Supporting Environmental Conservation With Information Visualization

Jason E. Petz

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Design

University of Washington
2014

Committee:
Karen Cheng
Tad Hirsch
Kristine Matthews

Program Authorized to Offer Degree:
School of Art,
Visual Communication Design

University of Washington

Abstract

Supporting Environmental Conservation
With Information Visualization

Jason E. Petz

Chair of the Supervisory Committee:
Professor Karen Cheng
Department of Design, Visual Communication

Since the advent of conservation practices, society has become increasingly separated from nature, which has led to a concealment of production from consumers known as the "black box." As a result, consumers rely on certifications to help guide environmentally supportive decisions but do not understand how and why these decisions matter. This project explores how information visualization can enable a better understanding of conservation strategies by revealing the "black box" of production. In particular, it focuses on revealing the complex supply chain of food, guiding consumers from farm to table in an effort to expose decision points to inform sustainable purchasing. Strategies include modeling supply chains and distributing these models by augmenting existing artifacts.

SUPPORTING ENVIRONMENTAL CONSERVATION WITH INFORMATION VISUALIZATION

JASON PETZ
Master of Design Thesis 2014
University of Washington

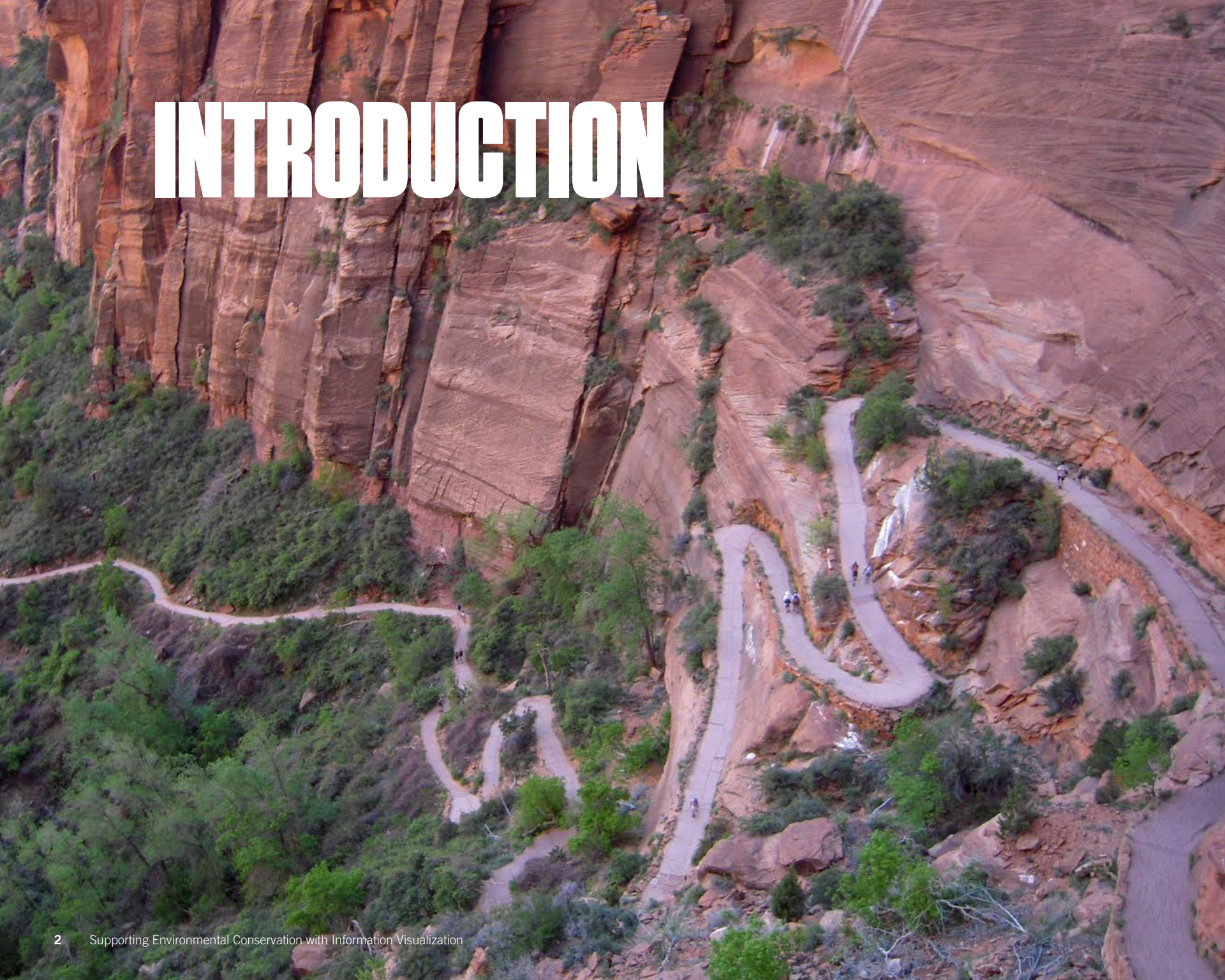

Chex
Bitz
KiX
Fresh Step
Crystals
whiskas
Friskies
Kit 'N Kaboodle
ALLEY CAT
Cat

CAN INFORMATION VISUALIZATION ENABLE A BETTER UNDERSTANDING OF ENVIRONMENTAL CONSERVATION ISSUES AND STRATEGIES?

JASON PETZ
Master of Design Thesis 2014
University of Washington

COMMITTEE
Karen Cheng, Chair
Tad Hirsch
Kristine Matthews

INTRODUCTION



Since the founding of Yellowstone National Park in 1872, governments and non-governmental organizations have demarcated natural spaces as "off limits" by permanently conserving 12.7 percent of total land from human influence.[1] This strategy, often termed *protectionist* or *fortress conservation*,[2] is achieved by removing current residents and usage in order to stop encroaching development, preserve natural heritage, and secure biodiversity for future generations. In some extreme cases, such as Yosemite National Park, indigenous communities were physically removed to ensure that nature was not impacted by human settlement.[3]

While such conservation is effective in preserving natural spaces, there are several unforeseen consequences aside from residential displacement. Protecting one area increases stress and demand on neighboring non-conserved resources, resulting in greater resource depletion from the latter.[4] Conservation can also shift the meaning of criminality; once elephant poaching was forbidden through conservation, the cost of ivory skyrocketed, resulting in an increased demand for what is now a lucrative, illegal substance.[5] Most importantly—and the focus of this research—conservation forces a cultural shift in how people view wilderness. By placing areas into protection, the resulting effect is an increased separation between nature and society.[6]

Today, this nature/society separation has become so distinct that humans are unable to have direct experiences with nature without going through intentional, pre-designed channels. Take visiting a national park, for example. Such a vacation has become synonymous with the American wilderness tradition. However, the experience is anything but natural. People interact with the area through constructed viewpoints, trails and visitor centers, all of which have been designed to maximize the "natural" experience.

While there are many valid arguments on the positive effects of such experiences, the increasing separation between nature and society has led to what Dan Brockington, Professor of Conservation and Development at the School of Environment at the University of Manchester, United Kingdom, refers to in Nature Unbound as a "commodification of natural dynamics." He posits that our society is increasingly giving nature an economic value that allows to it be traded and consumed. This phenomenon is most evident through mitigating services, which he describes as "the idea that conservation can offset the ecological impacts of economic growth."[7]

For example, if a person travels between Los Angeles and New York by plane, he can elect to donate money to planting trees that offset the carbon emissions of his travel, in a process known as carbon offsetting. From this perspective, the proper course of action in protecting environmental systems is simply better consumption. However, consumers should not believe that by selecting certain products or offsetting purchasing decisions, they are absolved of environmental responsibility—such a strategy shifts the onus of stewardship to environmental and conservation professionals. This behavior does not inform consumers of environmental cost but rather simplifies it. As a result, people are not necessarily thinking critically about consumption but rather restructuring it to work within the conservation ideal.

Perhaps what is missing from the strategy of mitigation is a greater understanding and consideration of the multiple steps and processes that occur between the origination of a product and the final end-consumption. Currently, market systems are structured to conceal these steps and processes—in fact, this concealment is known as the "black box" of production.[8] Consumers understand that products have to originate from a source somewhere, but how that origination occurs, or the steps that are needed to bring the product to market are, to most, not well understood. Without this information, people rely on simple signifiers—such as ecological product certifications— to guide decision-making. However, this reliance on one-dimensional (good or bad) labels encourages the public to continue their existing consumptive practices without engaging audiences in understanding more complex system dynamics. That is, practices such as certification and the purchase of carbon offsets do not provide an accurate or nuanced view of the global effects of selecting one product over another.

This project explores how to visualize what occurs between nature and society. By creating an effective visualization, people may be able to gain an understanding of what is concealed by the "black box," which in turn can support critical thinking about consumption and conservation. As stated by Dan Brockington:

> "Bringing about this awareness is a special kind of challenge since it requires people not only to see the connections between their consumption and environmental problems, but also for them to conclude that it is in their own interest to voluntarily reduce their consumption."[9]

Without this understanding about how choices impact the environment, decisions are being made simply by what is signified on packaging, which results in a dearth of critical thinking about environmental issues. Exposing the processes concealed by the "black box" may increase a person's literacy about conservation, certifications and consumption, allowing them to make more informed decisions in regards to environmental stewardship.

FOCUS ON FOOD

With consumption serving as a foundational component of our society, tackling the vast range of products may be insurmountable for this thesis. Production processes can be revealed for simple, everyday objects such as paperclips, to large one-time purchases like automobiles, or even the effects of systematic, intangible consumption such as blacktop roadways. Therefore, there is a need for boundaries to explore these ideas fully without overwhelming both viewers and author with information. Therefore, this thesis focuses specifically on food. Not only does food provide realistic boundaries to scope, all people purchase and consume food several times a day. Plus, grocery stores are flooded with certifications that inform purchases without revealing production processes. It is a quintessential market where people rely on signs, symbols and marketing to guide decision-making.

INFORMATION VISUALIZATION

By visualizing and distilling complex information about systems, design may be able to reveal hidden connections between society and nature. These information visualizations may be able to support environmental advocacy by structuring data into digestible and understandable formats that guide conversation and create greater understanding. The potential for information visualization as an appropriate method is two-fold. First, it can help expose the effect of individual actions in a local context, quantifying the impact of simple behaviors on everyday life. Second, visualizations can help remove misinformed opinions, demonstrating that by rethinking certain actions, it is possible to conserve resources through local, everyday decisions. Together, there is potential to use information visualization to educate people about the systemic ramifications of ecological choices by revealing the "black box" of production.

According to Kim Fulton, Professor and Acting Head of the Department of Science and Technology Studies at Rensselaer Polytechnic Institute, information systems are appropriate methodologies for environmental communication since they are "attuned to the material, political, and technological realities [in which they work], and to the social actors who will be its user." Stated more simply: situated to work in a localized context (i.e., work directly in the audience's environment).[10] Fulton goes on to explain that this localization is critically important for advocating with information. Within a globalized world, even small local decisions can be part of complicated international supply chains and processes, but these decisions may seem insignificant or unrelated.[11] By formatting information within a local context, data visualizations can provide a bridge between a person's everyday actions and large societal issues.

Localization can also encourage more meaningful processing of information, since it will connect with deeper emotions and beliefs. When people are confronted with communication materials, information is processed by either the central or peripheral route of cognition.[12] With the latter, information is weighed not by the validity of facts or quality of argument but rather by positive or negative cues correlated with a person's past experience and preferences. For example, if a person views an advertisement for running shoes but is not an avid runner, he will be more swayed by the persuasion attempt if the advertisement features a famous celebrity or model that the person either admires or finds physically attractive. The reaction will be of low emotional character and fleeting, and beyond any compulsive effects will result in little long-term shifts in thinking.

The opposite effect, created by the central route of cognition, is activated when the information presented has a strong relation to a person's life. With the shoe example again, if the viewer is an avid runner with strong personal involvement in the sport, he will be more concerned with the product specifications, materials and performance. Therefore, if information is presented in a local context that in turn activates the central route of cognition, it will encourage deeper reasoning and stronger emotional involvement on part of the viewer.

Beyond revealing localized effects, information visualization can correct misinformation and debunk closely-held-yet-incorrect beliefs better than verbal or written communication. A study conducted by Brendan Nyhan, Assistant Professor in the Department of Government at Dartmouth College, and Jason Reifler, Senior Lecturer of Politics at the University of Exeter, United Kingdom, showed that information presented in graphical format helps eliminate counter-arguments, and can increase the chance of persuading behavior changes and loosening deep-seated beliefs.[13] By structuring communication as quantitative visualizations, there is potential to persuade not only those who either already support or are undecided about an argument but also those who are currently opposed. With an April 2014 Gallup poll documenting that U.S. residents are becoming more skeptical of environmental issues,[14] using data visualization to inform conservation and environmental literacy has potential to reverse this trend.

RESEARCH

"It's hard because the labeling is not very clear a lot of the time, especially with beef. All of the beef in the butcher shop doesn't say where it comes from. It's just clear plastic wrapped. It doesn't say if they are grassfed or grain-fed, and I don't have any idea. But I have also been buying more yogurt. On that labeling it is grass-fed cows that produce the milk, so that makes me feel good. I definitely feel it is healthier. I use to get grass-fed beef at the farmer's market, too, but it was just too expensive. I just end up cooking a lot more chicken because that seems to be better labeled, and you don't have to worry about grassfed chickens."

