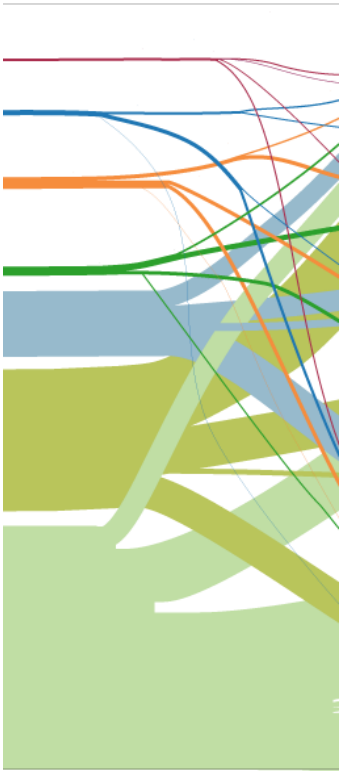

FARM BILL VISUALIZATON

I247: Information Visualization Spring 2008

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INTRODUCTION

The Farm Bill is a complicated and massive piece of legislation that gets passed every five years. It involves hundreds of billions of dollars and largely determines what Americans eat. The Farm Bill was originally started to support farmers during the Great Depression. Today, it is one of the "significant forces affecting food, farming, and land use in the United States" [1] Despite its huge budget and impact, the details of the Farm Bill have traditionally been determined by a few legislators from farm states and food industry lobbyists. According to Michael Pollan, the bill is "deeply encrusted with incomprehensible jargon and prehensile programs dating back to the 1930s," making it impossible for either legislators or the general public to understand the bill [2].

The United States Department of Agriculture, Economic Research Service (USDA/ERS), provides access to extensive data sets both about the Farm Bill and U.S. agriculture in general. Because information visualization can be used to help people more easily understand large sets of data, we decided to focus our project on available data around the Farm Bill. In this way, we hope to contribute to the public's awareness of the Farm Bill and understanding of its impact.

Our initial intent was to show how the Farm Bill influences the American diet. In addition to looking at Farm Bill data, we also looked at obesity and diabetes figures from the Center for Disease Control (CDC). However, we soon realized that it would be impossible to establish causality between Farm Bill subsidies and obesity and diabetes rates. People's dietary choices are complicated and could not be explained solely by looking at data; any visualization we did using Farm Bill and CDC data would be incomplete and possibly misleading.

Ultimately, we decided to simplify our goal and instead compare Farm Bill subsidies with USDA Food Pyramid dietary guidelines. It seems reasonable to expect that Farm Bill subsidies should roughly correspond with what the USDA recommends that we eat. Yet, according to researcher and writer Daniel Imhoff, the Farm Bill "favors just four primary groups: food grains, feed grains, oilseeds, and upland cotton. Most are either fed to cattle in confinement or processed into oils, flours, starches, sugars, industrial food additives, and, increasingly biofuels." [3]

The USDA has been issuing dietary guidelines for over 100 years [4]. As our understanding of food science and nutrition has changed, so have the dietary guidelines. In spite of these changes, many of today's guidelines are similar to those of past guidelines. The graphic version of the food pyramid as we know it was developed in 1992. There are many specialized versions for young children, diabetics, diets for different nationalities, and so forth. For simplicity, we focused on the 2005 Food Pyramid (Figure 1).

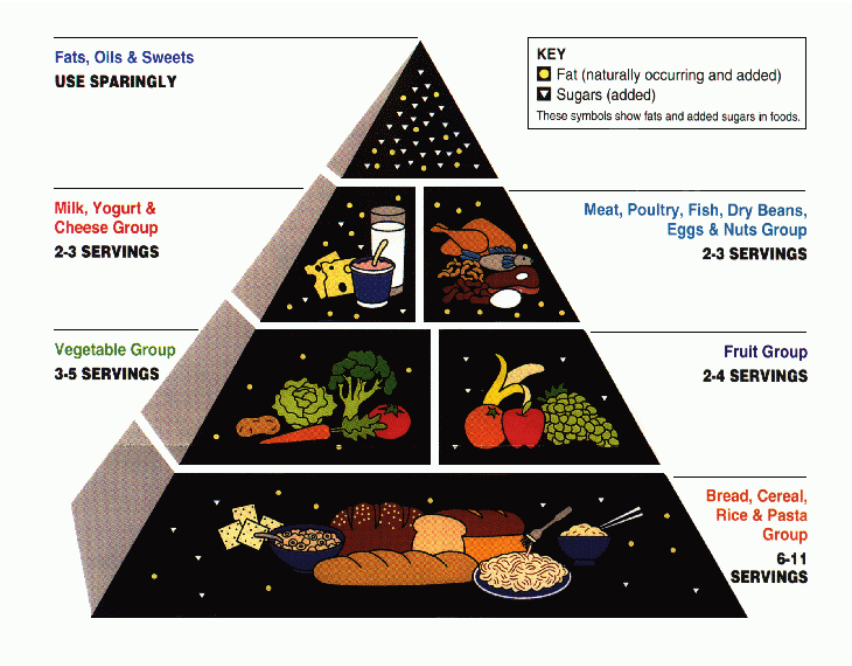


FIGURE 1 2005 USDA FOOD PYRAMID
http://web.mit.edu/athletics/sportsmedicine/wcrfoodpyr.html

It should be noted that many nutritionists disagree with the recommendations of the Food Pyramid. According to Marion Nestle, a nutritionist who worked on drafting the US Department of Health and Human Services' Dietary Guidelines in 1995, lobbyists from the food industry have a large impact on the department's dietary recommendations. Any recommendations to eat less of anything are met with strong objections from the lobbyists associated with that particular food [5]. Nevertheless, despite its many controversies and likely inaccuracies, we decided to base our visualization on the Food Pyramid because we believe most Americans are familiar with the it. And again, as mentioned previously, it is reasonable to expect that what the Farm Bill subsidizes should have a rough correlation to what the USDA recommends that we eat.

TARGET AUDIENCE

Journalists: Since various publications from multiple mediums (Michael Pollan's books, New York Times articles, NPR, etc.) inspired our project, ultimately we wanted our visualization to complement and contribute to such work. This visualization offers a quick method for examining unexplored relationships between the subsidy payments, crop supply flow, and daily dietary recommendations.

Farm Bill Advocates: Currently advocates such as the Environmental Working Group limits their data to cross-tab tables. Our work provides advocates an alternative to such text-based tables.

General Public: Although the Farm Bill impacts all consumers in the U.S., its complexity weakens its ability to effectively achieve mass audience appeal. Our visualization simplifies and allows exploration with minimal prior research.

GOALS

In addition to the specific goals outlined for each target audience, we also aimed to accomplish the following:

- *Simplify the complexity of the Farm Bill*: few visualizations exist except for simple tables and charts. The complexity of the Farm Bill hinders the ability for people to effectively visualize the information without delving into intricate details.
- *Offer an alternative or supplement to text-based formats*: the majority of information regarding the Farm Bill is in the form of written articles or commentary. Although tables are helpful, they also limit the ability to visualize information beyond two dimensions (Example: subsidy amount by state).
- *Reveal contradictions*: for political and economic reasons, fruits and vegetables receive no direct subsidies yet they are a key part of the USDA Food Pyramid. Farm Bill subsidies are in direct contradiction with USDA diet guidelines. The guidelines emphasize eating more fruits, vegetables and whole grains; the Farm Bill subsidizes sugars, starches and animal feed. Without an understanding of the Farm Bill or an effective visualization, audiences cannot readily perceive this contradiction.

Given the amount of data and time limitations, we limited our scope to the food crops for which we had sufficient data. These included rice, wheat, soybeans, and the feed grains - corn, oats, sorghum and barley; these represent the majority of food crops subsidized by the Farm Bill. (We did not include peanuts, a crop which receives substantial subsidies, because we did not have data on the flow of supplies to the various uses.) No fruit or vegetable crops, called "specialty crops" receive any direct subsidies from the Farm Bill.

RELATED WORK

As noted, at present time we have not encountered work similar to our visualization. Visualizations for journalists and Farm Bill advocates appear to focus primarily on which states receive the most subsides (Figure 2, 3) whereas we are focusing on which crops receive the largest subsidies, how their supply flows, and how this compares to the USDA Food Recommendations. The closest visualization we could find that matched our goals did not relate to the Farm Bill directly but to the flow of foods in general (Figure 4).

