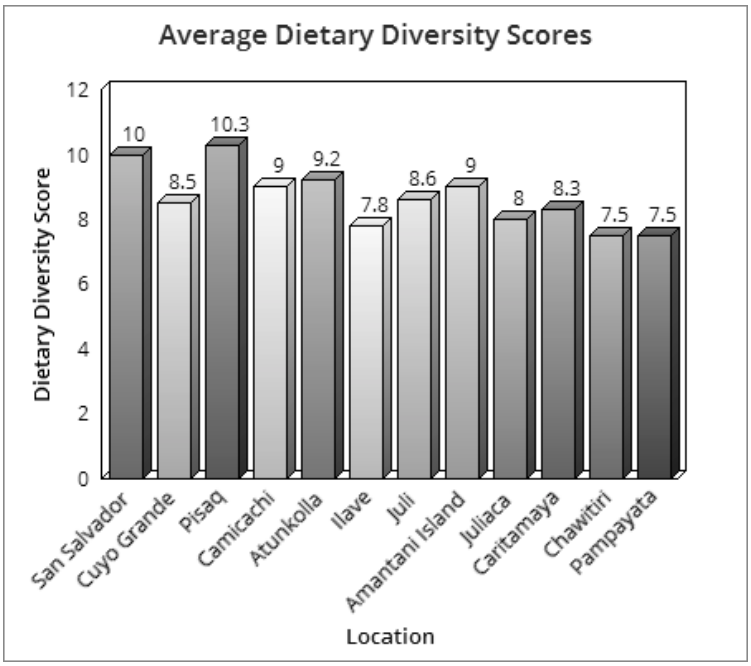


Figure 7

The average Household Dietary Diversity Score (HDDS) found in this study was 8.46 of 12 (Field Study 2015). See Figure 7 for a graphic representation of the average dietary diversity scores ascertained by this study. Beyond the usual combination of crops including quinoa, potatoes, corn, wheat, and barley grown by informants, household diets are supplemented by buying sugar, salt, oil, and seasonal fruit like tangerines that grow on the coast.

4.8.4 Food Frequency

In addition to measuring dietary diversity, this study explored food frequency by asking informants how many times per week they consume items from the following food groups: red meat, chicken, fish, vegetables, fruit, quinoa, grains and cereals. On average, informants ate red meat three times per week, chicken one time, fish one to two times per week, vegetables almost every day (6.5), fruit close to six days per week, quinoa nearly four times per week, grains 3.6 times, and cereals between two and three times per week.

4.8.5 Fair Trade and Organic Certifications

In addition to local farmer associations, secure market access is also made possible by the Fair Trade practices through which producers and buyers form long-term relationships (Stenn 2013: 390). Certified organic foods fetch higher prices at the market, though the arduous and costly certification process is often a restricting

factor. Only one of the twelve communities visited by this study produced certified organic quinoa, Caritamaya. Farmers there used tractors and were producing more quinoa than before.

4.8.6 Quinoa Vs. Wheat and Rice

There is some evidence to indicate that quinoa farmers are responding to the rising prices of their crop by producing more and consuming less. As the demand for quinoa has increased, the socioeconomic conditions of quinoa farmer households have changed, resulting in alterations in subsistence and spending. S.E Jacobsen (2011) suggests that Bolivian farmers export the majority of their quinoa and thus have replaced it in their diets with rice and pasta. In a response to Jacobsen, Winkel et al (2012) suggest that quinoa was not traditionally used as a staple in Bolivia and that the change to pasta and rice occurred before quinoa entered the export market. To which Jacobsen replied by presenting statistical data from Balcerzak (2011) that there is a clear decrease in quinoa consumption in Bolivia.

Traditionally, quinoa only played a minor role in income generation, but now farmers frequently decide that their quinoa is too valuable to eat, so instead they sell what they grow and switch to eating less-nutritious foods (Jacobsen 2011: 393). Jacobsen argues that this distressing trend of displacing quinoa with simple carbohydrates not only affects Andean farmer nutrition, but also their social organization and environmental sustainability (Jacobsen 2011: 396). These trends differ between Peru and Bolivia, which share the *altiplano* region, due to differing proportions of export to production, the social value of traditional crops, and the presence of programs that encourage local consumption. In response to the decreased local consumption of quinoa, the Bolivian government has initiated a national quinoa plan, which includes quinoa in food security programs, endorses mechanized production, promotes education on the health benefits of quinoa, and encourages people to *vivir bien* (live well) in accordance to the traditions of the indigenous people who live in harmony with nature and one another (MDRyT et al.