Interview participant, November 2, 2013

Prior to commencing visualization, research was done regarding current conservation and culture scholarship, and to gauge how everyday consumers view food consumption in regards to conservation. Research consisted of three methods: a literature review, in-person interviews, and observation studies. These methods are described in greater detail in this section.

The literature review was performed first to understand current challenges and successes with conservation as well as advocacy and persuasion methodologies. An additional goal of the literature review was to explore information design best practices. Findings from the literature review—many of which are expressed in the introduction of this paper—informed how to conduct the interviews and observation studies. Overall, the goals for all three methods are to gauge consumers' current understanding of markets and conservation, to confirm that the "black box" phenomenon accurately describes consumptive behavior, and to understand how consumers shop for food to inform tool development for potential designed interventions.

LITERATURE REVIEW[15]

Articles and books were sourced from three areas: environmental conservation and communication; advocacy and persuasion theory; and best practices in information design and data visualization. A partial list is detailed below. While this list does not include every source, the most influential writings for this project have been selected.

Environmental conservation and communication: literature discusses the history of conservation in the United States, including how conservation is practiced, and how environmental ethics and values are communicated.

Advocacy and persuasion theory: literature examines the methodologies for how people are persuaded to take certain actions. Many articles were found in journals of business and consumer marketing, where the intent is to sell specific products and services.

Information design and data visualization: literature discusses theories of visual perception, and suggests best practices when communicating with data and information graphics.

The literature review assisted in determining both the scope of this project and an understanding of context. Plus, it shaped the structure of the interviews and observation studies, explained further in the next section.

INTERVIEWS & OBSERVATION METHODS

Observation studies were performed to witness how consumers navigate consumption experiences with (or in select cases without) an environmental lens. These studies were followed by interviews to provide a narrative description of consumption and environmental literacy that would be difficult to achieve during observation. The intended goals for both studies were to confirm that consumption relies on certifications and other signifiers rather than critical consideration of environmental issues, and to gauge participants' current environmental literacy in regards to conservation and food issues.[16]

Eleven participants were selected to participate in an interview and observation study. Participants were roughly equally split male and female—five men and six women—predominantly college educated, and between 26 to 36 years in age. Of the eleven participants, six were in a committed relationship with each other. Participants received modest compensation (20 dollars), and interactions were tape-recorded.

Participants were shadowed as they shopped for groceries.[17] Then, they were interviewed for approximately 45 minutes regarding their shopping habits and perspectives about food. Interviews were conducted in a semi-structured format; questions were asked around four general categories—cooking background, shopping, meal preparation and seafood—though exact questions were customized per participant.

OBSERVATION FINDINGS

Surprisingly, of the nine participants that agreed to observation study, only three grocery stores were patronized: Amazon Fresh, an online food retail operation where purchased food is delivered to a home address the same day; New Seasons Market, a natural food market based in Portland, Oregon; and Trader Joe's, a supplier of predominantly higher-quality prepared foods.[18] While these locations differ in brand and food philosophies, there were similarities in experience between participants:

- All decisions were made prior to going to the market. Participants either prepared a list, or the meal being prepared was so frequently cooked that ingredients were memorized.
- Participants do not decide whether they will buy a certain certified product before shopping (i.e., listings "grass-fed beef" on their shopping lists).
- Deviations occurred because of price. Participants were more likely to not skimp on quality and certifications of proteins, sacrificing environmental quality in other ingredients to meet budget expectations.
- While there was occasional impulse shopping—often dictated by sale items—participants did not deviate widely from lists.

Overall, regardless of location, quality and enjoyment, shopping was seen as a chore. It was more important that grocery shopping happened quickly then the right ingredients were sourced. As a result, participants relied on certifications to assist in quick decision-making but rarely pondered the meaning behind such signifiers.

INTERVIEW FINDINGS

Most participants expressed a concern for environmental issues, but nearly all expressed confusion over what was a proper choice. For example, while participants admitted to selecting food due to a certification, they could not explain what processes had to be followed to grant such certifications. A few participants did express detailed knowledge regarding select certifications. However, this knowledge was heavily recited from a trusted source. In a sense, their response was primed from a trusted messenger with little deviation or understanding. Regardless of certifications, most participants were unclear about how food moves from farm to table.

Environmental awareness ranged wildly among participants, with some reciting deep knowledge on selected issues and others reciting shallow-but-broad knowledge on environmental concerns. A select few admitted to not considering any environmental issues when shopping; to these participants, the problem is so far advanced that their single actions will not have a large enough impact. Overall, there were few commonalities in how well versed participants were in conservation and the environment.

SUMMARY

Together, the observation studies and interviews provided three key findings. First, environmental literacy is either low or unfocused; many participants guessed at meanings of certifications and were unsure about their knowledge. Second, because shopping is approached with efficiency in mind, participants do not stop and consider their choices in markets. Rather, they rely on certifications (and price) to make quick decisions. Finally, there is overall confusion about food consumption and environmental issues are related and impact each other.

Most of these findings could be influenced by the lack of knowledge that is concealed by the "black box." Plus, what knowledge was expressed was not done with confidence; occasionally, participants would even express questionable or wrong information. Referring back to the study by Nyhan and Reifler,[19] information visualization could be used to correct this misinformation, while at the same time expose the "black box" of production to inform conservation behavior.

REVEALING THE BLACK BOX

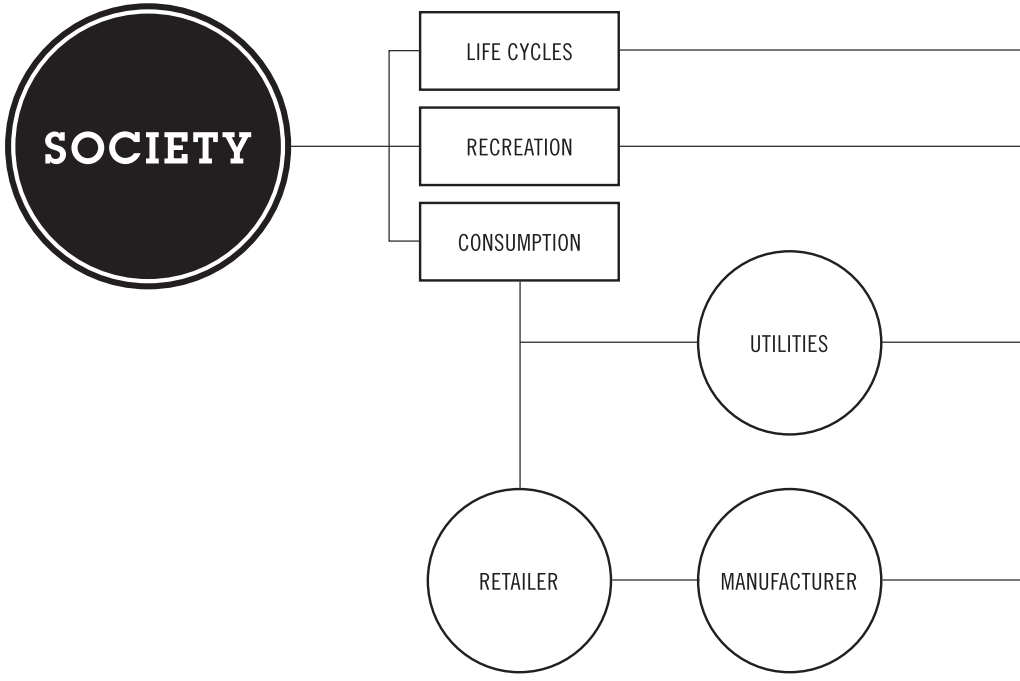
Initial steps focused on modeling the complete interaction between society and nature, not just food. The intention with this broader scope was to demonstrate how the separation between society and nature has expanded to nearly all forms of consumption, not just what consumers eat and drink.

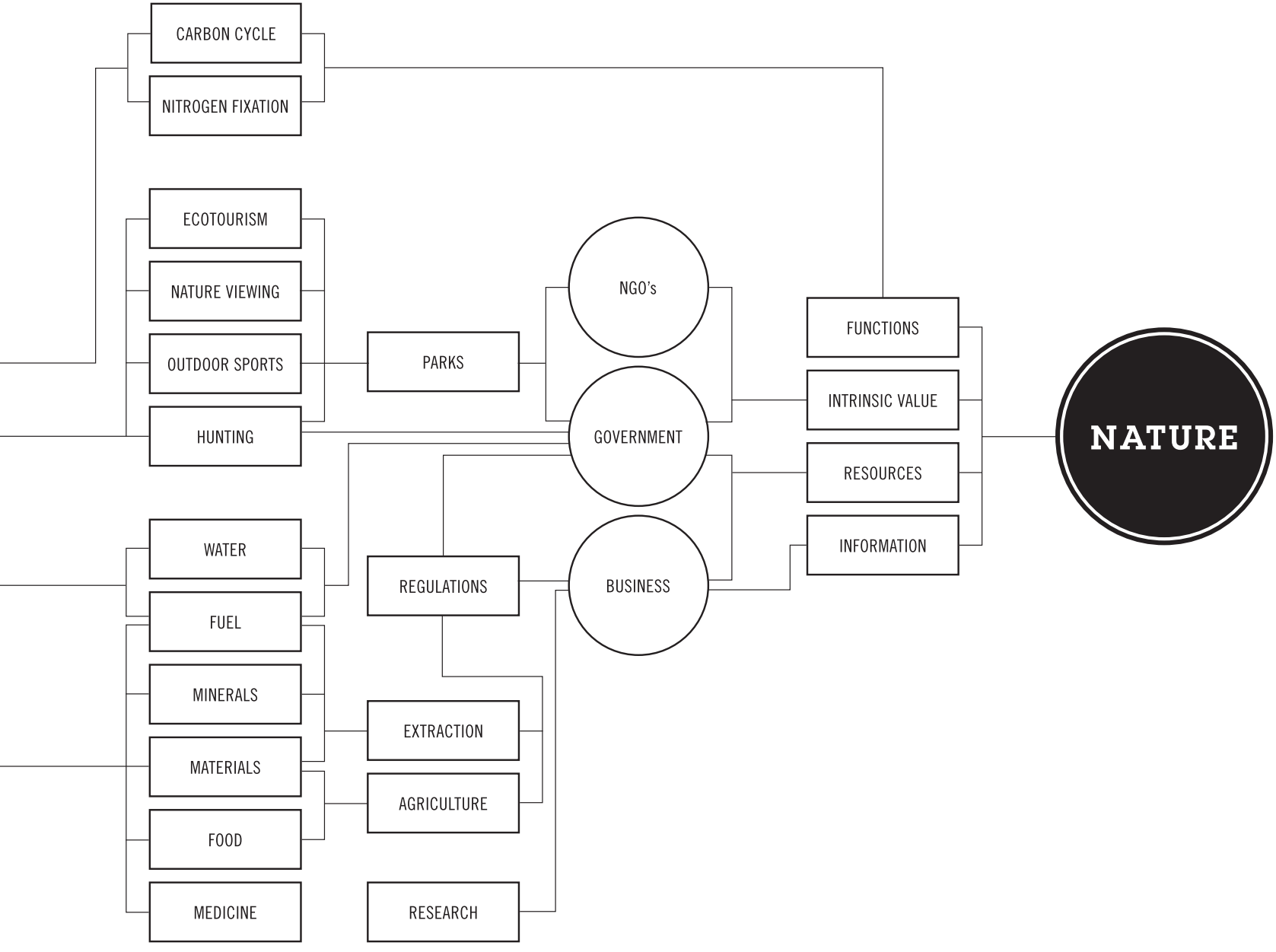
SEPARATION 1.0

The first iteration mimics a standard decision tree, with certain shapes representing specific processes. In the image to the right, rectangles represent products and systems, and circles are used for regulating bodies and organizations. Along with data from the USDA, this chart features information sourced from Mulder and Coppolillo's textbook on conservation, culture and economics, Conservation. In particular, that book argues that society has three general needs that originate from nature: life cycles, recreation and consumption. Nature fulfills these needs through four general services: life functions, resources, biological information and intrinsic value.[20]