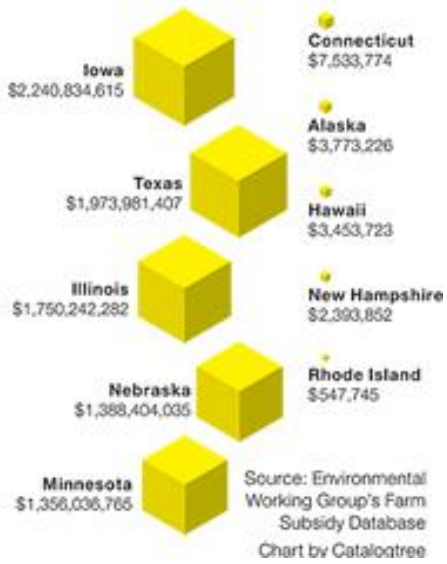


FIGURE 2 STATES THAT RECEIVED THE MOST AND LEAST SUBSIDIES IN 2005.
Copyright New York Times 2007

Top Commodity and Conservation Programs in United States, program years 2003-2005:

Rank	Program	Number of Beneficiaries program years 2003-2005	Total program years 2003-2005
1	Corn Subsidies	1,112,825	$17,630,092,559
2	Cotton Subsidies	183,212	$7,012,930,183
3	Conservation Reserve Program	571,572	$5,469,009,408
4	Wheat Subsidies	931,888	$3,613,436,170
5	Rice Subsidies	56,003	$2,186,098,850
6	Soybean Subsidies	829,214	$2,110,939,241
7	Dairy Program Subsidies	96,776	$1,304,847,731
8	Peanut Subsidies	43,161	$1,093,094,670
9	Sorghum Subsidies	387,123	$1,075,672,040

FIGURE 3 ENVIRONMENTAL WORKING GROUP TABLE

http://farm.ewg.org/sites/farmbill2007/progdetail1614.php?fips=00000&progcode=total&page=croptable

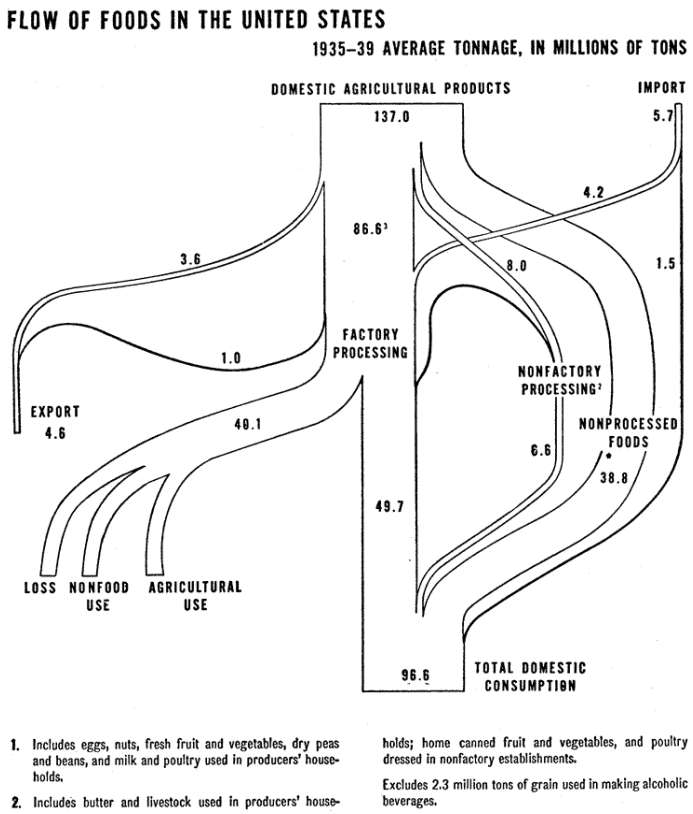


FIGURE 4 FLOW OF FOODS

The Yearbook of Agriculture: 1954, Marketing. United States Department of Agriculture.
http://thediagram.com/6_3/flowoffoods.html

DATA

The data introduced many challenges. To begin with, none of us had a full grasp of the Farm Bill. While we discovered a rich data source from the USDA Economic Research Service's various data sets (http://www.ers.usda.gov/Data/), correctly identifying Supply, Production, Utilization as our primary data source proved time-consuming. While the meeting with the Agricultural Economics department shed light on economic variables at a macro level, it failed to point us to the correct dataset. Fortunately Edwin Young, the senior economist at the USDA proved an invaluable resource for our various questions and directing us to appropriate data sets (Table 1). However, the lack of standardization between databases, tables, and even measurements added to the confusion.

We downloaded all tables and imported data into the Excel. Since crop measurements varied, we converted all crops to metric tons using appropriate conversion factors (Table 2).

TABLE 1

Data Sources

Data Type	Amount Type	Source and Respective Tables
Subsidy	Dollars	CCC Net Outlays by Commodity and Function (Table 35): http://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=bap-bu-cc
Crop Supply	Volume	Feed Grains Database Yearbook Tables: http://www.ers.usda.gov/Data/FeedGrains/FeedYearbook.aspx Corn Table 4 Sorghum Table 5 Barley Table 6 Oats Table 7 Wheat Yearbook Table (Table 5): http://www.ers.usda.gov/Data/Wheat/WheatYearbook.aspx Soybean Yearbook Tables: http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1290 Soybean Table 3 Soybean meal Table 4 Soybean oil Table 5 Rice Yearbook Table (Table 1 and Table 14): http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1229
Serving Recommendation	Serving Size	USDA Food Pyramid

TABLE 2

Conversion Factors

Crop	Original Measurement	Conversion Factor (to metric tons)
barley	million bushels	0.021772
corn	million bushels	0.0254
oats	million bushels	0.014515
sorghum	million bushels	0.0254
soybeans	million bushels	0.0272155
soybean meal	thousand short tons	0.0009072
soybean oil	million pounds	0.0004545
wheat	million bushels	0.0272155
rice	hundredweight	0.045359237

Data Reconciliation

In the end, Supply and Use yearbook tables for each crop served as our key source tables. The yearbook tables we used to find supply and utilization numbers generally offered the abstract levels of granularity for total supply (Table 3). However, inconsistent or latent levels of granularity compounded the pre-existing complexity of the Farm Bill.

Data Granularity was also inconsistent for each crop. For example, corn had the most details whereas other crops grouped data into only high-level categories (Table 4).

Also, soybeans had latent granularity that required converting three different measurements and deriving numbers.

Using the Total Supply as our "starting point" and accounting for the inconsistencies between column headings, we created our own categories:

1) Food (Bread and Cereal; Alcohol; Fats & Sugars)
2) Exports
3) Alcohol and Industrial
4) Seed and Leftover (originally called Seed and "Ending Stock," respectively)

TABLE 3

Data Granularity USDA Categorization For Each Crop

Crop	Food, Alcohol, & Industrial	Seed	Feed And Residual	Seed, Feed, & Residual	Exports	Ending Stock
barley					X	X
corn	X	X	X		X	X
oats		X	X		X	X
sorghum		X	X		X	X
soybeans*					X	X
soybean meal				X	X	X
soybean oil	X				X	X
wheat	X	X	X		X	X
rice	X	X			X	X

*See *Table 5*

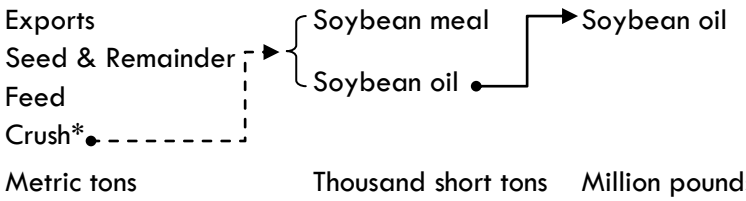
TABLE 4

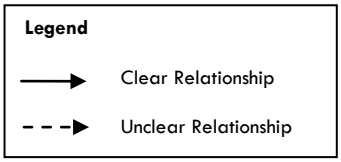
USDA Data Granularity Comparison for Corn and Rice

Corn	Rice
1. Food and Industrial 1.1. Breads and Cereals 2. Alcohol and Industrial 3. Seed and Remainder 4. Exports 5. Fats & Sugars 5.1. oil 5.2. glucose and dextrose 5.3. high-fructose corn syrup	1. Food and Industrial 2. Seed and Remainder 3. Exports

TABLE 5

Soybean Granularity and Measurement Unit Issues





* *Granularity not noted/readily available on USDA tables*

DESIGN PROCESS

Inspiration

We were strongly influenced by the thematic flow maps of French engineer Charles Joseph Minard (1781 - 1870). During his lifetime, Minard created over 42 different flow maps ranging in subject from cotton exports to Europe to wine exports from France (Figure 5) [6]. Minard's most famous information graphic was his *Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813* (Figure 6) which depicts the march of Napoleon's army to Moscow during the Russian Campaign of 1812. Minard manages to effectively display six variables in a single two-dimensional space with such elegance that Edward Tufte uses it as a prime example of graphical excellence in his book *The Visual Display of Quantitative Information*, claiming that "it may well be the best statistical graphic ever drawn" [7]. The advantage of such flow maps is that, by merging edges that share destinations, they allow the designer to display a large number of connections and show differences in magnitude among flows with a minimum of visual clutter.

