Food Security Worksheet for Willits
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Food security encompasses a wide range of topics, including sustainable local food production, processing and storage. This worksheet begins by examining the topic from an individual's basic needs level, and then builds towards those broader topics.

The Willits area is within a particular climatic and cultural region. I have emphasized crops items that can be stored readily within a small area and over long periods that also happen to be able to be grown here and are familiar parts of local diets.

Worksheet 1. Individual food needs

Daily human caloric need (on average):
2500 calories

For emergency purposes, the percent of above caloric need that will come from dried grains and legumes is given as *90%*, which assumes the remainder can be found from some local supply of vegetables, cheese, meat, etc.

Therefore, the daily caloric need from stored dried grains and legumes is:
2500 calories x 0.90 = 2250

Daily lbs of dried legumes and grains to meet daily caloric needs:
2250 calories per day/1600 calories per pound of grain = 1.4 lbs per day

Worksheet 2. Yearly food and storage needs and costs for an individual

Pounds needed per year:
1.4 lbs per day x 365 days per year = 513 lbs per year

Number of 5 gallon buckets needed for a year's supply of food:
513 lbs per year/35 lbs of dry grain or beans per 5 gallon bucket = 15 buckets

Cost for 15 food grade buckets plus lids at Sparetime, August 2005:
15 x $6.29 per bucket = $94.35

Cost for the grain, organic (wholesale prices for buying clubs quoted from Mountain Peoples Warehouse, Auburn CA, August 2005):

80% grains = 15 buckets x 0.8 = 12 buckets
$0.34 hard red winter wheat per lb x 210 = $71.40
$0.52 rye per lb x 70 = $36.40
$0.72 barley per lb x 35 = $25.20
$0.60 oats per lb x 35 = $21.00
$0.64 corn per lb x 70 = $44.80

20% beans = 15 buckets x 0.2 = 3 buckets
$1.00 pintos per lb x 35 = $35.00
$0.72 brown lentils per lb x 70 = $50.40

Total cost = $378.55 (Must check whether these costs include shipping and taxes).

To give a more diverse perspective on what these calculations mean: A family of 4 could have about 3 months of food storage per person at less than $100 each. People are also familiar with 1 quart mason jars, and calculations could be made from that perspective also, e.g., there are 4 quarts in a gallon, and 20 quarts in 5 gallons, so 300 quarts jars would equal the volume of the 15 buckets used above.

The costs for the grains and beans may be reduced by a factor of 3 to 4 if purchased directly from a farmer. Organizing a large purchase and shipment could do this, but further research is needed for more details.

Worksheet 3. Annual food needs of the population

Size of population:
13,500 for 95490 zip code of greater Willits

Total annual requirements based on Worksheet 2:
13,500 people x 513 lbs per year/person = 6,925,500 lbs of dry grains and beans

Total for grains and beans in terms of bushels:
6,925,500 lbs/55 lbs* per bushel = ca.125,918 bushels

*a bushel is a volumetric measure and varies in weight among crops, 55 lbs is used as an average.

Total annual needs in terms of calories
13,500 people x 2500 calories per day x 365 days per year = 12,319,000,000 calories per year (over 12 billion calories)

Worksheet 4. Historic grain production levels in Mendocino County

		yields per acre, bushels					bushel	average	calories per
crop	1899	1909	1919	1924	1929	1934 average	in pounds	acre avg.
barley	30	23	27	22	28	27	26.2	1256.0	1,988,248
corn	31	27	20	16	28	23	24.2	1353.3	2,136,913
oats	31	27	26	31	34	28	29.5	944.0	1,669,936
wheat	20	15	15	15	21	17	17.2	1030.0	1,541,910
potatoes	105	128	88	104	115	93	105.5	6330.0	8,678,430

The available data on grain and potato production are sparse due to loss of records from fires. However, the 1899-1934 period pre-dates the Green Revolution and is therefore

probably the best indication of what we can expect in a world without artificial fertilizers and large irrigation systems.

Dry beans are similar to grains in terms of yields per acre and caloric density (Jeavons, 2002).

Source of data on production levels from:
"Statistical Information on Mendocino County Agriculture 1899-1936." J.M. Thompson, Extension Specialist in Agricultural Economics. University of California College of Agriculture and United States Department of Agriculture. January, 1938. (Made available via County of Mendocino Department of Agriculture, 2005).