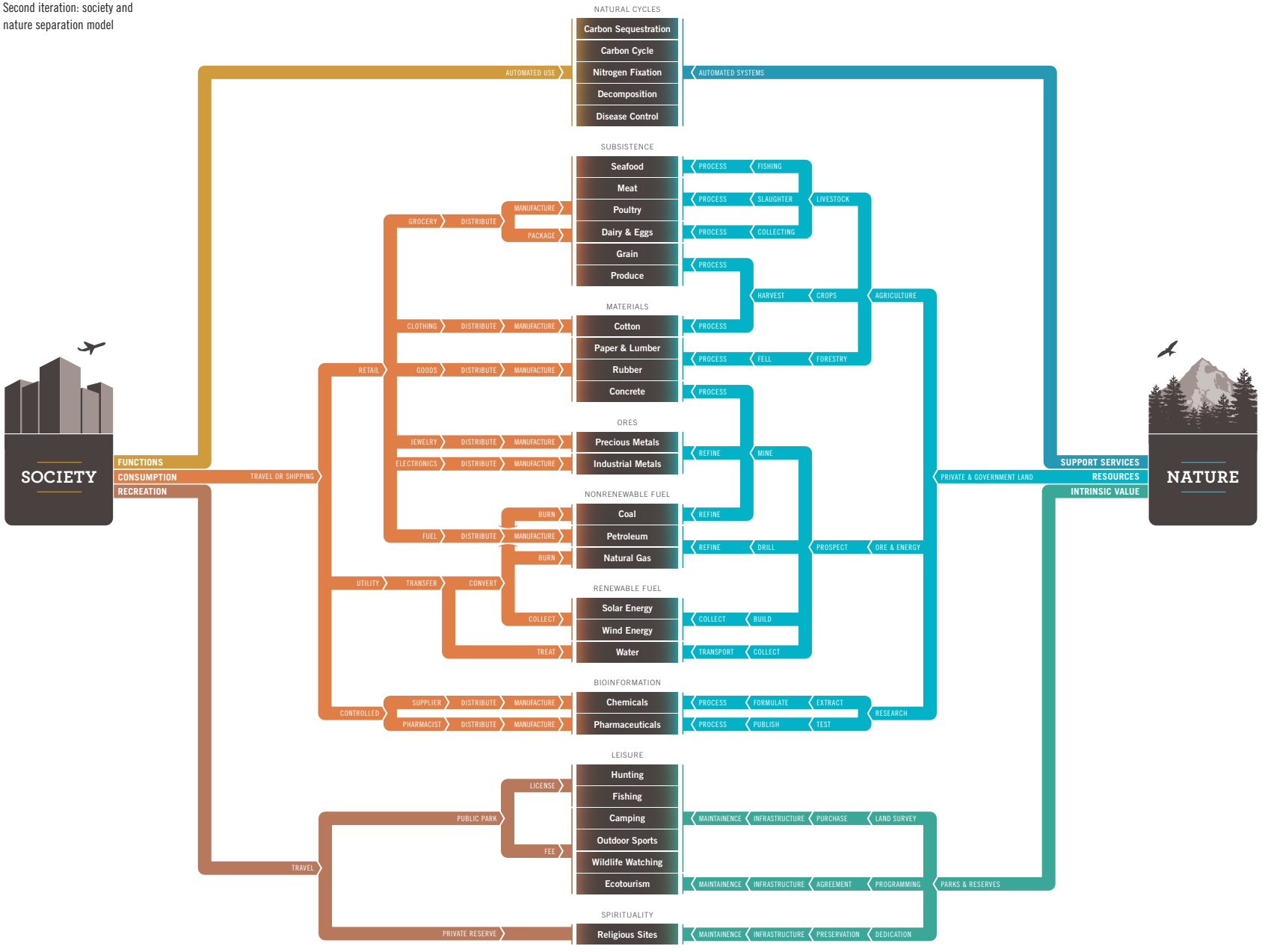
The level of complexity between the needs of humans and the services provided by nature varies in terms of human intervention and involvement. For example, human respiration/ breathing is naturally facilitated by nature's carbon cycle, and therefore occurs without interaction. In contrast, visiting the Grand Canyon is more complicated; not only do park facilities have to be constructed as designed experiences, people also have to physically travel to the location. Human consumption requires the most interventions and steps. Eating an apple, for example, can require farms, regulations, distributers and retailers.

Society and nature separation model




CARBON CYCLE
NITROGEN FIXATION
ECOTOURISM
NATURE VIEWING
OUTDOOR SPORTS
HUNTING
PARKS
NGO's
GOVERNMENT
BUSINESS
FUNCTIONS
INTRINSIC VALUE
RESOURCES
INFORMATION
NATURE
WATER
FUEL
MINERALS
MATERIALS
FOOD
MEDICINE
REGULATIONS
EXTRACTION
AGRICULTURE
RESEARCH

Second iteration: society and nature separation model



SEPARATION 2.0

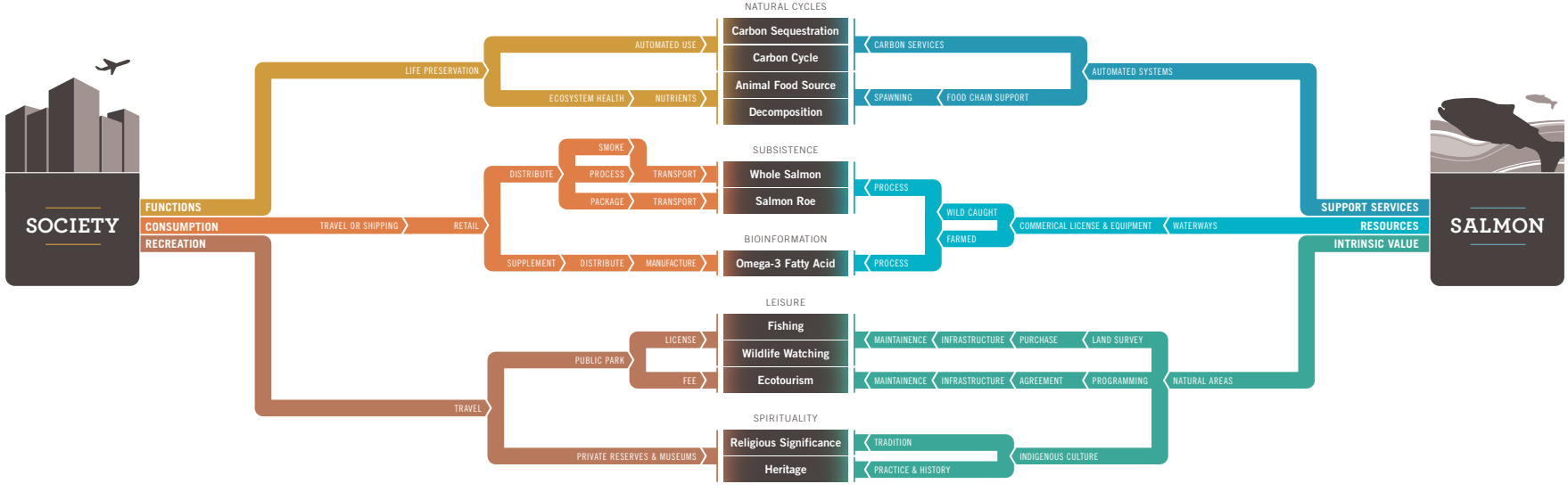
The next iteration of the separation model greatly expands upon the first iteration described on page X. Nature's services are combined to make three general categories: support services, resources and intrinsic value. Products are identified in the center column, and are grouped into categories to clarify similarities between commodities. Instead of having various icons for organizations and processes, all steps are treated equally so as not to over- or underemphasize differing processes. Lastly, pathways were cleaned up by minimizing overlap and directional changes to make them easier to visually follow.

USING THE SEPARATION MODELS

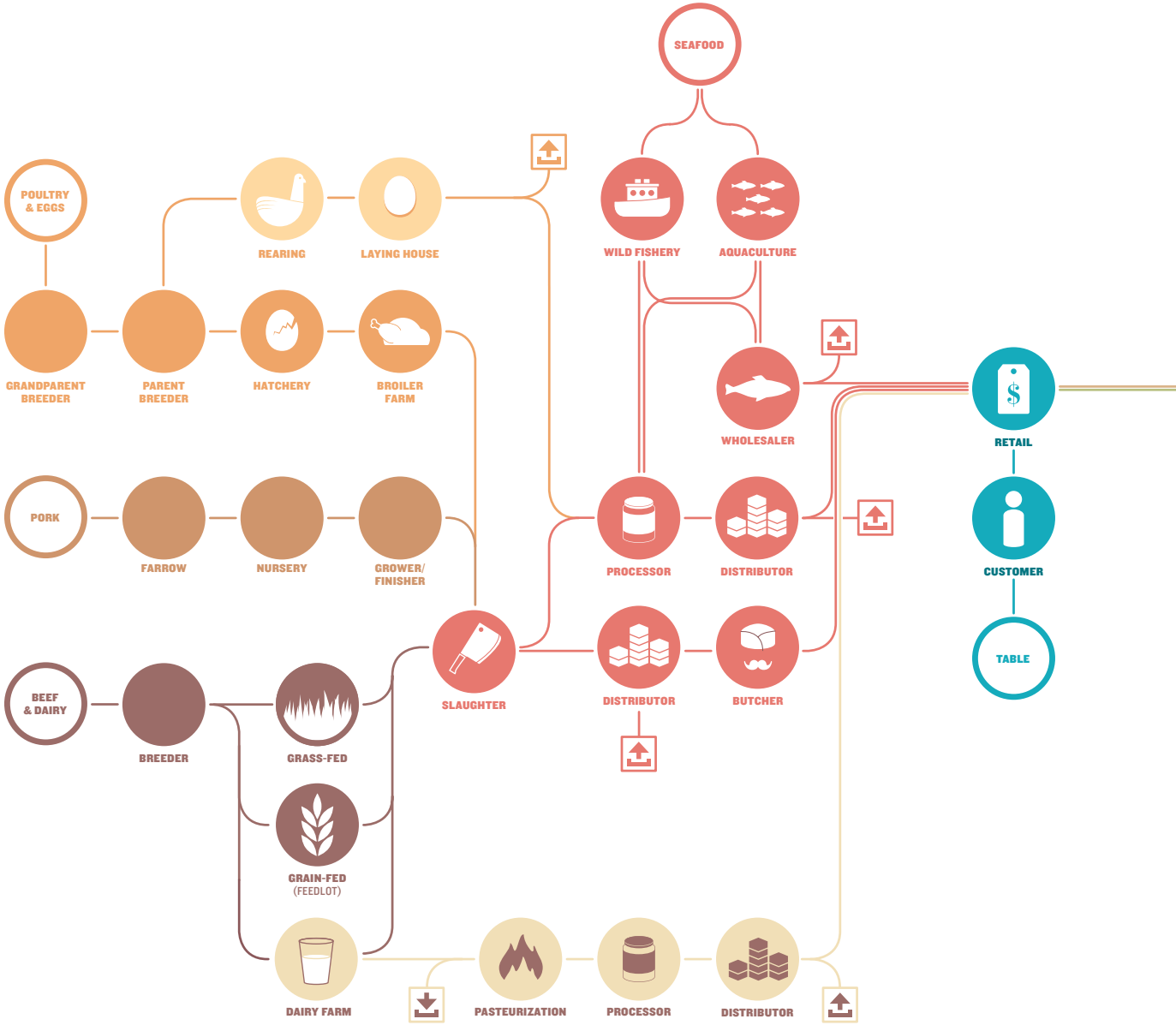
While there is potential for using the entire model as a large system map, focusing on a specific product can help narrow the amount of information presented to viewers to avoid information overload. The example below shows how the separation of society and nature graph would be constructed for salmon. Doing so reveals that salmon is not just food; salmon offer many benefits to society ranging from carbon sequestration to religious significance. Therefore, to avoid information overload, this model can be customized for particular products or even sub-products, such as focusing specifically on the consumption to resources pathway in the image below.

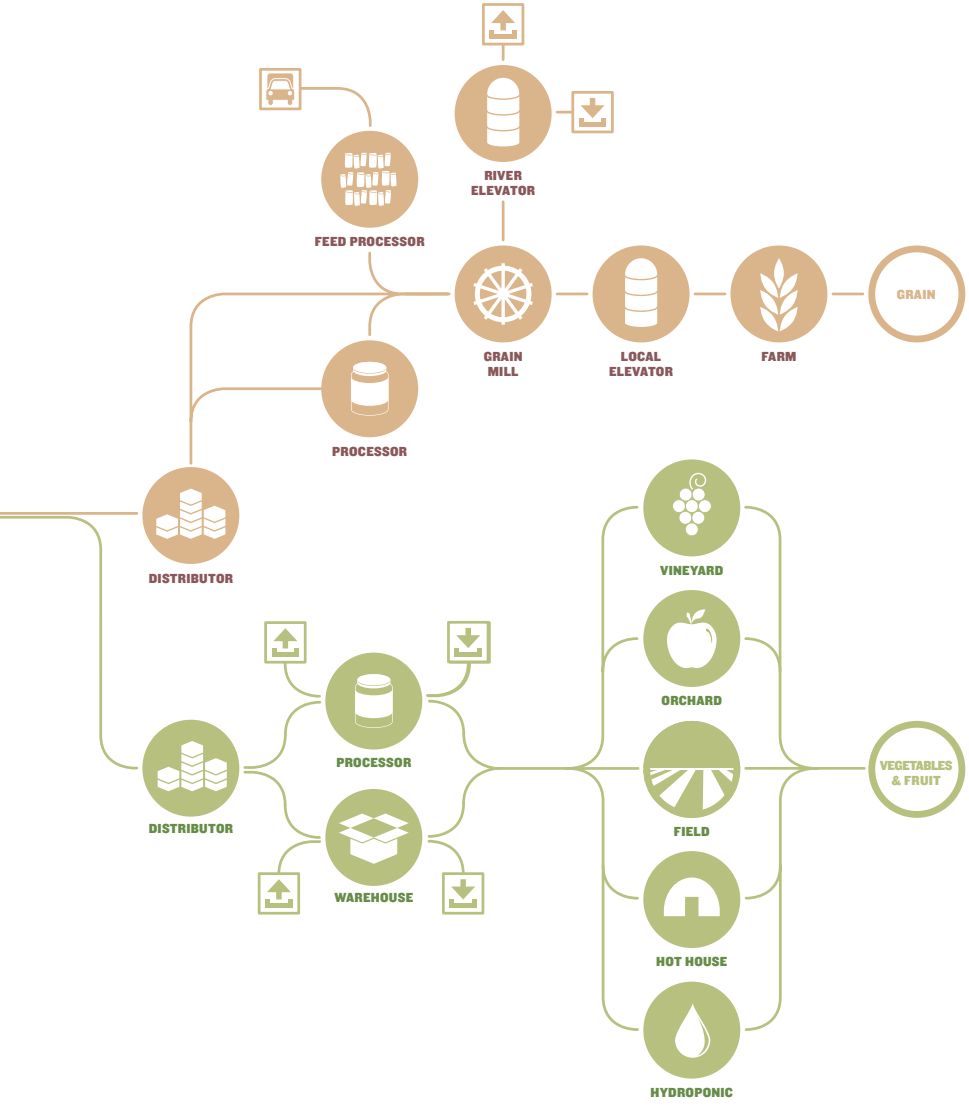
The question that arises, however, is if the amount of information expressed is adequate to correct environmental misinformation and expose the "black box" enough for critical thinking? The system level perspective currently generalizes categories in order to reduce information, but to show specific products like market-ready salmon would result in a plethora of small charts for every single product. While this visualization communicates that the separation between society and nature is evident, and in some cases, complex, it does not provide any information that could be actionable or impact a consumer's life. The visualization depicts the framework without any guiding narrative.