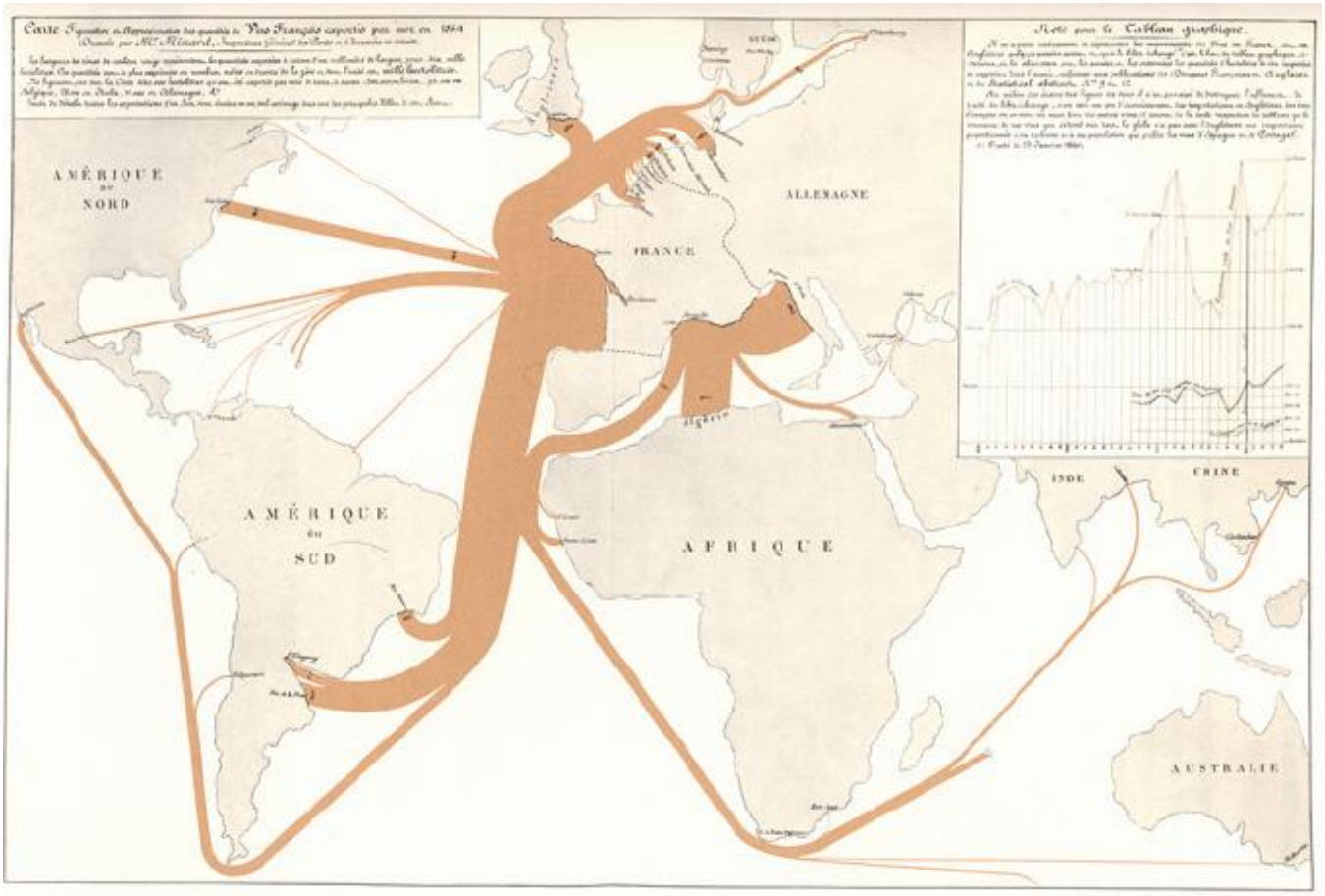
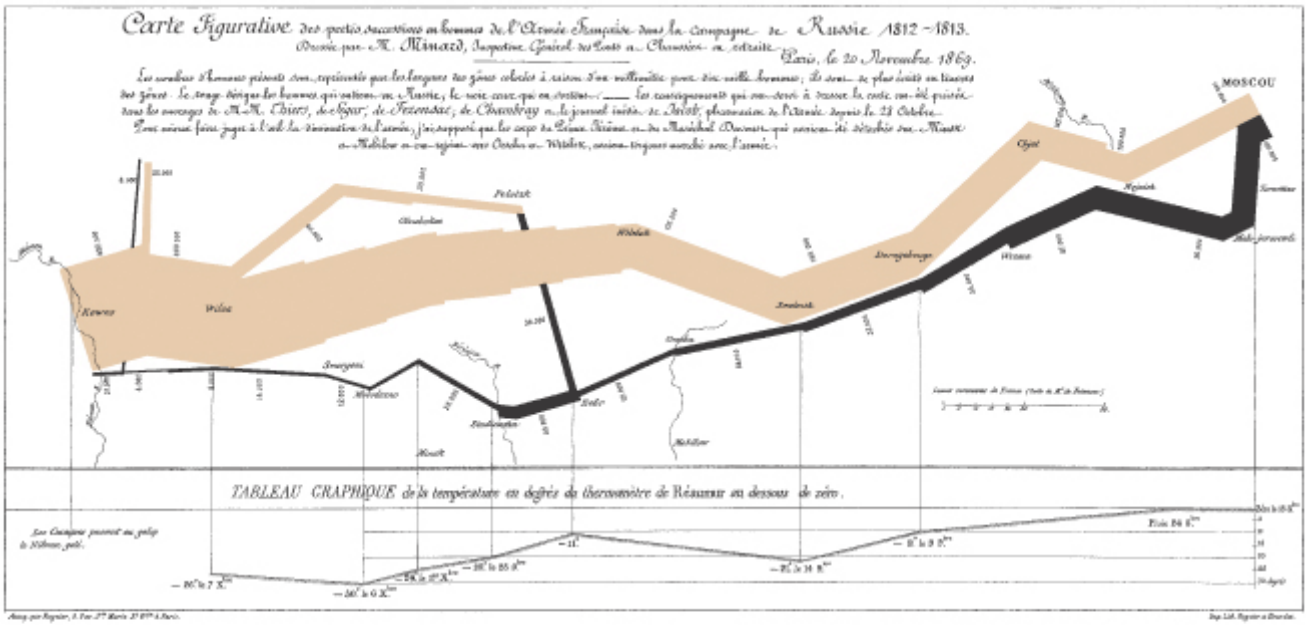


FIGURE 5 FRENCH WINE EXPORTS

Minard's Carte Figurative Et Approximative Des Quantités De Vin Français Exportés Par Mer En 1864



Napoleon's March to Moscow The War of 1812

Charles Joseph Minard

This classic of Charles Joseph Minard (1781–1870), the French engineer, shows the terrible fate of Napoleon's army in Russia. Described by E. J. Marey as seeming to defy the pen of the historian by its brutal eloquence, this combination of data map and time-series, drawn in 1869, portrays the devastating losses suffered in Napoleon's Russian campaign of 1812. Beginning at the left on the Polish-Russian border near the Niemen River, the thick band shows the size of the army (422,000 men) as it invaded Russia in June 1812. The width of the band indicates the size of the army at each place on the map. In September, the army reached Moscow, which was by then sacked and deserted, with 100,000 men. The path of Napoleon's retreat from Moscow is depicted by the darker, lower band, which is linked to a temperature scale and dates at the bottom of the chart. It was a bitterly cold winter, and many froze on the march out of Russia. As the graphic shows, the crossing of the Berezina River was a disaster, and the army finally straggled back into Poland with only 10,000 men remaining. Also shown are the movements of auxiliary troops, as they sought to protect the rear and the flank of the advancing army. Minard's graphic tells a rich, coherent story with its multivariate data, far more enlightening than just a single number bouncing along over time. Six variables are plotted: the size of the army, its location on a two-dimensional surface, direction of the army's movement, and temperature on various dates during the retreat from Moscow. It may well be the best statistical graphic ever drawn.