2009). As the global demand for quinoa increases and farmers grow their traditional foods for export, the Andean quinoa farmer way of life is changing.

The export-driven rise in quinoa prices is potentially reducing consumption. Escalating prices boost farmer incomes but drive down local consumption when quinoa is considered too valuable to eat. Higher income may result in a switch from traditional foods to high status foods from the 'Western' diet, which are commonly less nutritious. As farmers in these areas earn increased incomes, observable changes in their diets should occur, including expansion (increase in calories consumed) and substitution (shift in consumption of foodstuffs). Increased income, urbanization, transnational food corporations and marketing, retailing, and consumer attitudes and behavior drive changes in dietary patterns, particularly toward Westernization (Kearney 2010).

4.8.7 Increased Incomes

As incomes increase, so does the propensity toward high value foods like animal products and fats (Kearney 2010: 2796). As processed foods are marketed as desirable for their social value, long shelf life, and ease of consumption, more of this kind of food is produced, displacing healthy food (Kearney 2010: 2801). In the case of quinoa farmers living in the remote high plains of the Andes, where access to a variety of foods is limited by geography, reduced consumption of quinoa can be especially harmful if it is not replaced by a more diversified diet. This trend will depend not only on the income of the farmer but also on the availability of certain foods, proximity to local markets, and preferences. Farmer incomes also relate to land ownership as those with larger land parcels can produce more quinoa. The shape and location of the land is also a critical consideration as land that is flatter facilitates the use of tractors whereas marginal, uneven terrain requires hand tools and greater inputs of labor.

4.8.8 Increased Empowerment

In addition to the possibility of material gains that farmers can enjoy from the expansion of the quinoa market, this expansion can have benefits that are more difficult to quantify. Higher esteem can come from the newfound global appreciation for a crop that has been a part of Peruvian lives for generations. By sharing their ancient knowledge with a world that is very interested in what they have to say, peasant farmers have a semblance of authority, something that they may not have had previously. Thus, market expansion can result in empowerment for local farmers (Urdanivia 2014: 35).

4.8.9 Observed Trends

Throughout the interview process various trends emerged that illustrated the similarities and differences between the farmers. For instance, the farmers who participated in the market would bring their crop in woven plastic sacks to sell to intermediaries who then sell to other intermediaries and retailers. The farmers were unaware of the final destination of their quinoa crop. Whether it will feed consumers domestically or internationally was not something they were privy to so the destination did not impact the amount the farmers earned per kilo. It was observed that although the supply chain benefits the retailer rather than the farmer, quinoa is a source of esteem for Andeans. The informants tended to grow the same crops: potatoes, barley, wheat, corn, lima beans, amaranth, and livestock (cows and pigs primarily) using a crop rotation system. They utilize traditional methods more frequently than mechanized methods and tended to advocate for traditional: this implies that the social value of traditions, at least for now, trumps the need to expand production beyond the capacity of traditional methods. Part of this tradition is the adherence to rigid gender roles in labor and food preparation which puts women in the role of nurturers and providers of sustenance. While this should give women elevated value in society as being the ones who provide for the family's most basic needs, the kitchen walls provide invisibility instead.

The majority of informants are growing more quinoa thanks to promotional efforts on TV, radio, murals, and speeches by public figures like First Lady Nadine Heredia to increase local quinoa consumption.

4.9 Food Systems Change Quinoa; Quinoa Changes Food Systems

The world food system is explained as the combination of activities that comprise food production, processing and packaging, distribution and retailing, and consuming food (Ericksen 2008: 238). These food system activities, when operating effectively, ensure that all humans are food secure. Clearly illustrated by the still large number of people combating malnutrition and food insecurity, the food system as it stands fails. Welch and Graham (1998) assert that these deficiencies are the result of problems in the current food system paradigm, which must be resolved to sustainably produce higher quantities of nutritious foods. The failings of the food system, according to these authors, result in part from the 'green revolution' paradigm of high productivity of cereals, which, while producing more food, displaced more nutrient-dense traditional crops (Welch & Graham 1998: 2). Andersen and Chandyo suggest that currently underutilized traditional crops, like ricebean in South and Southeast Asia, could reduce malnutrition and also provide indirect ecological benefits like improving soil health (Andersen & Chandyo 2010). Contributing to the evidence that high-productivity 'green revolution' cropping systems have actually contributed to 'hidden hunger,' Lal suggests that low concentration of micronutrients can be attributed in part to soil degradation, which inhibits yields and food quality (Lal 2009).