Society and nature separation model customized for salmon



Food system model that demonstrates how food products travel from origination to market





FOCUSING ON THE FOOD SYSTEM

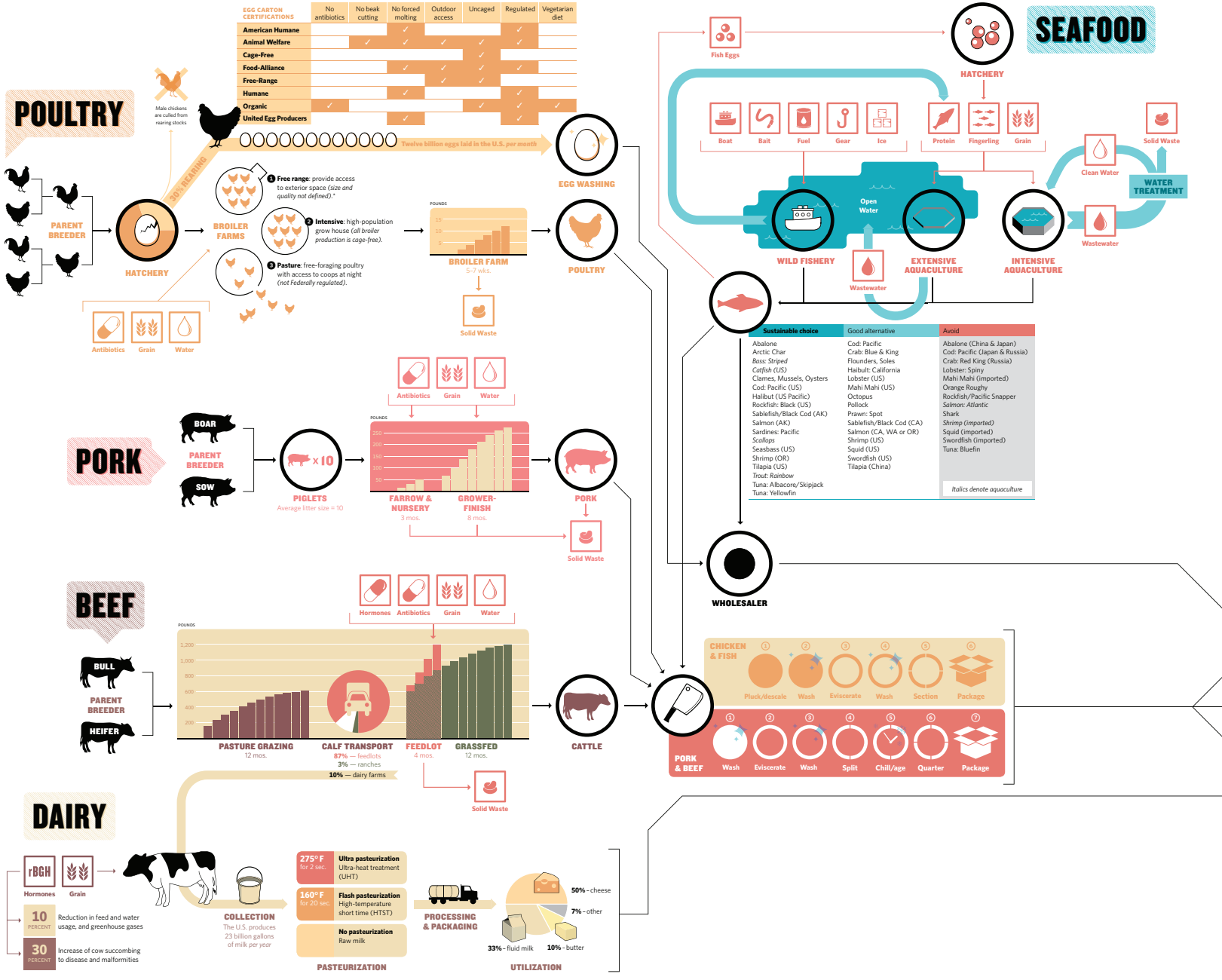
To begin making the visualization more applicable for market experiences, all items except for food were eliminated. Also, instead of showing how items travel from nature to product, then from product to society, information was structured to begin from product origination and to end at the supermarket. Most people have little to no influence over how food is initially produced (i.e., from seed or reproduction). Therefore, that information was minimized to allow for greater emphasis on production processes.

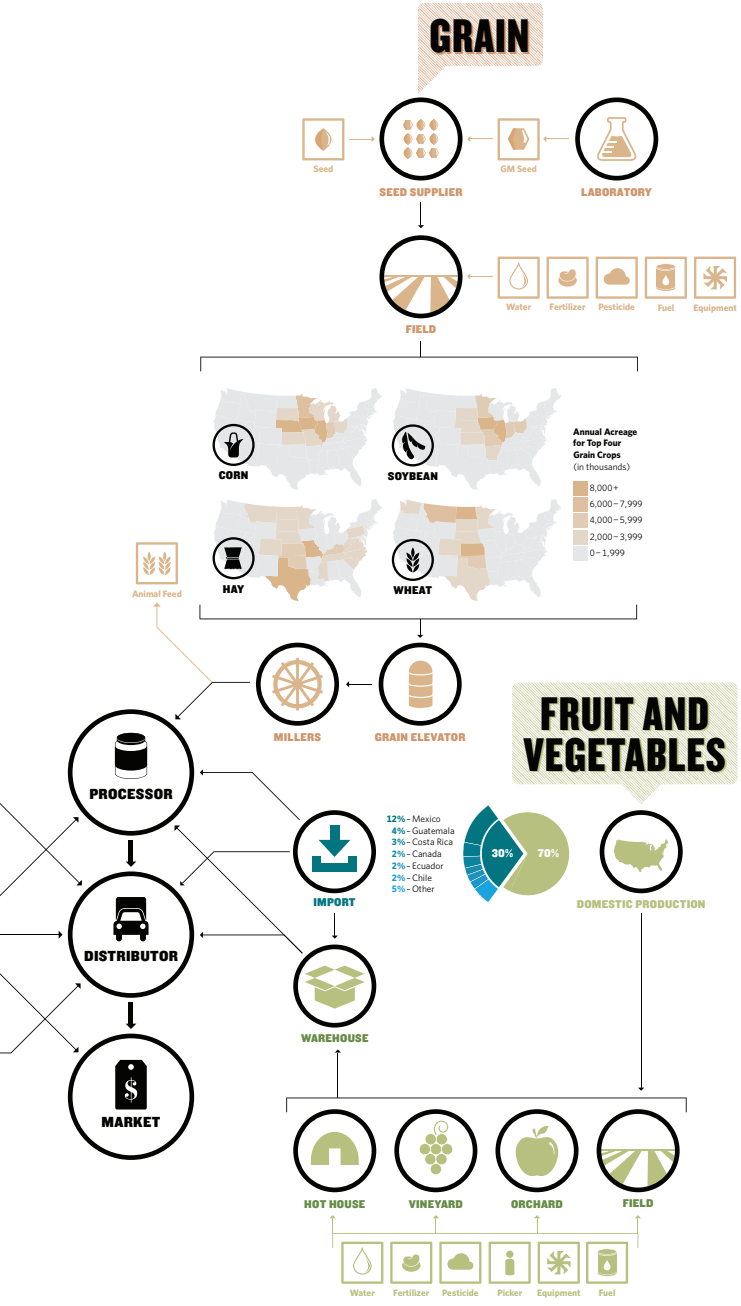
Information between market and table has also been greatly condensed. While there are many steps between shopping and consumption, the actual steps are varied for each consumer. For example, participants from the observation study who shopped through Amazon Fresh had a different experience than those that drove to the grocery store. While there is validity in discussion carbon emissions and transportation methods, these details muddle the argument on revealing the "black box."

FOOD SYSTEM 1.0

The food system model organizes information into a tree-branch format. Different food products start on the exterior branches and work down to the common root, in this case "table." The product segmentation is influenced by how the USDA compiles information: beef, pork, seafood, poultry, eggs, dairy, grain, and fruit and vegetables.[21] This visualization demonstrates that different groups coalesce into similar processes. For example, all meat products, whether beef or seafood or poultry, all proceed to slaughterhouses. However, this model still suffers from the same lack of information as the previous separation model, calling into question its effectiveness in revealing production processes.

Annotated food system model that demonstrates how food products travel from origination to market with additional information





FOOD SYSTEM 2.0

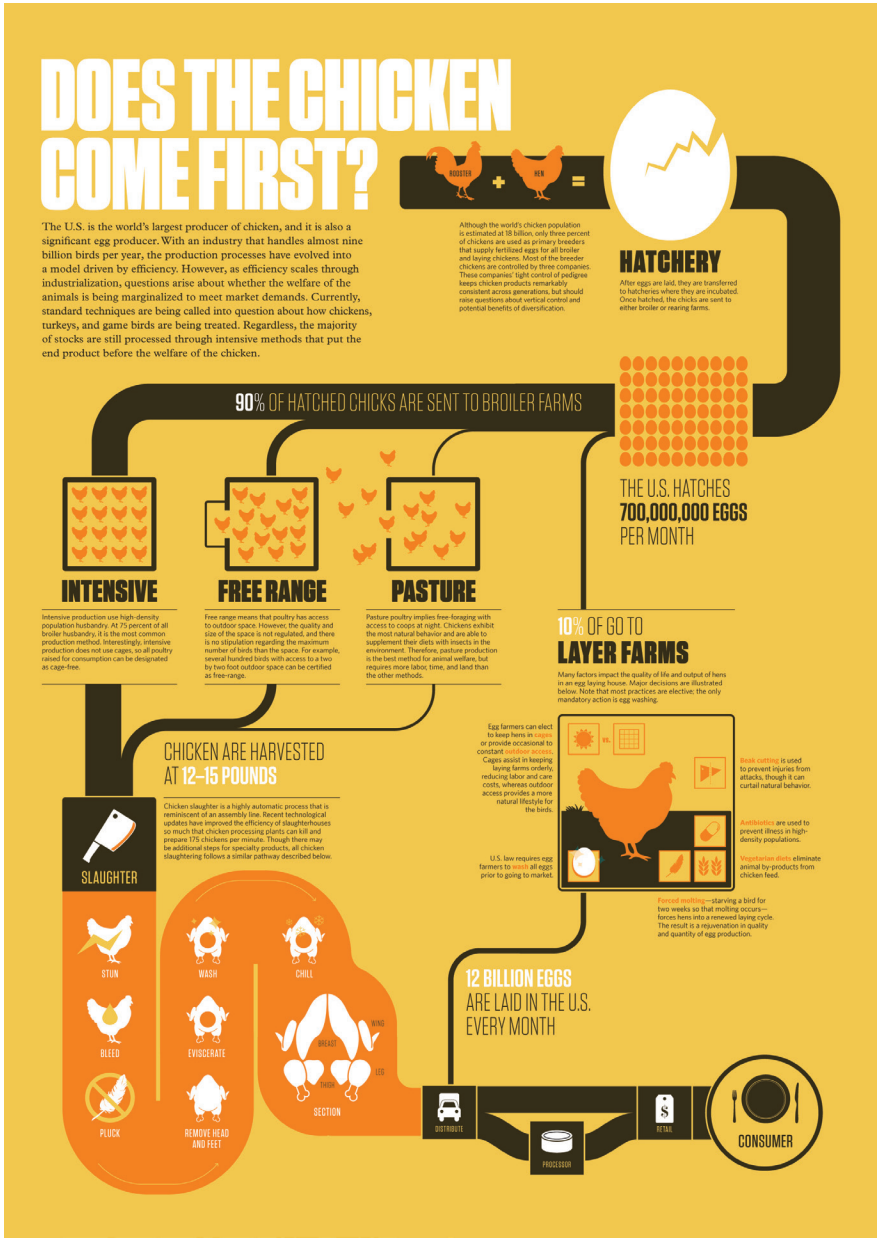
To begin incorporating more information beyond just process identification, the food system model was augmented with additional information on certifications, quantities, and production options. For example, instead of poultry leading from hatchery to boiler farm, it now depicts the different finishing options—intensive, free-range, and pasture—paired with brief descriptions. In addition, consumers have a bird's eye view of the entire system at once. However, this amount of information is very complex. With multiple multi-directional pathways and several starting points, this model is very difficult for users to visually enter. To help alleviate the confusing existing in the previous model, separate models were created for each of the USDA food divisions.