Edward R. Tufte, The Visual Display of Quantitative Information Graphics Press Box 430 Cheshire, Connecticut 06410

FIGURE 6 NAPOLEON'S MARCH TO MOSCOW 1812

Minard's Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813 from http://www.edwardtufte.com/tufte/posters

Implementation

Ideally, we hoped to implement our flow map using the Java source code, built upon the prefuse visualization toolkit [8], from the Infovis 2005 "Flap Map Layout" paper, developed by researchers at Stanford University [9, 10]. However, we quickly ran into problems with the extensibility of this implementation that could not be resolved in the given timeframe. Since the code was a simplified version of the algorithm used to generate the flows in the paper, it only allowed for one source node with many destination nodes. We needed the ability to specify multiple sources (i.e. one for each crop) and multiple destinations. Even though the source code did not perform exactly as desired, we still loved the organic nature of the flows that it created (Figure 7), so we used the software to generate each flow independently (Figure 8), and then used Illustrator to layer all of the flows and achieve the intended result. Unfortunately, this approach was extremely tedious and involved many hours of tweaking. As described later, we hope to automate this process in the future.

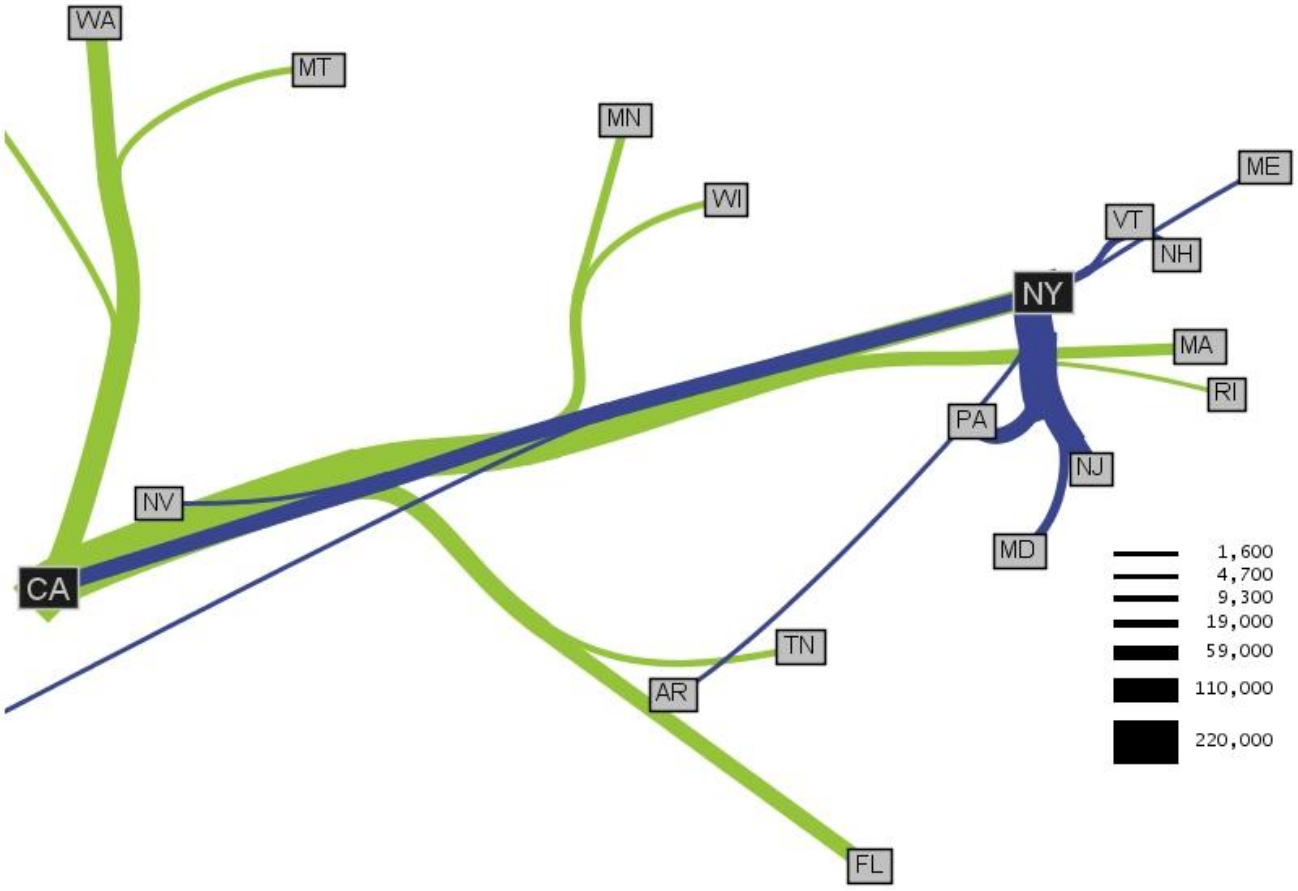


FIGURE 7 EXAMPLE OF THE BEAUTIFUL ORGANIC FLOWS CREATED FOR THE FLOW MAP LAYOUT PAPER.

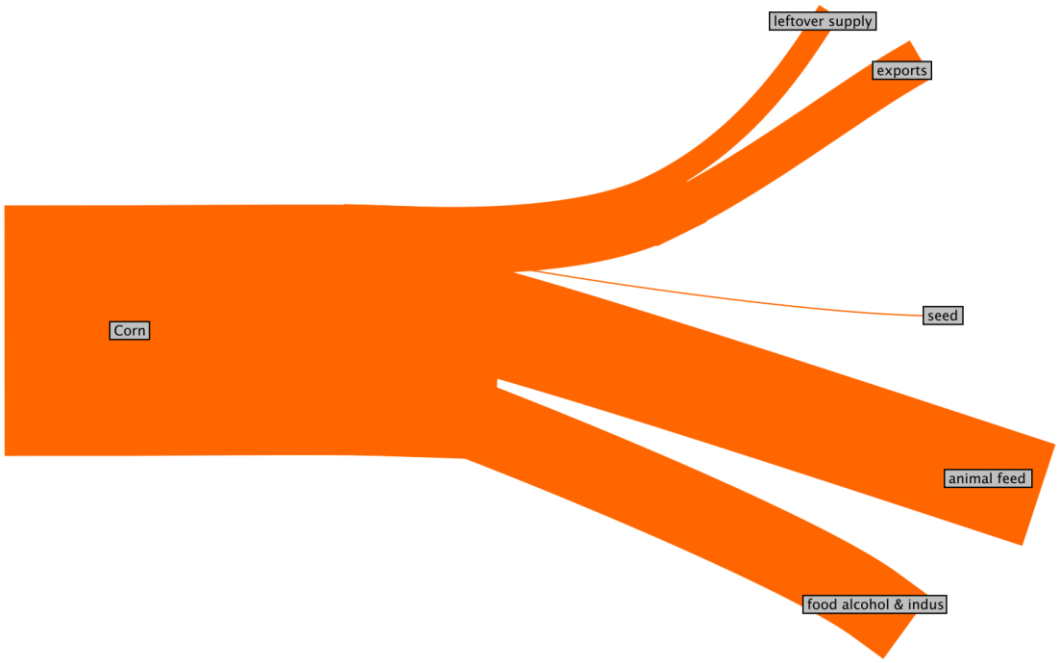


FIGURE 8 EXAMPLE OF A TYPICAL "BASE" FLOW GENERATED USING THE SOFTWARE WITH OUR CORN DATA.

Design Guidelines

In order to achieve a flow map with the same natural beauty of the ones created by the original code described above, we attempted to follow the design guidelines outlined in the "Flow Map Layout" InfoViz paper [10]. These guidelines were developed from analyzing effective hand-drawn flow maps such as those of Minard:

- We made sure that our flow lines were the "dominant visual element" and were "easily distinguishable from other map symbols."
- We used a linear mapping to transform our data values into line widths.
- We layered thinner lines on top of thicker ones where edges crossed.

To design the rest of our information display, we incorporated many strategies suggested by Stephen Few in his book *Information Dashboard Design* [11].

- We used a combination of bright and muted colors for our flow lines since too many of one "can quickly become visually exhausting."
- We used light chalk lines in order to delineate groups of data. We chose these "subtle borders" since such visual means are "non-data pixels" that "should only be as visible as necessary to do the job."
- We encouraged meaningful comparisons by placing the $ signs, flow lines, and food icons close to one another, respectively.

First Iteration (Sketches): Design Rationale

Initial sketch

Figure 9 is an initial sketch of our concept. Circles represent the amount of subsidy for each crop; lines represent the flow of crops to the different food groups. Line widths (not shown in this sketch) represent the amount of the crop going to the particular food group. Our original idea was to use the food pyramid, with its original triangular layout and proportions, as this is a graphic that is familiar to the general public.