Trends in the current global food system put small farmers, who produce 50 percent of the world's food, at risk (Naerstad 2012). One such trend is the shift from small, traditional agriculture to large-scale industrial production. This is in part the result of urbanization, which results in more consumers per producer and puts increased stress on fewer farmers who must provide for a growing number of people. This trend has contributed to the development of large-scale commercial farms which practice monoculture across many acres to produce cash crops like

tobacco, maize, wheat, and soya. These and other cash crops are grown primarily for export, which has resulted in a shift in production from staples to cash crops and from local consumption to production for export (Patel 2007). This has been the cause for a shift in food system analysis from concerns about production and supply to access and allocation.

The shift in quinoa production, and valuation, from traditional toward modern, and its position as a hybrid bridge between the two, has been discussed earlier in this paper. The following table compares features of "traditional" and "modern" food systems, placing quinoa firmly in the traditional yet leaning toward the modern in terms of influence.

Table 4: Comparing some features of "traditional" and "modern" food systems

Comparing some features of "traditional" and "modern" food systems

Food system feature	"Traditional" food systems	"Modern" food systems
Principal employment in food sector	In food production	In food processing, packaging and retail
Supply chain	Short, local	Long with many food miles and nodes
Food production system	Diverse, varied productivity	Few crops predominate; intensive, high inputs
Typical farm	Family-based, small to moderate	Industrial, large
Typical food consumed	Basic staples	Processed food with a brand name; more animal products
Purchased food bought from	Small, local shop or market	Large supermarket chain
Nutritional concern	Under-nutrition	Chronic dietary diseases
Main source of national food shocks	Poor rains; production shocks	International price and trade problems
Main source of household food shocks	Poor rains; production shocks	Income shocks leading to food poverty
Major environmental concerns	Soil degradation, land clearing	Nutrient loading, chemical runoff, water demand, greenhouse gas emissions
Influential scale	Local to national	National to global

Source: adapted from Maxwell and Slater (2003).

(Ericksen 2007: 2)

5. CONCLUSION

Quinoa's role in southern Peruvian society has seen dramatic shifts since its cultivation began over 6,000 years ago. It has gone from sustaining the Incas to providing quality protein on modern health food shelves worldwide. It has moved from the background to the foreground as increased interest results in increased efforts to meet the global demand. Such efforts have mixed results for local quinoa farmers, who must make sacrifices in order to step up their production if they want to benefit from this newfound appreciation for a food that they have grown for

generations. As global appetites for quinoa dictate the level of participation in the global market, such demand also results in a shift of attitudes regarding the crop. Although quinoa was not forgotten, it certainly did not receive its current level of attention and dedication now that it is increasingly mainstream.

This study concludes that quinoa's skyrocketing popularity has changed its value economically and socially, making it a crop of increasing importance to Peru and to the globe. However, the current system is not sustainable. Supplies are insufficient to meet the growing demand, so South Americans can either grow more or risk losing their hold on the market. Due to the informant's recent entry into the quinoa market, not many significant changes in their diets or lifestyles could be discerned from semi-structured interviews conducted in southern Peru. However, the global demand for quinoa has had wide ranging and interesting results that are rippling throughout the whole food production chain.

This study found that amongst the informants, foreign demand has stimulated local consumption, despite the resulting price hikes. The price of quinoa has tripled since 2006 (Krivonos 2013: 64), which constitutes a beguiling reason for farmers to make changes in production to include more quinoa. The local use of quinoa has changed dramatically over time, often due to the influence of outsiders. The Incas originally used quinoa as a sacred power food, and then Spanish conquistadores spurned quinoa as primitive, whereas today national leaders and retailers promote it as a healthy, gluten free protein source.