Instead of bombarding consumers with all information at once, the subsequent approach focuses on one particular food at a time. Unlike the complete system perspective, this approach is much easier to visually enter. And, by being presented in a more digestible format, the movement throughout the pathway is simpler to follow. However, it still lacks a clear starting point, and by giving equal weight to all facets, it is unclear on what information is priority for consumers.

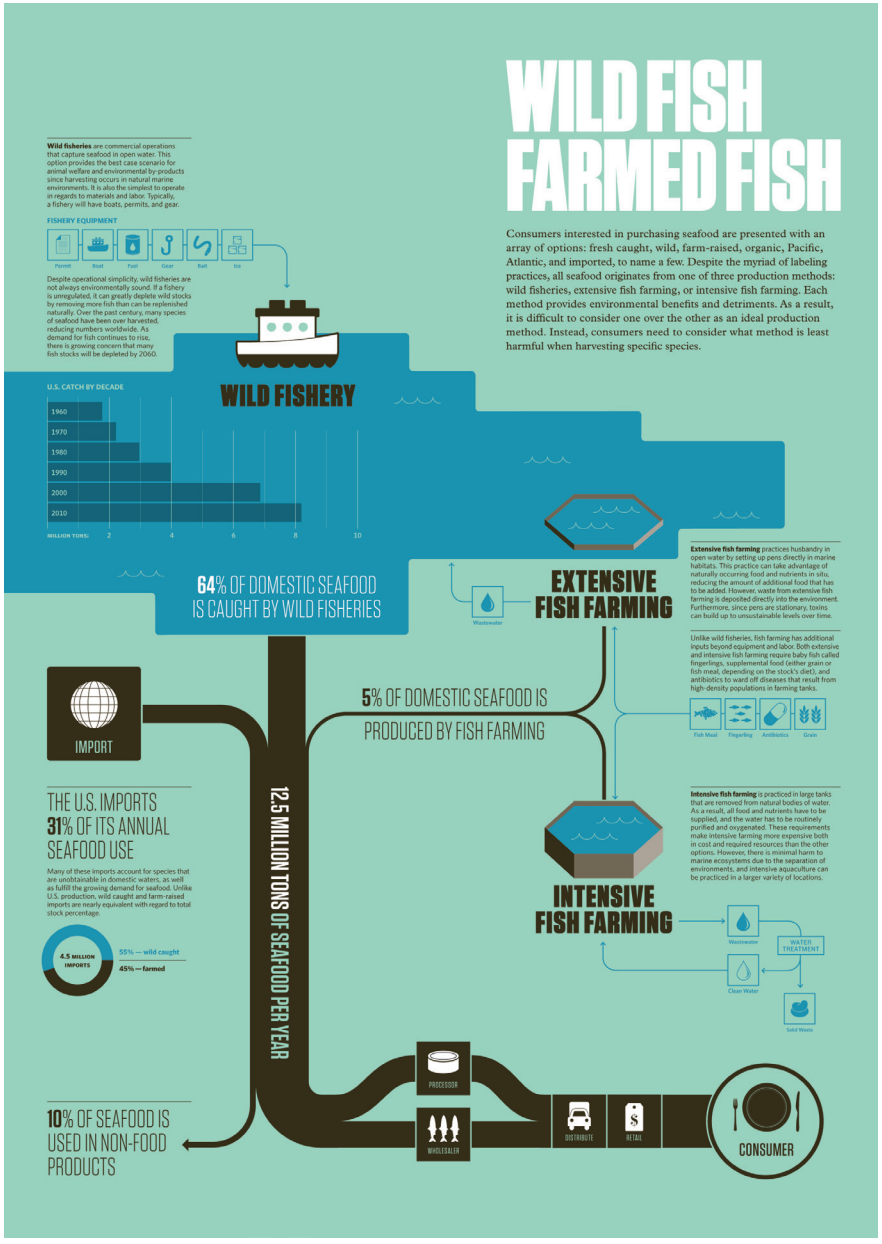
INFORMATION PATHWAY 2.0

Using individual pathways as inspiration, this next generation of models all have a clear starting point. The pathways are done as Sankey diagrams, with the width of the pathway fluctuating to denote the proportion of products that are allocated to each production method. Along this pathway, there are opportunities to highlight key statistics and information with additional graphics. By adjusting the hierarchy between information, the more salient points for consumers (such as what percentage of grains are genetically-modified for each variety) can be maximized in relationship to less actionable information.

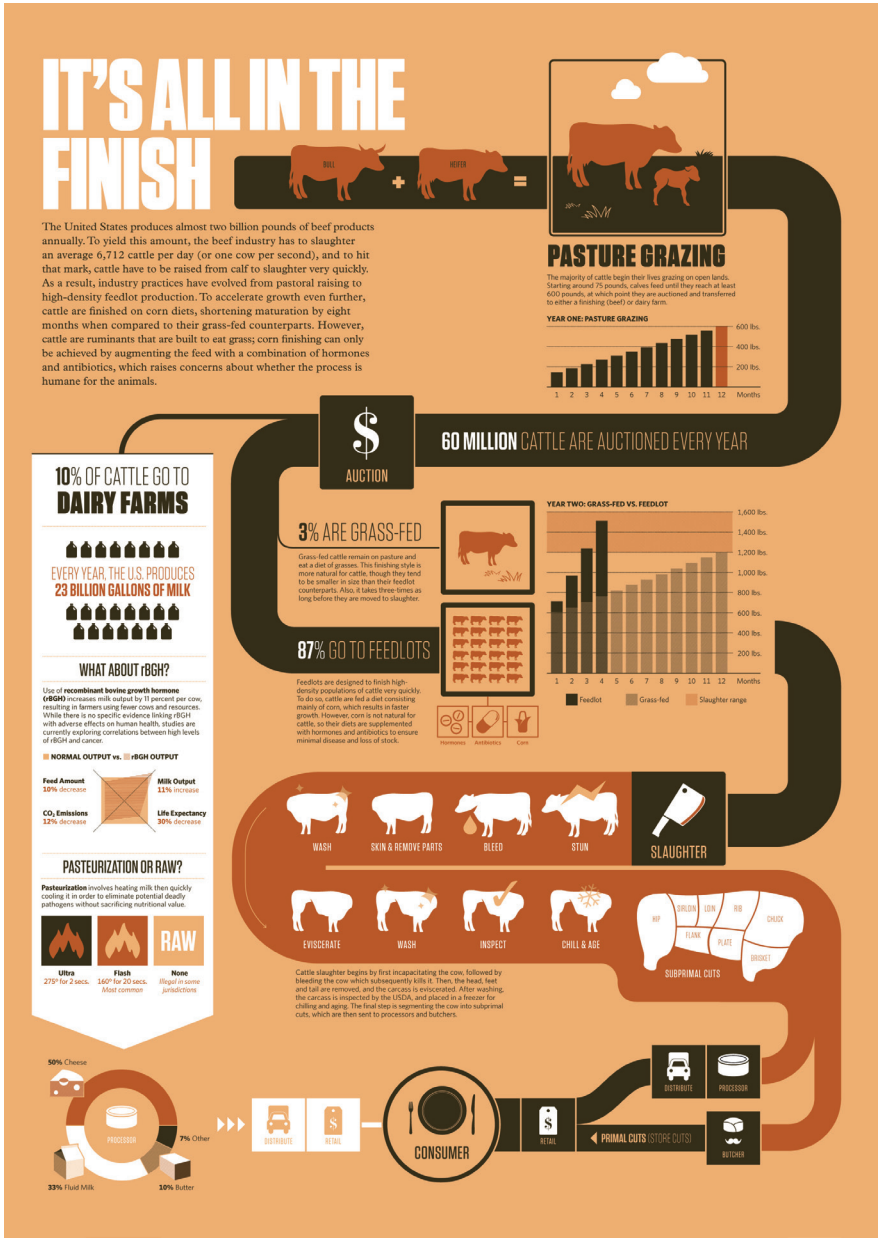
Five pathways were constructed: poultry and eggs, seafood, beef and dairy, grain, and fruit and vegetables. Each expanded Sankey diagram demonstrates how the particular food type is sourced, produced and distributed. By examining each supply chain, consumers might be able to gain an understanding of what happens within the "black box" of production, which in turn could encourage critical thinking about consumption and conservation.