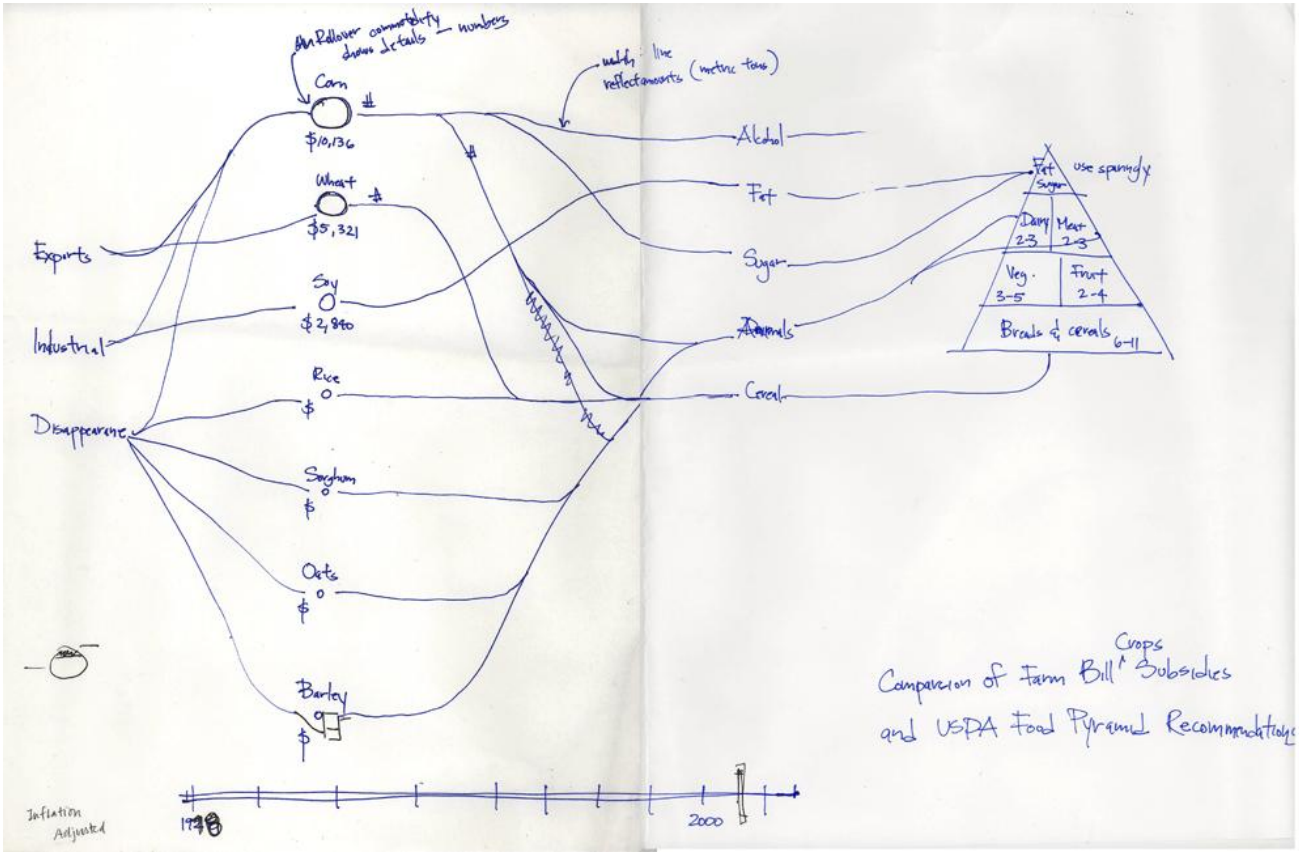


FIGURE 9 INITIAL HAND-DRAWN SKETCH

Initial Digital Sketch

In this next sketch (Figure 10), we started to lay out the subsidies, crop supply flows and the food groups in the form of a pyramid. We found the triangular shape of the pyramid difficult to work with; its proportions did not work well with the rest of the elements. At this point, we decided not to use the literal shape of the food pyramid, and instead to depict the food serving recommendations in a different layout. Even with this rudimentary sketch, it was very time-consuming to do this using Illustrator, so we decided to use a more precise drafting tool - AutoCAD.

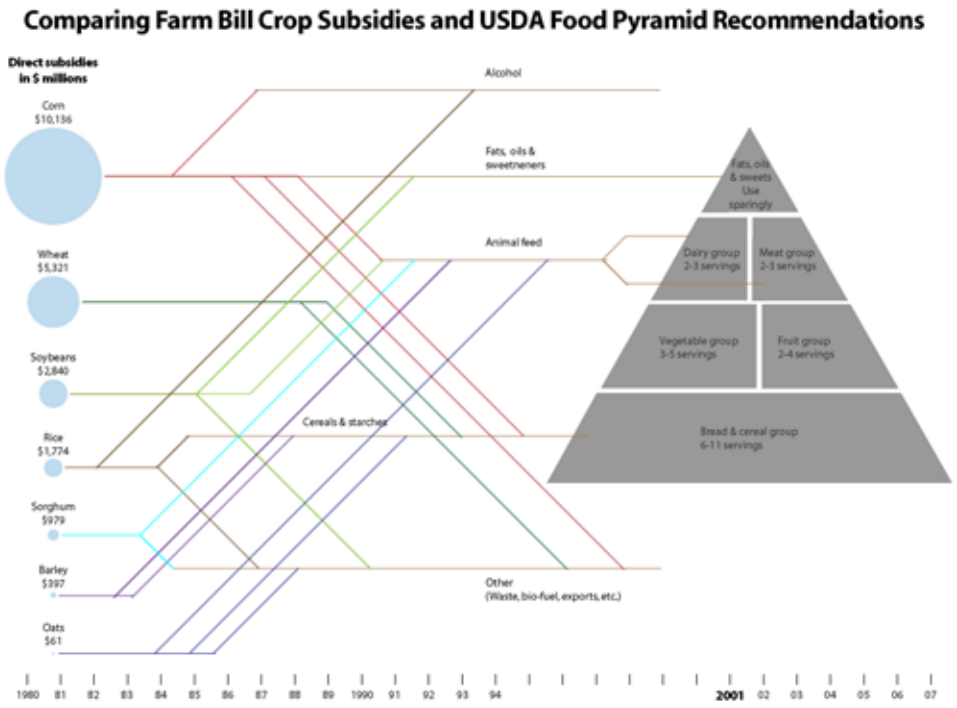


FIGURE 10 INITIAL DIGITAL SKETCH

Second Digital Sketch

In Figure 11, instead of literally drawing the food pyramid, we tried using a series of horizontal bars whose lengths represented the number of recommended food servings. Bars were stacked from widest to narrowest; we also stacked the circles representing the crop subsidies in the same order. Using AutoCAD proved no less time-consuming in laying out our visualization.