5.1 Food Sovereignty

With no end in sight for its growth in popularity, there is only so much quinoa that can be grown in South America. The *altiplano* has a maximum capacity and already quinoa programs are in place to develop strains to adapt to climates in other countries. This poses some threat to Peruvian producers, who are already in competition with Bolivia. Investments in research and development of quinoa within Peru would enable the country's farmers to stay ahead of the market.

Retention of Peru's place in the global market can also be augmented by creating a kind of brand of quinoa as a South American original crop that has been cultivated consecutively for at least six millennia.

5.2 Peruvian Quinoa Vs. Bolivian Quinoa

As the largest producers and exporters of quinoa, Bolivia and Peru have responded to the pressure of external demand by significantly altering the scope, scale, and methods of production, as well as the level of local consumption, of quinoa. The two countries have coexisted side by side, growing enough quinoa for themselves. Nowadays, though, competition to provide quinoa for the global market is increasing with the growing demand and has caused tension between the two countries. Competition is fierce not only to produce larger quantities of quinoa, but also to get the best prices. Given that Peru and Bolivia share a border, it is unsurprising that quinoa shipments pass from one country to the other, much to the chagrin of quinoa farmers who resent having the market flooded by cheaper product. In some regions of Peru, like Arequipa, quinoa farming looks more modern than traditional as large commercial farms take the place of smallholdings. Informants interviewed for this study are displeased by the expansion, as are many Bolivians. In fact, in late 2014, 23 metric tons of Peruvian quinoa were seized by Bolivian authorities at the Bolivian border, dumped into a ditch, soaked with diesel fuel, and ignited. This extreme act was followed by a protest where 500 Bolivian quinoa farmers marched to the presidential palace to demand that President Morales halt the Peruvian quinoa invasion (Valdez and Bajak 2014).

As for the regions examined in this study, the level of smallholder participation in the market was relatively limited and the farmers do not depend upon their market earnings to survive. While they are not considered major players on the global stage, smallholders are the original quinoa farmers and it is their efforts that have formed the foundation of modern quinoa production. As the global interest in quinoa continues to escalate, and it appears as though it will stay on this upward trajectory at least for the foreseeable future, demands will result in

increased production, and perhaps competition, in South America for both smallholders and big businesses, and abroad.

5.3 Peruvian Quinoa Vs. Global Quinoa

As appetites for quinoa grow, so does the interest in its production beyond the *altiplano*, which could mean competition or a reduction in the pressure to produce more of what has thus far been centered in South America. Although quinoa has cultivars that are adapted to grow in a wide variety of conditions, there are limitations to growing quinoa abroad. It grows best in mountainous regions, though as stated earlier, it is adaptable to wide ranges in temperature and humidity. Due to its long maturation period, around 150 days, climates in Europe and elsewhere result in an insecure seed harvest (Jacobsen 2003: 167). Varieties better suited for cultivation farther north are those with early maturation, though more promising areas for increased cultivation have longer growing seasons. Southern Europe, the United States, and parts of Asia and Africa show promise for quinoa cultivation (ibid.).

In particular, production in Kenya was evaluated as part of the American and European Test of Quinoa and it was found to have comparable seed quality and yield level to the Andes. This is significant both for South American quinoa farmers as well as for Kenyans, whose reliance on the agricultural sector would be enhanced by the inclusion of such a nutritious and profitable crop. In reference to the question posed earlier in this paper regarding whose food security would improve by increased quinoa production: food security in Africa would benefit from quinoa cultivation due to increased crop diversification, which as stated earlier is a proxy indicator of food security (ibid.: 169).

Whether global quinoa production is a threat or a godsend to Peruvian farmers will depend upon the strength of Peruvian market agreements and the level of investment into research and development. Such investment would need to devote particular attention to those varieties with special resistance to adverse

environmental factors, though this strategy would jeopardize agrobiodiversity. Fair trade qualification provides farmers with greater financial security, which will keep them from moving on to other vocations that they may find more profitable.

At the current level of demand, South American production will soon prove insufficient. According to the following estimation in Table 5, supplies have been falling short of demand for years, but if this estimation is correct the gap is narrowing as increasing supplies attempt to meet increasing demand (Jacobsen 2001: 396). Jacobsen (2003) affirms the belief that "increased consumption of quinoa in developed countries will enhance the internal, urban markets in countries with a traditional production of quinoa" (Jacobsen 2003: 168).