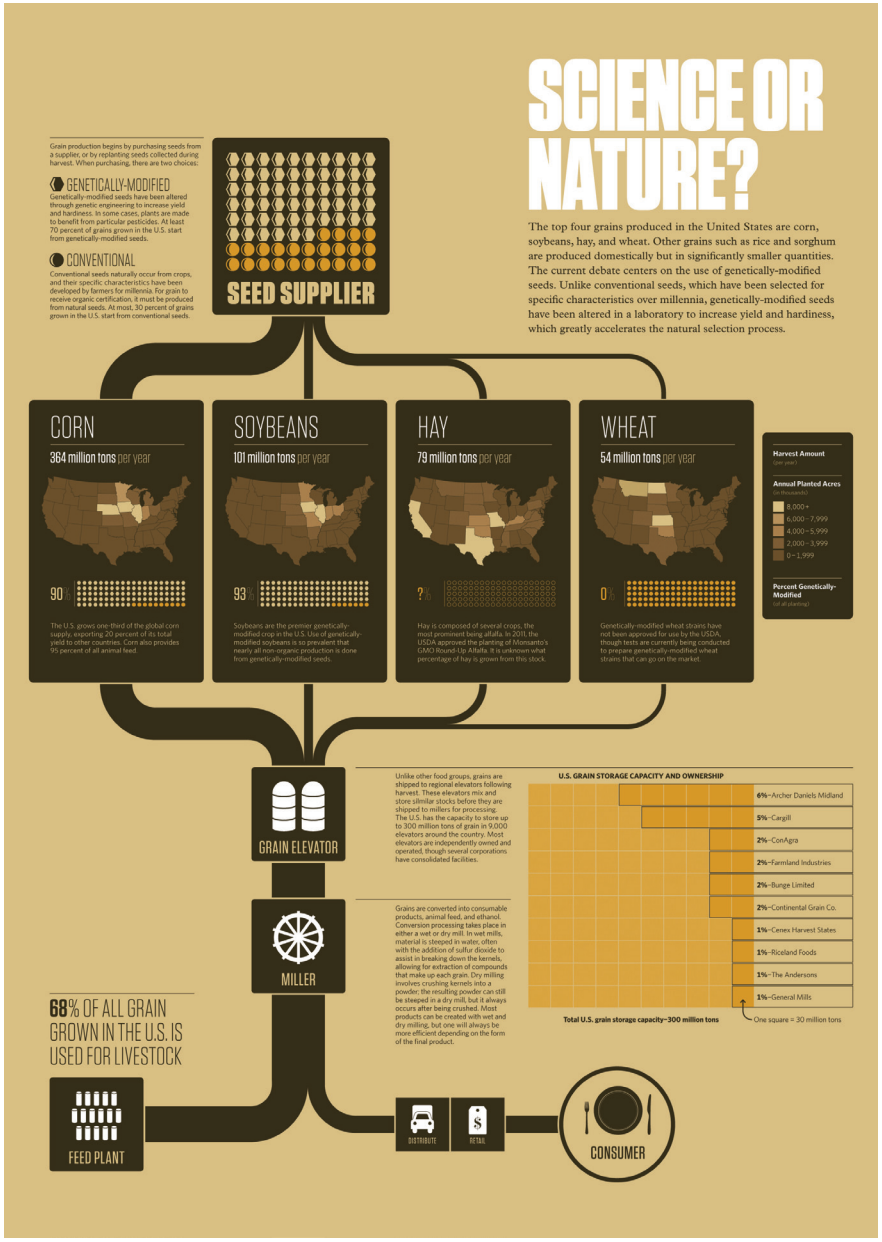
Poultry and eggs Sankey model



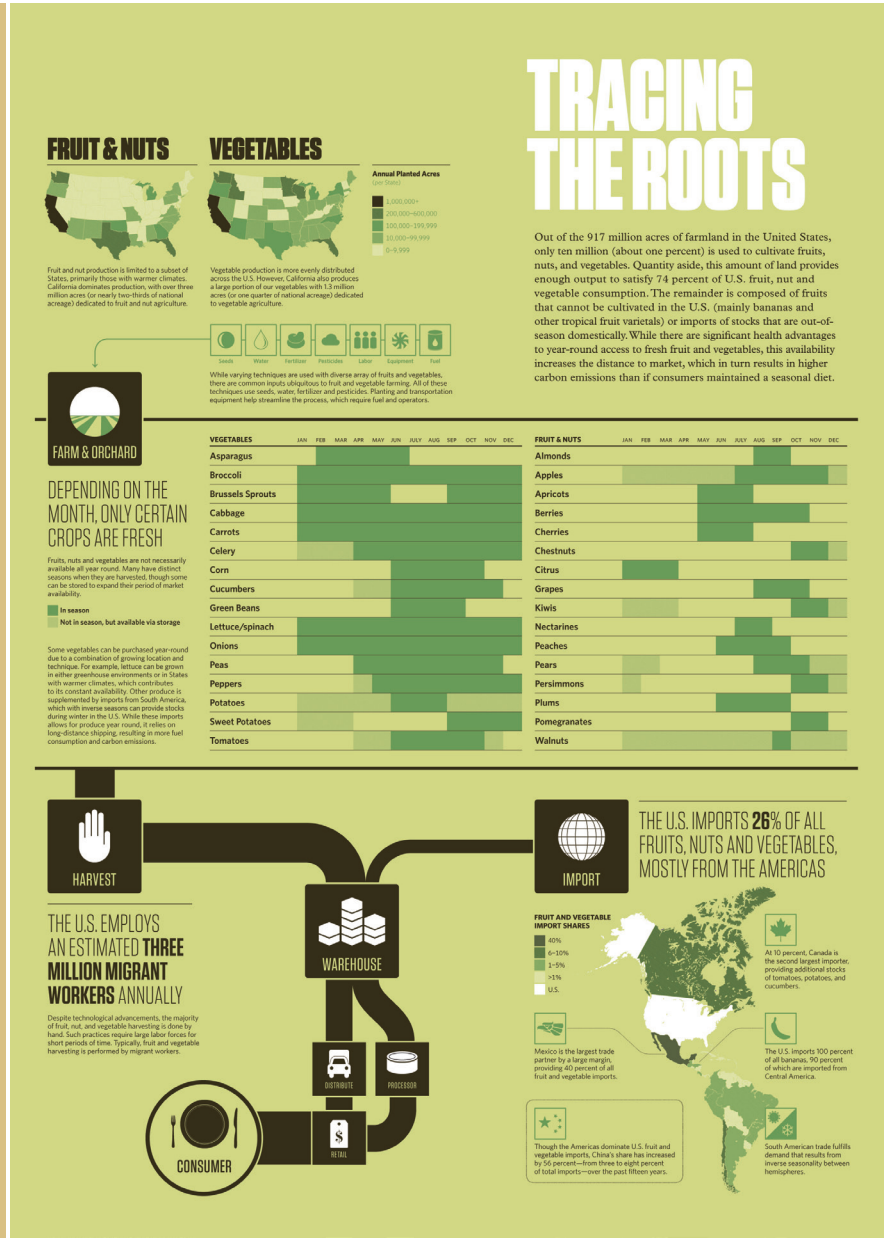
Seafood Sankey model



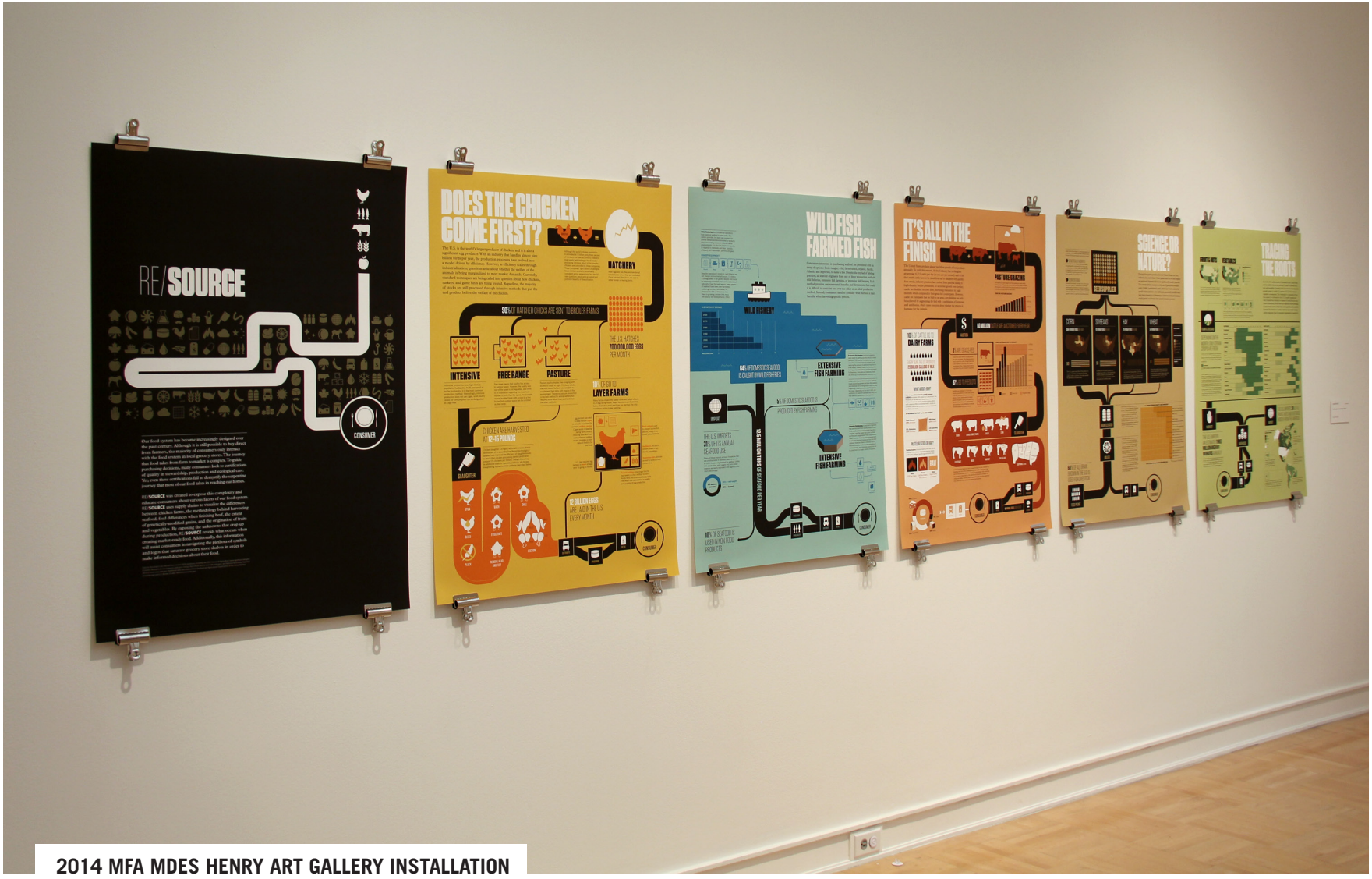
Beef and dairy Sankey model



Grain Sankey model



Fruit and vegetable Sankey model



2014 MFA MDES HENRY ART GALLERY INSTALLATION

Each supply chain /expanded Sankey diagram was printed as a 30 x 40 inch large format poster, and displayed as a visual system in the Henry Art Gallery, located at the University of Washington in Seattle.

DATA ACQUISITION

Data was sourced almost exclusively from government databases and reports. The intention in doing so was that these sources would be (hopefully) the most unbiased in data collection and presentation. Also, most data was available unformatted in spreadsheets, which allowed for greater flexibility in the design change.

The largest share was found in various U.S. government agency databases and reports, as well as the Food and Agricultural Organization of the United Nations:

- **2012 Census of Agriculture**
  (www.agcensus.usda.gov/Publications/2012/)
- **Economic Research Service**
  (www.ers.usda.gov/)
- **Foreign Agriculture Service**
  (www.fas.usda.gov/)
- **National Agricultural Statistics Service**
  (www.nass.usda.gov/)
- **U.S. Bureau of Labor Statistics**
  (www.bls.gov/)
- **FAOSTAT**
  (faostat.fao.org/)
- **FAO Aqauculture report**
  (www.fao.org/docrep/016/i2727e/i2727e00.htm)

Various industry and marketing organization materials were reviewed to corroborate and clarify data.

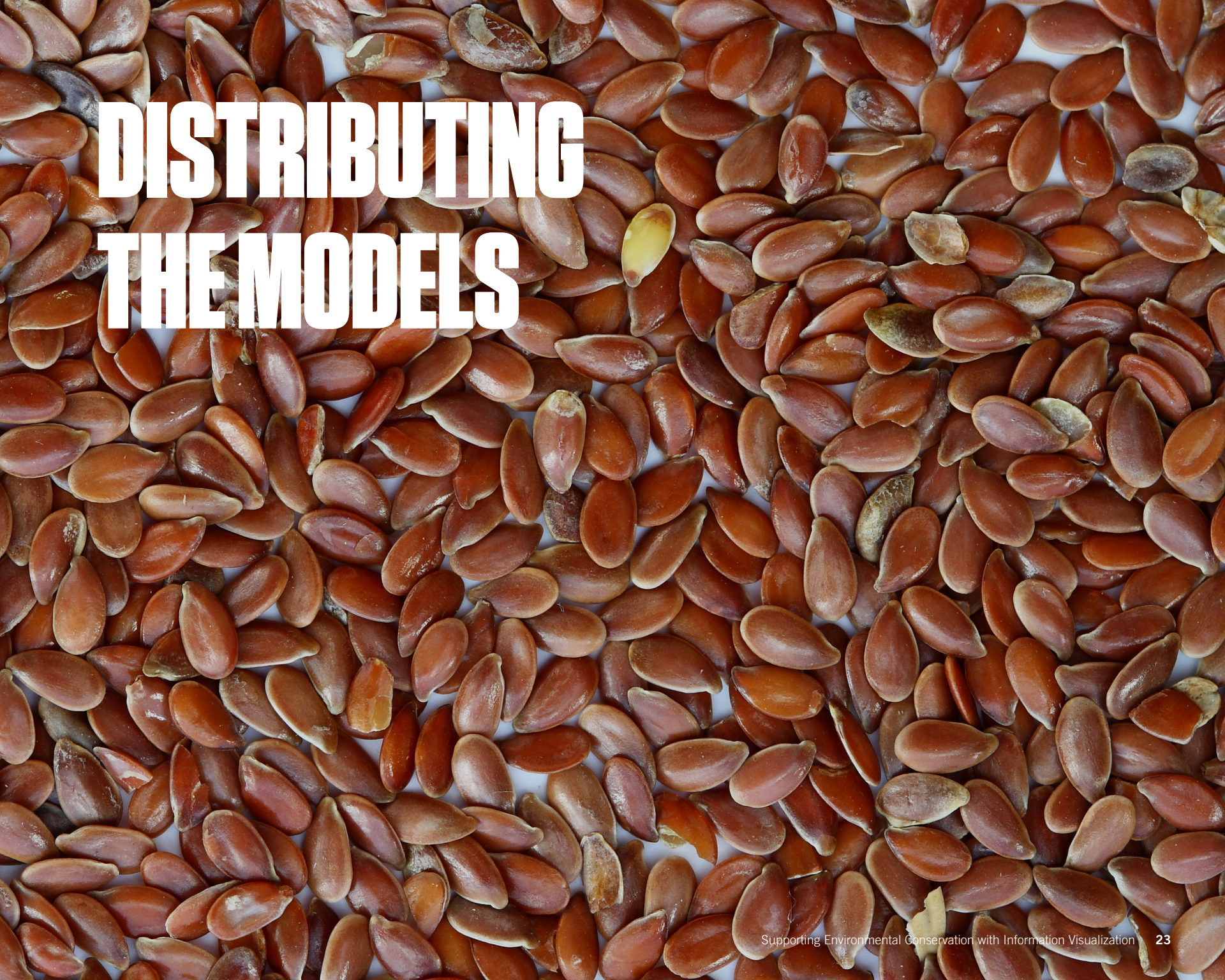
- **National Chicken Council**
  (www.nationalchickencouncil.org/)
- **Beef.org**
  (www.beef.org/)

Additional certification requirements were also verified through various awarding organizataions.

HOW DATA WAS USED

Information was sourced to confirm two primary aspects: production flow and quantity. With the former, sources depicted the steps that occur between source and market. For example, poultry products start with specific parent breeders, followed by hatcheries, finishing farms, slaughterhouses, distribution, processing, and finally, market. Quantity data was sourced to model the importance of certain steps as well as geographic prevalence. Finally, all data was compared against certification and organizational standards to illuminate varying production details at certain steps, such as the difference between finishing farms with poultry.

DISTRIBUTING THE MODELS



While the models were displayed in a public exhibition, there is a need to have these tools available to consumers who are purchasing and preparing food everyday. In particular, an ideal scenario would be to present this information to consumers through a format that could inform behaviors prior to decision-making. The challenge is packaging the information for situations where consumers will interact and contemplate these models.

The first step is determining an appropriate context for information delivery. Reviewing the findings from the observation study, grocery shopping is seen as a chore, and participants desired for that experience to be done efficiently. Therefore, having these models displayed in grocery stores or act as design interventions during shopping may not be the most effective method; it may be too cumbersome to require introspection in these locations. Instead, consumers should interact with these models before markets.

Interview participants noted that they use cookbooks primarily for education and inspiration. Individuals refer to cookbooks when to explore new ingredients or try new recipes. Most cookbook interactions occur during leisure time; participants casually browse through the pages while deciding what they would like to prepare in the future. Since they act as source of inspiration and reflection on food, one hypothesis is that this information could be delivered within cookbooks.

The difficulty, though, is that cookbooks are abundant. Performing a cursory search on Amazon.com turns up 100,000 plus volumes. Therefore, adding another cookbook to the market may not be the most viable distribution option, especially since most participants responded that their favorite cookbooks are ones that they trust. It may be challenging to persuade people to add another cookbook to their library since it will be originating from an unknown source that has not be vetted through experience and use.