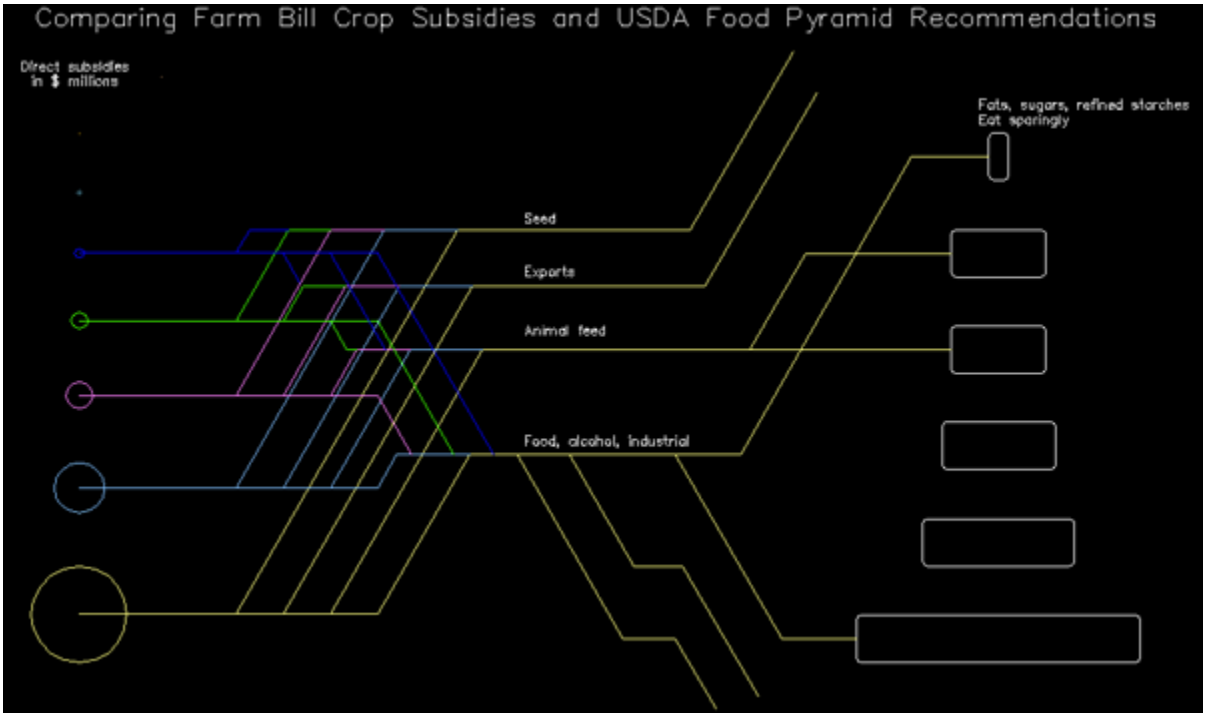


FIGURE 11 SECOND DIGITAL SKETCH USING AUTOCAD

Fine-Tuning the Details: Design Rationale

For our next sketches we used a flow layout tool built for Prefuse (discussed in the implementation section above). This tool allowed us to input a source (i.e. corn) and multiple destinations (i.e. exports, animal feed, sugar, etc.) with associated numerical values. Using the inputted values, the tool generated a flow map with lines of varying width (Figure 8). However, the tool only worked with single sources and what we wanted to do required multiple sources. The tool was helpful in drawing the correct widths for flow of crop supplies to the various food groups. However, since it did not handle multiple sources, we used Illustrator to put together several flow maps, and adjust the lines to flow to the various food groups. It was painstaking and time-consuming work.

Sketch With Prefuse Flow Map Lines - Version 1

In this version (Figure 12), we combined the separate Prefuse-generated flow maps for each grain into a single layout. We started to manipulate the lines to flow to the various food groups. To represent the crop subsidy amounts, we now use bars whose height reflects the subsidy amounts. (In the previous versions, we mistakenly used circle diameters instead of areas to represent subsidy amounts. When we tried to use circle areas, the difference between the largest and smallest circles was too great.) Food group servings are still represented by horizontal bars; we don't really like using bars for both subsidies and servings, and decide to explore different options in the next version.

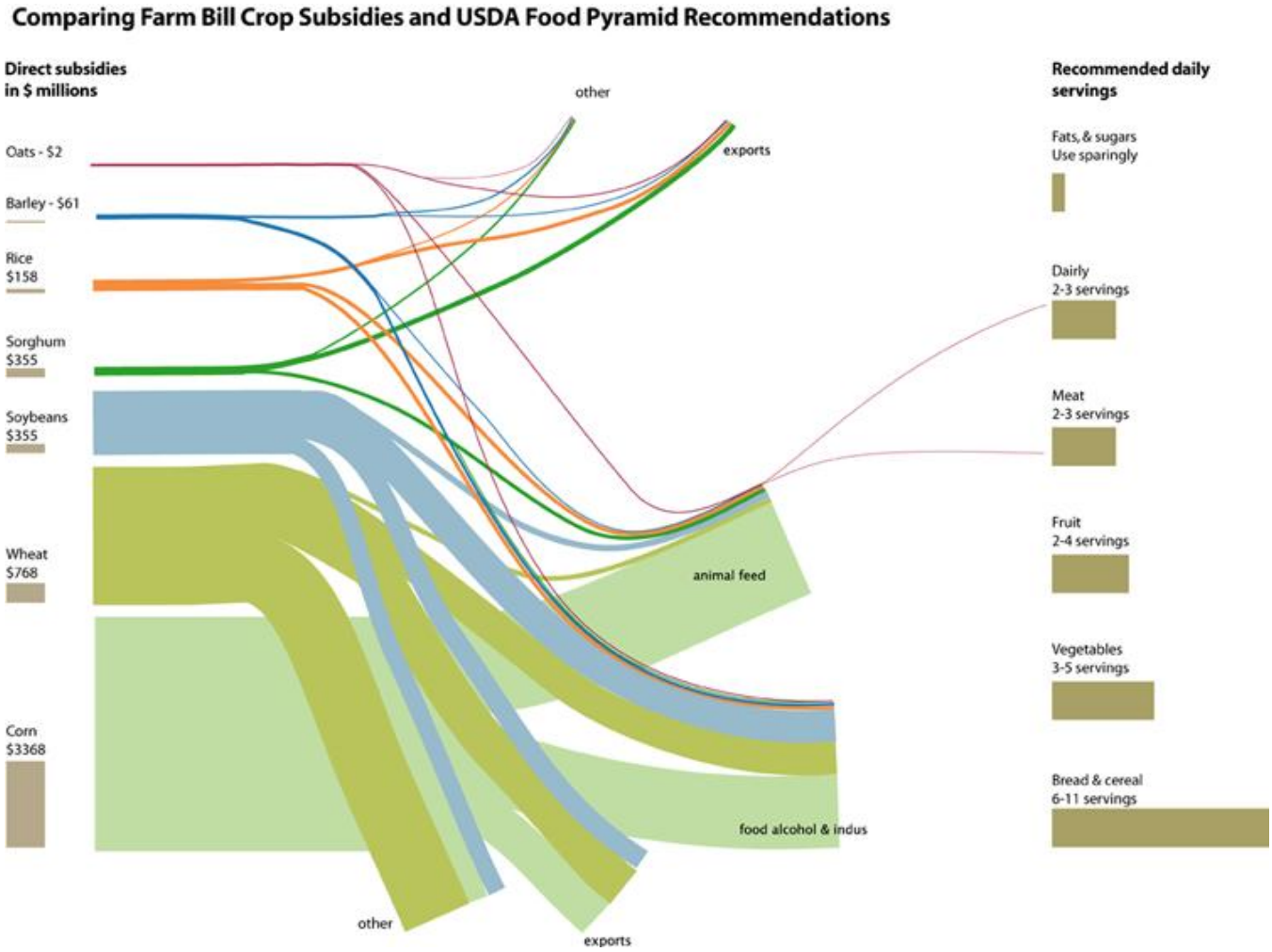


FIGURE 12 USING PREFUSE FLOW MAP: VERSION 1

Sketch With Prefuse Flow Map Lines - Version 2

For Figure 13, we have completed most of the crop flow line adjustments. We switched to using $ signs for the subsidy amounts, and think this works much better than the vertical bars. We still plan to explore other options for the food servings. We've also added a timeline and play button. Although we are currently working on a static image, we are designing for an interactive version.