Caloric data from:
"How to Grow More Vegetables." John Jeavons. Ten Speed Press, Berkeley and Toronto. 6th edition, revised, 2002.

Worksheet 5. Number of people potentially fed per acre in Mendocino County

crop	calories per acre avg.	people fed per acre*
barley	1,988,248	2.2
corn	2,136,913	2.3
oats	1,669,936	1.8
wheat	1,541,910	1.7
potatoes	8,678,430	9.5

*total calories only, not other nutrients

This table carries over from Worksheet 4. It divides calories per acre for each crop by annual caloric need per person per year, which is:
2500 calories per day x 365 days per year = 912,500 calories per year.

For grains the average is about 2 people per acre, and for potatoes 9.5.

The actual yield in an agricultural system is highly dependent on the knowledge of the farmers, the methods employed, and the quality of the labor force. Much knowledge has been gained over the past century, but on a population level, much has also been lost.

Worksheet 6. Number of acres needed to sustainably feed the greater Willits population

Though the data on Worksheet 5 may tempt people to sustain themselves on potatoes, this would eventually lead to starvation. Potatoes are susceptible to a blight when grown too intensively, which periodically leads to crop failure (e.g., Ireland). Furthermore, potatoes deplete the soil when not part of a rotation with other crops, such as nitrogen fixing legumes and grains. They have the disadvantage of being more difficult to store and transport than grains as well.

For these reasons, an intensive agrarian system should probably sow an area of grains and dry beans about 8 times larger than the area of potatoes, i.e., an 8:1 ratio. These grains, dry beans and potatoes would represent about 90% or more of the area under cultivation, the rest being other vegetables and fruits.

If we take an average of 2 people per acre supported by grains, and 9.5 supported by potatoes (Worksheet 5), then the following equation gives the overall number of people supported per acre with the 8:1 ratio rule.

2 people per acre X 0.89 + 9.5 people per acre X 0.11 = **2.77 people per acre.**

13,500 people/2.77 people per acre = **4873 acres** for basic calorie crops.

Areas cultivated for grains and potatoes should be of prime quality. Marginal lands will have much lower yields and will degrade quickly if cultivated, and should instead be reserved for light grazing, tree and berry crops, or natural ecosystems. All these activities would provide diet diversity and added calories to the calculations given here for the fundamentals. Due to annual fluctuations in output and potential for large failures, any system should aim to have about 20% more food than required. The 4873 acres is therefore a minimum area based on the most important calorie crops.

Worksheet 7. How many acres of prime ag land are in our area?

The 95490 zip code encompasses about 322 square miles. The largest area with high agricultural potential is Little Lake Valley. Smaller areas include Ridgewood Ranch, with probably a few hundred acres of prime ag land, as well as Sherwood Valley and small pockets along area rivers such as near Hearst.

The main area of Little Lake Valley is about 2.5 miles wide and 5 miles long, with extensions on either side of Hilltop as well. The total area of valley fill is about 18 square miles, or ca. 12,000 acres. I estimate about a quarter of this area is wetland habitat, mostly in the northern section, another quarter is housing and roads, mostly to the west, and another couple thousand acres is forested, riparian zone, or non-prime ag land due to soil texture. **This gives about 4000 acres of potential prime ag land in Little Lake valley**. (Further research should try to locate GIS products for more accurate estimates).

Irrigation water may be rate-limited in the southern portion of the valley, and water availability and quality may limit irrigation along the valley margins where boron, arsenic and other minerals reach high concentration. Dry-land farming methods are likely to be the norm.

Smaller areas of prime ag land likely occur

See the following publications for detailed information:

Farrar, C.D. 1986. Ground-water resources in Mendocino county, California. U.S. Geological Survey Water-Resources Investigations Report 85-4258

Howard, Richard F. and Roy H. Bowman. 1991. Soil Survey of Mendocino County, Eastern Part, and Trinity County, Southwestern Part, California. United States Department of Agriculture, Soil Conservation Service.

An image of Little Lake can be found at:
http://www.google.com/maps?ll=39.416370,-123.328829&spn=0.129776,0.088062&t=k&hl=en

Bottom Line: the greater Willits area still has the potential to be food self-reliant, but just barely.