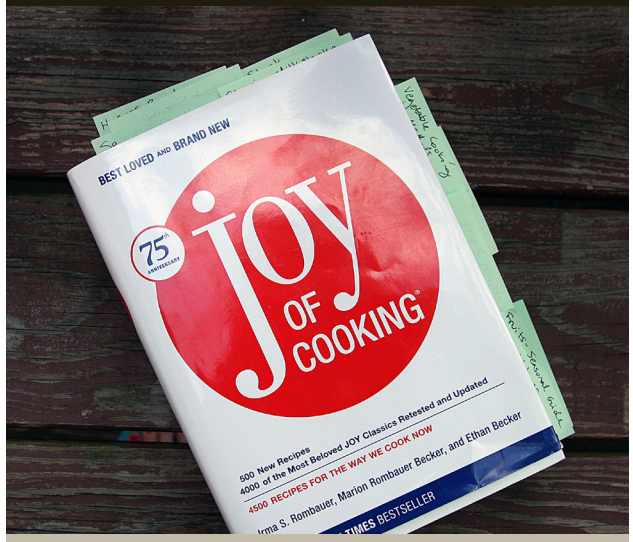
Looking at cookbooks deeper, many people actively augment their books with notes regarding recipes, dog-eared pages and notecards. Can these models be distributed not as a standalone cookbook but rather as an augmentation system? Providing consumers with tools to alter their trusted cookbooks can help introduce this information into existing artifacts, as well as pairing them with go-to cooking sources.

RE/**SOURCE SYSTEM**

The following system uses the models to create a family of information tools. Information from the models was dissected and packaged into an augmentation system known as RE/SOURCE.[22] The system uses tools that are familiar to books, using elements that fit the context of a cookbook.[23]

Concept sketch of distribution packaging for RE/SOURCE system, including cookbook booklets, stickers and other materials.

WHY JOY OF COOKING?

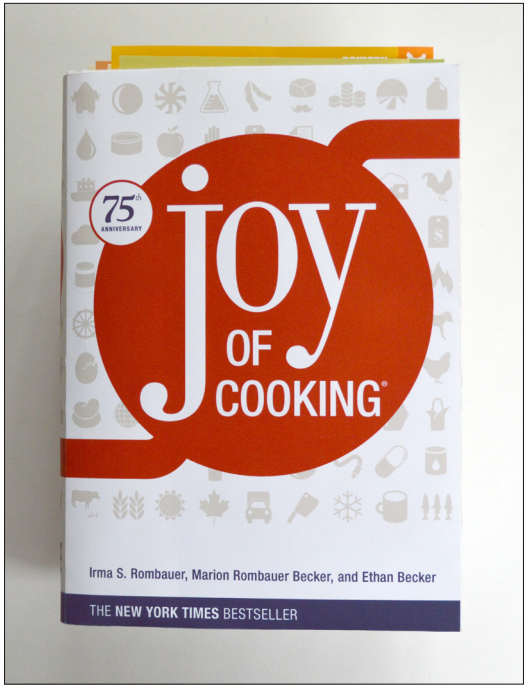


While the RE/SOURCE system is created to work with any existing cookbook, the thesis uses The Joy of Cooking (JOY) as a demonstration. First published in 1931, JOY was authored by Irma von Starkloff Rombauer, a cooking amateur determined to prepare a cookbook for people interested in learning how to cook at home. Created around the understanding that novice cooks "learn faster in the company of a friend,"[24] JOY purposefully communicated with a friendly voice larded with personality, instructing users not as an expert but rather as a peer. More importantly, the book pioneered the contemporary recipe format of listing ingredients first followed by step-by-step directions. Eight editions later—Rombauer personally updated six of the eight—JOY has become a staple of the American kitchen.

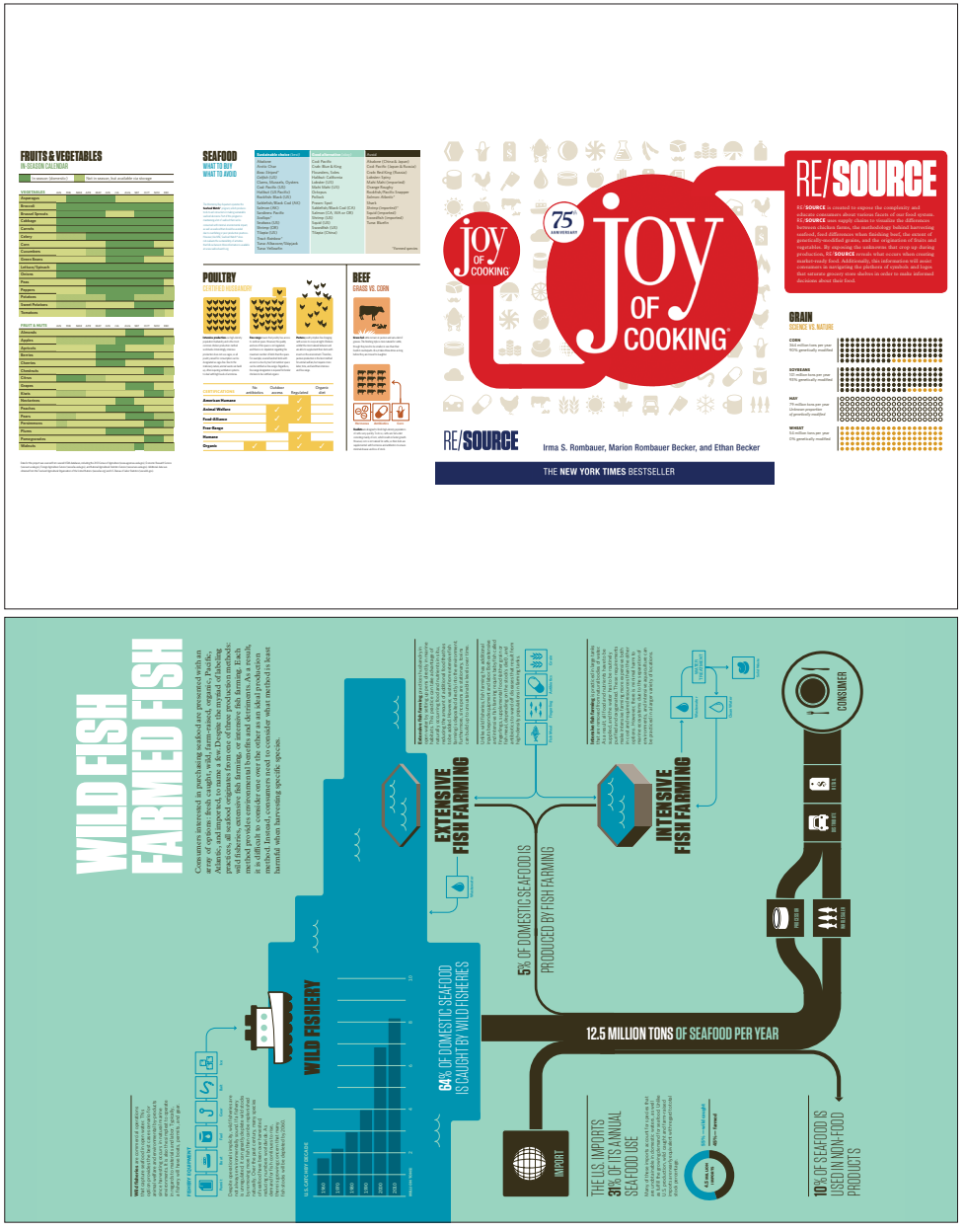
With the book starting as an at-home project developed to combat the status quo, JOY can serve as an appropriate vessel for the RE/SOURCE system. Adding the insert, bookmarks and dust jacket is akin to how the book was developed by consolidating recipes from friends and family. The tone of the book—teaching cooking skills to novices—matches the intended context for these materials. And, with the JOY continually updating to meet current tastes and trends, tacking on an environmental artifact compliments the book's continuing evolution.

DUST JACKET OVERVIEW

The dust jacket replaces the current cover. One of the five models is featured on the inside that can be used as poster if desired, providing a method to distribute the exhibited models. The outside retains the existing brand so that the book still retains a useable shelf presence. However, the brand has been augmented with symbols from the models to help create a revised presence to signify and remind consumers of the altered content. On the inside flaps and back cover, the measurement conversion charts typical of most cookbooks have been replaced with selected environmental information. This information is meant as a quick-resource guide that helps consumers plan shopping lists efficiently.



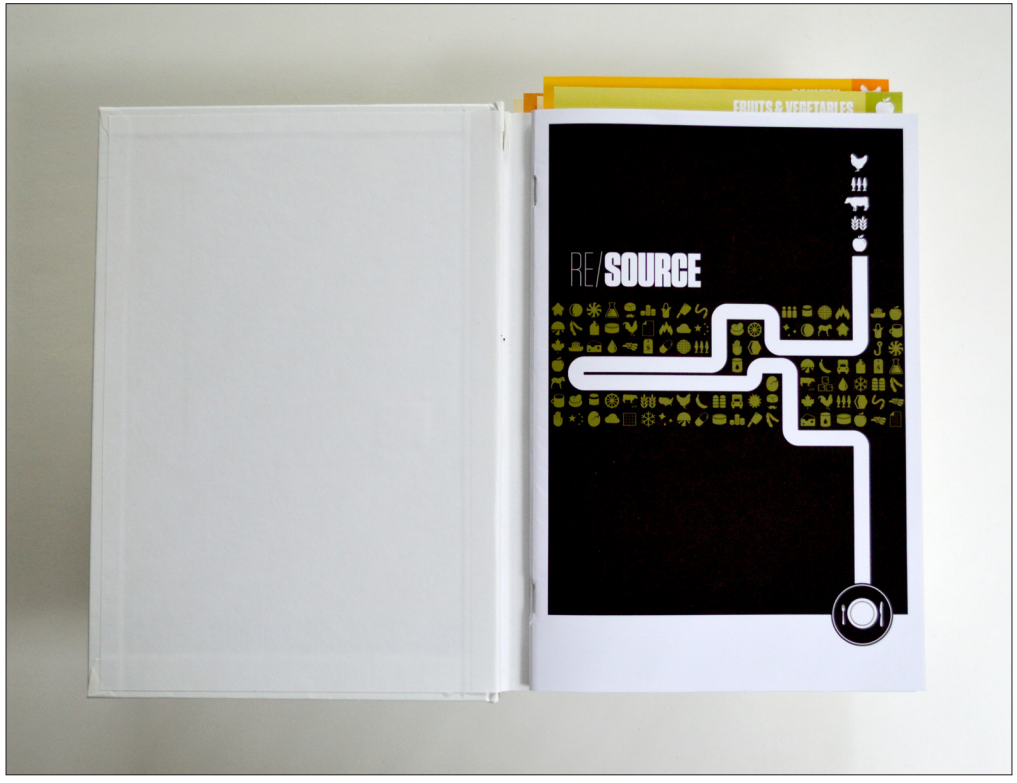
The Joy of Cooking with applied RE/SOURCE dust jacket.



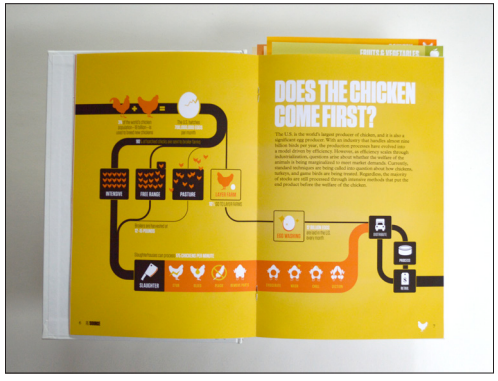
RE/SOURCE dust jacket: outside information including revised cover and environmental tables (top), and inside poster with seafood Sankey model (bottom).

INSERT BOOKLET

The insert booklet adheres into the inside front cover, either with tape or glue. The booklet features abridged models with top-level facts only. Each model is then followed by more narrative content describing how select food moves from farm to table, as well as extrapolating on certifications and in-store varieties.



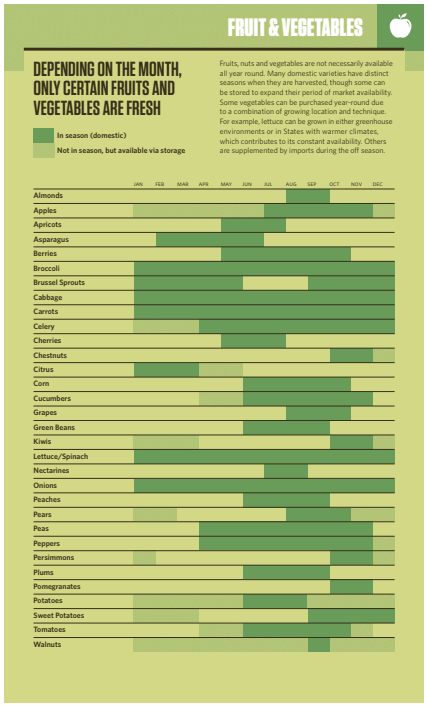
RE/SOURCE insert booklet adhered to inside front cover of *The Joy of Cooking*.

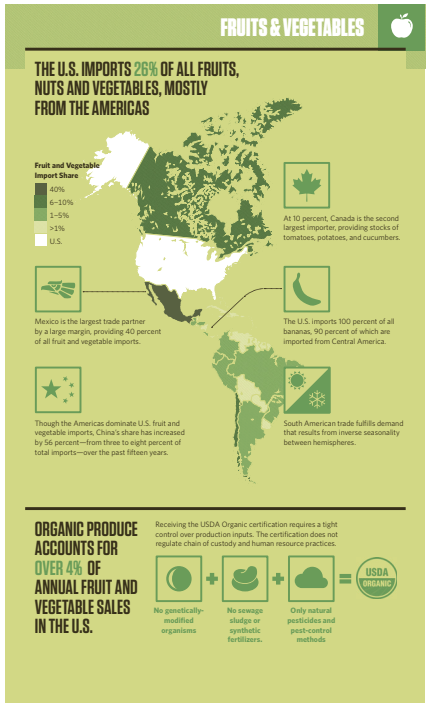


RE/SOURCE insert booklet spread examples: poultry Sankey model (top) and poultry narrative explanation (bottom).

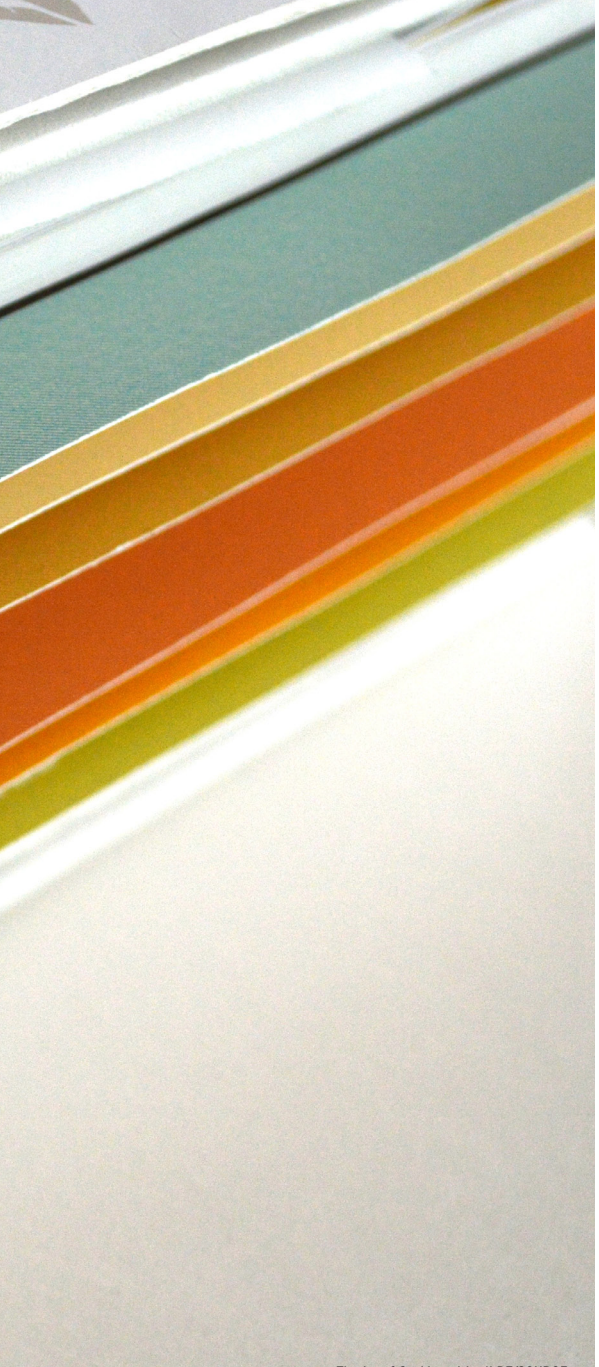
BOOKMARK/INSERTS

Bookmarks serves as in situ reference material that can be placed by frequently visited content. Bookmarks feature similar quick-reference information as seen on the dust jacket, and if desired, they can be taken to the store to reference while shopping.





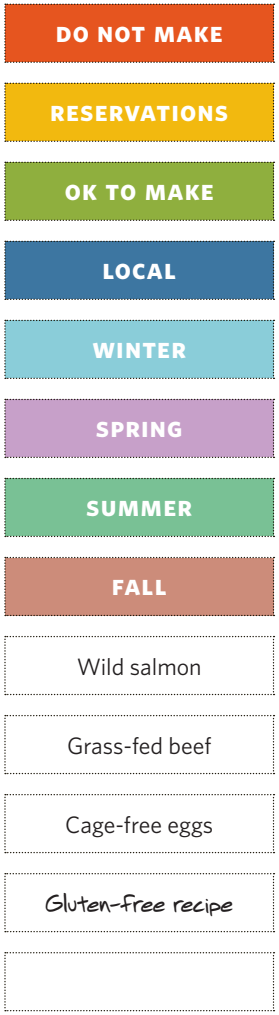
RE/SOURCE fruit and vegetable bookmark, front and back.



The Joy of Cooking with all RE/SOURCE bookmarks inserted into the book.

STICKERS

Stickers can be used to augment recipes in the cookbook. Examples include marking certain recipes by seasonality of vegetables, preferred certification of proteins, and blank stickers that can be customized per user's unique needs.



RE/SOURCE sticker examples

DISTRIBUTION

RE/SOURCE will be available free to download via an online clearinghouse. There, consumers can select which materials they would like to use and download a free PDF formatted for production.[25] If consumers would rather receive preprinted materials, they can order materials formatted for their trusted cookbook at cost.[26] As the system is distributed and used, there is also potential to partner with a grocery store or author to format these materials for specific contexts. For example, a natural food market may consider placing this information at meat counters through brochures or fliers. Also, the materials (specifically the large models) could be used for an educational context, distributing posters for classrooms and cafeterias.


HATCHERY
T TO BROILER FARMS
THE U.S. HATCHES
700,000,000 EGGS
PER MONTH
RE
10% OF GO TO
LAYER FARMS

FURTHER STUDY

Though the RE/SOURCE system provides one method for delivering these models to consumers, the system itself still needs to be tested for effectiveness. In particular, there is a need to observe individuals interacting with the system, preempted and followed by questions concerning environmental knowledge, to gauge if these materials fulfill their intended purpose of exposing the "black box." Also, the system is lacking an online component. Most participants acknowledged that they frequently source recipes online; creating a system where people could select specific ingredients to generate models is an interesting possibility for RE/SOURCE.

In all, the questions raised by this project are more about how information is delivered than constructed. Today, people interact with information visualizations as stand-alone pieces, whether online, in periodicals or as posters. RE/SOURCE attempts to move information graphics away from standalone experiences to actual tools in situ, but it is just a small step towards exploring and understanding potential applications. Further research and exploration can be done on how to get consumers to interact with information in meaningful, unique ways.

The models raise further question as well. While many reactions that occurred during the Henry exhibition were positive, the models are currently very broad—and therefore may result in overloading consumers with information. Moving forward, there is potential to format these models for very specific issues, such as for a specific certification, overfishing or byproduct pollution. Doing so may also lead to more concrete actionable decisions for consumers. Also, while the models explore a good portion of the food system, there is still additional content that could be added; for example, two notable additions are pork and fungi.

Regardless of these future areas to explore, the models and RE/SOURCE system provide a case study for how designers can begin to reveal the "black box" of production. By demonstrating these processes, these materials can help increase consumers' understanding of conservation and environmental issues, leading to more informed decision-making and dialogue. Though there is no guarantee that the system as-is may result in significant changes, it can serve as a launching pad for exploring how to use information visualization to address large, societal challenges.

ENDNOTES

1 Mulder, M. B., & Coppolillo, P. (2005). *Conservation: Linking ecology, economics, and culture*. Princeton, N.J: Princeton University Press.

2 Dan Brockington first defined the term *fortress conservation* as "an approach that seeks to preserve wildlife and their habitat through forceful exclusion of local people who have traditionally relied on the environment in question for their livelihoods." Brockington, D. (2002). *Fortress conservation: The preservation of the Mkomazi Game Reserve, Tanzania*. Oxford: International African Institute in association with James Currey.

3 Dowie, M. (2009). *Conservation refugees: The hundred-year conflict between global conservation and native peoples*. Cambridge, Mass: MIT Press.

4 Mulder, M. B., & Coppolillo, P. (2005). *Conservation: Linking ecology, economics, and culture*. Princeton, N.J: Princeton University Press.

5 Duffy, R. (2010). *Nature crime: How we're getting conservation wrong*. New Haven, Conn: Yale University Press.

6 Brockington, D., Duffy, R., & Igoe, J. (2008). *Nature unbound: Conservation, capitalism and the future of protected areas*. London: Earthscan.

7 Ibid.

8 Ibid.

9 Ibid.

10 Fortun, K. (June 01, 2004). Environmental Information Systems as Appropriate Technology. *Design Issues*, 20, 3.

11 Ibid.

12 Petty, R. E., Cacioppo, J. T., & Schumann, D. (September 01, 1983). Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement. *Journal of Consumer Research*, 10, 2.)

13 Nyhan, B., & Reifler, J. (September 20, 2011). Opening the Political Mind? The Effects of Self-Affirmation and Graphical Information on Factual Misperceptions.

14 Since 2001, the percentage of Americans who believe in climate change has remain stagnant (39 percent) while those who are skeptical has grown from 12 to 25 percent. Saad, L. (April 22, 2014). One in Four in U.S. Are Solidly Skeptical of Global Warming. Gallup Politics. Retrieved from http://http://www.gallup.com/poll/168620/one-four-solidly-skeptical-global-warming.aspx

15 The background section to this document was researched and developed following the literature review. The methodology is described here solely for narrative flow.

16 When this study was conducted, the original intention was to address solely seafood consumption. Since completion, the scope of this project has expanded since this project was completed. While the seafood data is not as pertinent, enough information regarding shopping was obtained to be relevant to the shifting scope.

17 Two participants declined participating in the observation study.

18 Most participants admitted to shopping at a higher-quality store than usual as a result of being shadowed.

19 Nyhan, B., & Reifler, J. (September 20, 2011). Opening the Political Mind? The Effects of Self-Affirmation and Graphical Information on Factual Misperceptions.

20 Mulder, M. B., & Coppolillo, P. (2005). *Conservation: Linking ecology, economics, and culture*. Princeton, N.J: Princeton University Press.

21 Categories were sourced from the USDA 2012 Census of Agriculture, available at http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/

22 The name RE/SOURCE is a play on words. First, it acknowledges that the materials in question are in fact resources. However, by visually separating the syllables, it denotes the purpose of these materials: to actively consider the source of commodities. Finally, the prefix "re" is a nod to environmental practices, such as recycling and reusing.

23 Many other tools were considered to be part of the RE/SOURCE system, including dishtowels, cookbooks, and packaging. While these tools could be feasible additions, the ones described in this document could be produced locally and economically by any consumer.

24 Mendelson, Anne. "The History of the Joy of Cooking." Retrieved April 1, 2014. http://www.thejoykitchen.com/all-about-joy/history-joy-cooking.

25 PDFs also include a cover sheet detailing printing specifications.

26 Additional costs may be covered by this fee, including web hosting, shipping and handling.

BIBLIOGRAPHY

Brockington, D. (2009). *Celebrity and the environment: Fame, wealth and power in conservation*. London: Zed.

Brockington, D., Duffy, R., & Igoe, J. (2008). *Nature unbound: Conservation, capitalism and the future of protected areas*. London: Earthscan.

Dowie, M. (2009). *Conservation refugees: The hundred-year conflict between global conservation and native peoples*. Cambridge, Mass: MIT Press.

Duffy, R. (2010). *Nature crime: How we're getting conservation wrong*. New Haven, Conn: Yale University Press.

Fortun, K. (September 06, 2004). Environmental Information Systems as Appropriate Technology. *Design Issues*, 20, 3, 54–65.

Friestad, M., & Wright, P. (June 01, 1994). The Persuasion Knowledge Model: How People Cope with Persuasion Attempts. *The Journal of Consumer Research*, 21, 1, 1.

Hearn, G., Foth, M., Stevenson, T., & Special Issue: Community Engagement for Sustainable Urban Futures. (May 01, 2011). Community engagement for sustainable urban futures. *Futures*, 43, 4, 357–360.

Kempton, W., Boster, J. S., & Hartley, J. A. (1995). *Environmental values in American culture*. Cambridge, Mass: MIT Press.

Mooallem, J. (2014). *Wild ones: A sometimes dismaying, weirdly reassuring story about looking at people*. S.l.: Penguin Books.

Mulder, M. B., & Coppolillo, P. (2005). *Conservation: Linking ecology, economics, and culture*. Princeton, N.J: Princeton University Press.

Nyhan, B., & Reifler, J. (September 20, 2011). Opening the Political Mind? The Effects of Self-Affirmation and Graphical Information on Factual Misperceptions.

Nyhan, B., & Reifler, J. (June 01, 2010). When Corrections Fail: The Persistence of Political Misperceptions. *Political Behavior*, 32, 2, 303–330.

Petty, R. E., Cacioppo, J. T., & Schumann, D. (September 01, 1983). Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement. *Journal of Consumer Research*, 10, 2.

Shiv, B., & Fedorikhin, A. (December 01, 1999). Heart and Mind in Conflict: the Interplay of Affect and Cognition in Consumer Decision Making. *Journal of Consumer Research*, 26, 3, 278–292.

ACKNOWLEDGMENTS

This project would not have been possible without the guidance and input from my thesis committee: Karen Cheng (chair), Tad Hirsch and Kristine Matthews. Additional recognition for proofreading and critique services from Beth Bullemer and Christopher Riley, design feedback from Jay Young Gerard and LeAnn Locher, and input on conservation and environmental issues from Megan Styles. Special thanks to the Master of Design classes of 2014 and 2015 for their patience and support: Jonathan Cook, Shaghayegh Ghassemian, Scott Ichikawa, Catherine Lim, Ryan Moeck, Haeree Park, Alexander Pawson, Abigail Steinem, Bradley Trinnaman and Kun Xu.