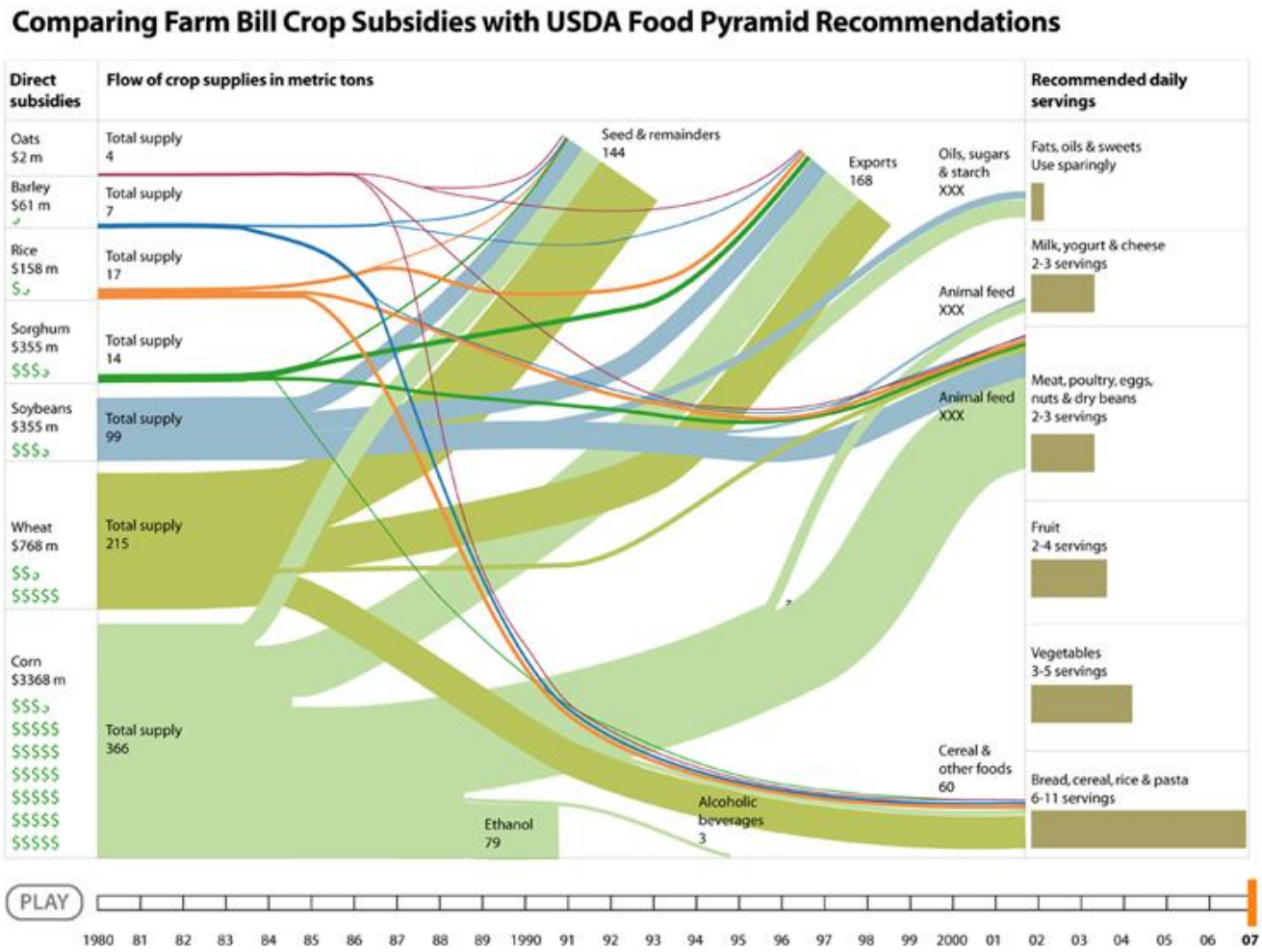


FIGURE 13 SKETCH WITH PREFUSE FLOW MAP LINES - VERSION 2

Sketch With Prefuse Flow Map Lines - Version 3

We used food icons to represent the number of servings for Figure 14. Since each food group has a range of recommended servings, we applied a white transparency to servings beyond the minimum recommendation. For example, 3-5 servings are recommended. In our visualization, 3 carrot images are left as is, but two have an applied white transparency. We use this version to do some usability testing. Users were confused by the two labels for "Animal feed" and did not notice the transparency over some of the food serving icons.

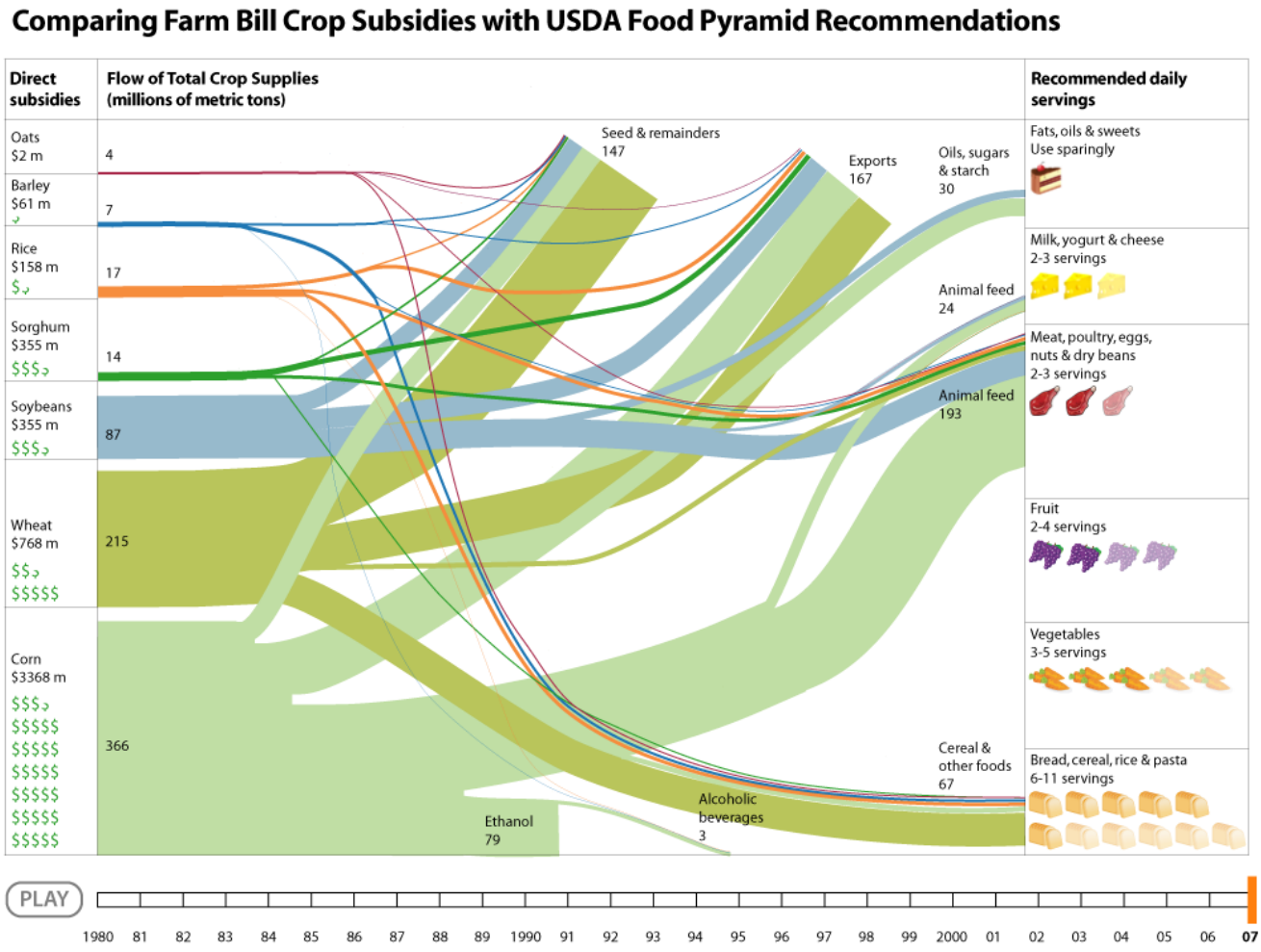


FIGURE 14 SKETCH WITH PREFUSE FLOW MAP LINES - VERSION 3

Sketch With Prefuse Flow Map Lines - Version 4

In this final version, we modified the flow of the animal feed, so that the crops came together before diverging into feed eaten by dairy cows verses food eaten by all other general livestock. We also clarified the "Animal feed" labels. We eliminated the white transparency over the additional serving icons. Finally, we added arrows to strengthen connection between the crop flow lines and the food groups (Figure 15).

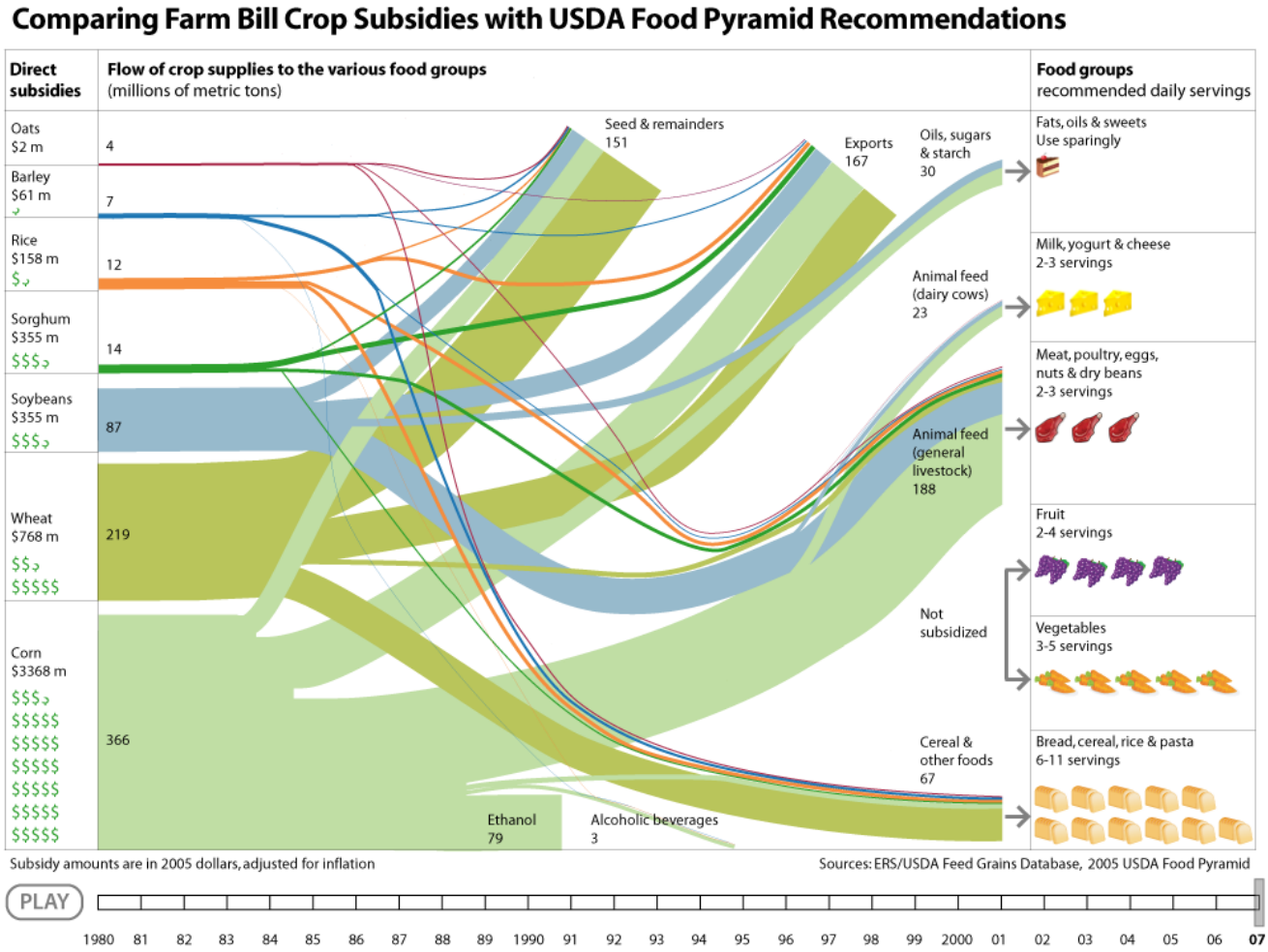


FIGURE 15 SKETCH WITH PREFUSE FLOW MAP LINES - VERSION 4

INFORMAL USER EVALUATION

We showed users our prototype throughout the design process in order to continually iterate and improve upon our design.

TABLE 6
Usability Study Participant Information

Participant #	Gender	Profession	Age	Farm Bill
1	M	Architect	60's	Yes
2	F	iSchool Student	20's	No
3	M	iSchool Student	20's	No
4	M	iSchool Student	30's	No
5	M	Technical Producer	30's	No
6	F	UI/Visual Designer	30's	No
7	M	iSchool Student	30's	No

Conceptual Findings

Flow Map

While all of the users understood that the widths of the flow lines represented differences in magnitude and were able to make sense of the splits in these flows, they also felt that the relationship between the crop supply flows and the USDA recommendations was unclear and not immediately apparent. One user thought there was no connection and that the relations between the supply flow and dietary recommendations were simply different parts of the graph. Most users understood the flow of "Cereal & other foods" into the "Bread, cereal, rice & pasta" food group and found that to be a logical connection since the source of the flow directly contributed to the destination of the flow. However, Users had the most trouble understanding the connection between "Animal Feed" and the Meat and Dairy food groups and found it to be more of a conceptual leap. For example, Participant 2 felt the visualization made it seem like "dairy cows" were a type of Animal Feed instead of animal feed "*consumed by* dairy cows" and further expressed confusion, saying: "animals don't drink their own products, right?"

Disparity Between Crop Subsidies and Dietary Recommendations

Some users did not notice that fruits and vegetables received no subsidies. But, the users who did notice believed the lack of flow into the fruit and vegetables categories was natural since the crops shown on the left were unrelated to those food groups. Also, they assumed the supply flow was the "original ingredient" or the "supply going into production" while the USDA recommendations were the "final end product." They incorrectly deduced a deliberate omission of supply flow for fruits and vegetables.

Design Findings & Changes Made

Based on the feedback from the participants, we incorporated the following ideas into our final design:

- Have all the "Animal Feed" flow come together in one flow before splitting into the separate flows into Meat and Dairy respectively
- Have the "Animal Feed" flow labeled with amount shown only at the final endpoints rather than showing the total before it splits
- Have the non-food group flows end at the top or bottom chalk line, similar to how the food group flows end at the right chalk line.
- Have the flow lines be more continuous rather than using a space and an arrow to indicate their flow into the food group destination points.

CONCLUSION & FUTURE WORK

Working on this Farm Bill visualization has given us a better sense of the true complexity behind such agricultural policy. Visualization in this area requires dealing with numerous unstandardized data sets and understanding quite a bit about agricultural terminology and practices in order to provide the viewer with a complete picture. We feel that our visualization is a successful first step in simplifying the data presentation such that it can be comprehended by anyone, from journalists and Farm Bill advocates to the general public. Given the importance and value of such a visualization, we hope to continue our work by modifying the Prefuse flow map layout source code in order to automate the process of creating the visualization. This would allow us to build out the visualization for all 27 years of data that we have compiled (i.e. from 1980 to 2007) in order to allow for exploration of trends over time.

We also feel our work could greatly benefit from further development in the following areas:

Improving Our Design

Given the feedback from our informal user evaluation, we feel further exploration is needed to determine how to make the connection between what is subsidized and what is recommended more salient. One possibility might include converting the servings on the right to annual servings and showing a ratio of the amount that is subsidized and the amount that is recommended to allow for a more direct comparison.

Incorporating Additional Data Sources

After showing our prototype to C. Edwin Young, Senior Economist for the USDA/ERS, he explained how our view of "Animal feed" flowing into the "Meats" food group was somewhat misleading since we did not take into account the fact that a lot of the meat produced by animals eating soybeans and other grains ends up exported rather than consumed domestically. In the future we would fix this by incorporating data from the ERS/USDA Livestock, Dairy, and Poultry Outlook: Commodity Yearbooks (available at http://www.ers.usda.gov/publications/ldp/yearbooks.htm).

Incorporating Interactivity

Automating the process of creating our visualization would allow us the freedom to further expand upon Ben Shneiderman's "Visual Information Seeking Mantra" [12] and shift from the "Overview first" stage to "zoom and filter" and "details on demand." In its current state, our prototype provides users with an overview of the entire collection of data for one year.

We hope to add brushing functionality that provides users with the ability to highlight a subset of the data (i.e. effectively "zooming" in on it) by isolating specific flows, in order to focus their attention on how these

specified flows change over time, and de-emphasizing the others. We envision this interaction would involve clicking on a specific crop to isolate the flow out of it while the other flows fade into the background or clicking on a specific food group to isolate the flow into it while the other flows would fade into the background.

We also hope to add "details on demand" in the form of mouse-overs and tooltips, so users can view data granularity for each flow and learn more about certain label definitions when needed. We envision this interaction would involve mousing-over a specific crop to view the numbers for the flow out of it or mousing-over a specific good group to view the numbers for flow into it. We also feel that tooltips would enhance users' understanding of certain labels. For example, if a user moused-over the initial flow to the right of each crop, a tooltip would appear saying "Production, Imports, and Beginning Stocks (leftover from the previous year)" to give the user a better understanding of what we mean by "crop supplies" without cluttering up the display space.

REFERENCES

[1] Daniel Imhoff, "Food Fight: The Citizen's Guide to a Food and Farm Bill", University of California Press, February 2007.

[2] Michael Pollan, "You Are What You Grow," New York Times Magazine, April 22, 2007.

[3] Daniel Imhoff, "Food Fight: The 2007 Farm Bill", Center for Ecoliteracy, http://www.ecoliteracy.org/publications/rsl/dan_imhoff_farm_bill.html.

[4] Carole Davis and Etta Saltos, "Dietary Recommendations and How They Have Changed Over Time", USDA/ERS, AIB-750.

[5] Marion Nestle, "Food Politics - How the Food Industry Influences Nutrition and Health", University of California Press, 2002.

[6] John Rennie Short, "Thematic Maps", The World Through Maps: A History of Cartography, Firefly Books, 2003.

[7] Edward R. Tufte, "Graphical Excellence", The Visual Display of Quantitative Information, Graphics Press, Chesire, Connecticut, 2001.

[8] Jeffrey Heer, Prefuse Interactive Information Visualization Toolkit. http://prefuse.org/.

[9] Doantham Phan, Ling Xiao, Ron Yeh, Pat Hanrahan, and Terry Winograd, Flow Map Layout Code, http://graphics.stanford.edu/~dphan/code/flowmap/.

[10] Doantham Phan, Ling Xiao, Ron Yeh, Pat Hanrahan, and Terry Winograd, "Flow Map Layout", *Proceedings of the IEEE Symposium on Information Visualization (INFOVIS'05)*, pp. 219-224, 2005.

[11] Stephen Few, "Designing Dashboard For Usability", Information Dashboard Design The Effective Visual Communication of Data, O'Reilly Media, Inc., January 2006.

[12] Ben Shneiderman, "The Eyes Have It: A task by Data Type Taxonomy for Information Visualizations", In Proceedings IEEE Visual Languages, Boulder, Colorado, pp. 336-343, September 1996.

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