Table 5: Estimation of demand and supply of quinoa (PROQUIOR 2008 from Jacobsen 2001: 396)

Table 1 Estimation of demand and supply of quinoa (PROQUIOR, 2008)

	2008	2009	2010	2011	2012	2013	2014	2015
Demand (t)	14566.28	15127.68	15689.08	16250.49	16811.89	17373.29	17934.70	18496.10
Supply (t)	11620.86	12195.74	12770.62	13345.49	13920.37	14495.25	15070.12	15645
Availability (t)	−2945.42	−2931.94	−2918.46	−2905.00	−2891.52	−2878.04	−2864.58	−2851.10

5.4 Global Significance of Quinoa Now and Into the Future

Its water efficiency and adaptability enable quinoa to produce yields in low rainfall and varying temperatures. These traits make quinoa a crop of interest in climate change adaptability schemes (Krivonos 2013: 59). Quinoa will be a crop to watch in the coming years as its rising stardom does not appear to be waning any time soon.

Zooming out from the micro-level to the big picture, quinoa's tiny seeds not only influence the people who consume it, and vice versa, but also food systems as a whole impact and are in turn impacted by quinoa. This paper has illustrated that the global demand for quinoa is growing, and with that demand comes its ability to shape supply. Consumers vote with their spending, thus influencing what is

produced and how. For example, consumers who choose to spend slightly more for organic and fair trade products deliberately encourage ethical, responsible production. For those consumers who wish to make food choices that are healthy and ethical, quinoa has posed an interesting conundrum. Quinoa production is largely pesticide free, yet it is not locally sourced and must be transported long distances; adding food miles and increasing its carbon footprint for foreign consumers. Of course, producing quinoa outside of South America will mean that people around the world can enjoy it without incurring the environmental damage associated with shipment. This too would make sense from a food security standpoint to decentralize production.

The global hunger for quinoa speaks to some interesting trends, particularly the desire by affluent foreigners for novel/exotic foods and the need for nutrient-dense foods particularly where soil infertility impacts nutrient density. Quinoa is of particular importance because as a native "peasant" food that is gaining global attention, it is extremely profitable and is still being produced by peasants. The future will tell if the global demand for quinoa will help or hurt Peruvian farmers and if it will remain in the hands of its original producers, as a traditional or hybrid/transitional crop, taken over by multinational corporations, or grown elsewhere.

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7. APPENDIX

7.1 Questionnaire

1. How many people are in your household?
2. What are their ages?
3. Is anyone in the household pregnant/nursing?
4. How many people in your household work on the farm?
5. How many people are involved in food preparation/cooking in your family?
6. Do you own or rent the land you farm on?
7. What kind of crops do you grow? How much land is dedicated to each crop?
8. What is the size of land that you have devoted to each crop you grow?
9. In recent years have you changed the crops in your field? To what?
10. Do you use traditional or modern/mechanized methods?
11. Are you a member of a farmer association?
12. How many times per week do you eat meat, chicken, fish, vegetables, fruit, quinoa, grains, and cereals?
13. Do you eat more quinoa now or did you eat more quinoa in the past?
14. How many meals do you eat in a day?
15. Do you usually eat at home or at restaurants?
16. What is your favorite food?
17. What kinds of food do you buy?
18. Does the food you eat change with the seasons?
19. Is the food you eat today different than the food you ate 30 years ago?
20. Do you sell quinoa? How much do you sell and how much do you earn (price)?

7.2 Dietary Diversity Survey

Question Number	Type of Food	Examples	Yes (1), No (0)
1	Meat	Chicken, guinea pig, fish, Llama, Pork	
2	Dairy	Milk, cheese, cream	
3	Egg	Chicken eggs	
4	Vegetables (vitamina A)	Sweet potato, carrot	
5	Fruit (vitamina A)	Melon, mango	
6	Grains	Rice, Wheat	
7	Beans, Nuts, Seeds	beans, nuts, seeds	
8	Roots & tubers	Yacon, oca,	
9	Oil	Vegetable oil, fat	
10	Sweets	sugar	
11	Misc.	drinks, soda, spices	
12	Quinoa	white, red, yellow	

<u>24- Hour Recall</u>

Breakfast:

Lunch:

Dinner:

Snack:

Beverages: