User-Friendly Resource Design: Providing Accessible Ground Squirrel Extension for the Web

Monica Dimson
University of California Cooperative Extension, South Coast Research & Extension Center, Irvine, California
Roger Baldwin
Dept. of Wildlife, Fish and Conservation Biology, University of California-Davis, Davis, California
Niamh Quinn
University of California Cooperative Extension, South Coast Research & Extension Center, Irvine, California

ABSTRACT: In terms of internet access, California farmers are some of the most well-connected in the country. According to the USDA, 70% of farms in the U.S. have access to the web as of 2015. In California, 93% of counties exceed that national average. This prompts us to take advantage of the opportunity to employ passive extension approaches, such as websites, which can save both time and resources for Extension audiences and personnel alike. Because digital media can be distributed without the expenses associated with static print resources, this allows us to update our information platforms with greater ease and frequency. Our goal is not to replace print publications, but to adapt Extension resources for a web context and thus connect with a large and geographically extensive audience, especially those who may not customarily seek or have access to more traditional Extension services. A website allows homeowners, landowners, and pest-control professionals to consult this resource freely, at their leisure, and to adopt best management practices more quickly. However, the movement toward cloud-based resources comes with greater web familiarity and thus greater expectations for the websites people use. We are currently developing a ground squirrel best management practices website. In order to provide a user-oriented experience comparable to that of other digital media resources, we need to consider the specific needs and behaviors of a web-based audience. We aim to achieve this by synthesizing new and existing resources into consumable, approachable content on a website that focuses on usability, clarity, visual impact, and site-wide cohesion. We will discuss these goals and how we achieved them.

KEY WORDS: Belding's ground squirrel, California ground squirrel, Extension, ground squirrels, *Otospermophilus beecheyi*, outreach, *Urocitellus beldingi*, user-oriented design, web design, web usability

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INTRODUCTION

Internet use continues to grow across U.S. demographics. In 2015, internet use increased to 84% among American adults, compared to 52% in 2000 (Perrin and Duggan 2015). Internet access continues to improve in both rural and urban areas: 76% of California farms have internet access as of 2015 (USDA 2015). This presents outreach and extension programs with an opportunity to reach a growing audience through an increasingly popular digital medium. Websites can be updated and distributed with greater ease and frequency than printed media, saving time and resources for both developer and end-user. They allow us to efficiently reach a wider audience that may not otherwise have access to other training opportunities.

With increased internet access and familiarity come greater expectations for the web-user experience. Though outreach and Extension resources are available in various forms of media, content language and structure are not always optimized for effectiveness on the internet. Because of their subject matter, Extension websites are typically information-heavy, and they often draw from highly detailed sources originally intend for print.

Many studies indicate that audiences process digital and print resources differently, and some suggest that we would rather read paper than screens (Wastlund et al. 2005, Nielsen 2008a, Kretzschmar et al. 2013, Mangen et al. 2013). But with so many Americans on the internet, it is difficult to argue that this is necessarily because we are turned off by screens. Rather, the problem may lie in the way that content is developed and presented.

User-focused design is thus key to successful web extension. Design goes beyond aesthetic decisions; when effective, design enhances content clarity and improves usability for the end-user. Every step of the design process, from content development to building individual pages, must be approached with the needs of the audience in mind.

We are currently in the process of developing a new website for ground squirrel best management practices (BMPs) in California. The website focuses on two common species: California ground squirrel (*Otospermophilus beecheyi*) and Belding's ground squirrel (*Urocitellus beldingi*). Resources will also be provided to help users distinguish between these pest ground squirrels and other non-target wildlife.

Throughout our design process, we have attempted to develop content, site architecture, and visual elements that make the website as user-friendly as possible. Our audience includes managers of both agricultural and urban environments, as ground squirrel activity can impact landscapes and infrastructure, as well as crops. Ground squirrels are also reservoirs for diseases such as bubonic plague. Ground squirrels consume fruits and nuts, and they frequently girdle trees. Their extensive burrow systems increase soil erosion and cause damage to farm equipment, irrigation systems, and flood control structures.

Economic damage from California ground squirrel activity has been estimated at $20-$28 million annually (Marsh 1998). It is likely that their impact is much greater today.

We will present an overview of basic web-user behaviors and expectations, and discuss their influence on the development of usable, impactful web resources in the context of our ground squirrel BMPs website. Examples from our ongoing project are used to illustrate how Extension programs might adopt a user-friendly approach to web design.

WEB-USER BEHAVIOR: AN OVERVIEW

Web resources can be effective Extension tools as long as content is tailored to the way that people use the internet. This requires understanding the way that users interact with digital versus print resources.

User Expectations for Digital Media

Some studies find that we may still prefer reading on paper, but they also suggest that it does not necessarily take more cognitive effort to extract information from a digital screen (Kretzschmar et al. 2013, Mangen et al. 2013). While we do experience some physical fatigue when using screens, this may be a result of the additional tasks involved, e.g., scrolling and clicking through sections. Compared to turning pages, website navigation requires more cognitive resources (Wastlund et al. 2005). Thus, poorly designed navigation may negatively impact the overall user experience and discourage visitors from browsing within a site.

A preference for reading on paper may have less to do with our ability to process words on a screen and more to do with our specific expectations for digital media (Kretzschmar et al. 2013). Web-users expect different experiences from informational websites versus textbooks. Long indexes, narrative content, and tables of chapters and subchapters are familiar to and expected by readers of printed media. The web, however, must offer clear, succinct content to users who typically arrive at a site with a specific goal in mind (Nielsen 2008a). This is partly due to competition: a Google search for "ground squirrel control" yields over 600,000 results. If users cannot find what they need on a given webpage, thousands of alternative resources are just a few clicks away.

Aesthetic Preferences

Positive first impressions are crucial to encouraging visitors to stay on a webpage and continue browsing the site. Web-users know how they feel about a website's aesthetic within the first 50 milliseconds of exposure, with a strong preference for websites of lower visual complexity and higher prototypicality (Reinecke et al. 2013, Tuch et al. 2012). A highly prototypical website reflects user expectations for how a website should look and function, based on their previous internet experience.

Cluttered, "busy" webpages with unfamiliar (and thus, unintuitive) layouts are less appealing to users. A user seeking very specific information, like ground squirrel management techniques, may be more inclined to search within a site for the information they need. However, a negative aesthetic experience may make it more difficult for them to digest or even locate that content.

Consumption of Written Content

Simple, easy to navigate webpages allow users to better focus on content. As with aesthetic impressions, users make quick evaluations of a webpage's ability to meet their goals. They tend to scan webpages in an F-shaped pattern that focuses on the top and left side of the page (Nielsen 2006). If they do decide to linger, they may not read all of the text on the page. One study estimates that experienced web users only read about 28% of the text on a given page (Nielsen 2008b). Offering more information does not guarantee a proportionately longer page visit; the study also found that the higher the word count, the lower the percentage of text likely to be read.

THE DESIGN PROCESS

What works for the web does not necessarily work on paper, and vice versa. Our website for ground squirrel BMPs, like many Extension resources, is a synthesis of existing literature. The purpose of this digital guide is to present digestible content on a simple, visually appealing interface. It is not a replacement for long-form print publications, nor do we want to merely replicate material originally intended for print. Extension for an internet audience must adhere to the basic web design principles that enhance usability.

Discussed below are the various steps we took to address common challenges to web usability such as text-heavy content, distracting navigational tasks, and high visual complexity. These potential issues can be addressed by developing content, site architecture, and an overall visual design that are conducive to the specific expectations and needs of a web audience.

Audience and Project Goals

Web resources can lengthen the reach of Extension programs that serve a large geographic area like California, where only one University of California Cooperative Extension (UCCE) vertebrate pest advisor and one UCCE wildlife damage specialist are assigned to the entire state. Ground squirrel management in California is likely to draw a fairly niche crowd, but this audience includes several thousand individuals from the agricultural sector and pest management industry. In addition to the 58,000 California farms with internet access, nearly 24,000 pest control professionals are licensed by the California Department of Pesticide Regulation. We also plan to make this resource applicable to homeowners.

Our website is intended to offer ground squirrel BMPs to a California audience, with a focus on two common pest ground squirrel species (*O. beecheyi* and *U. beldingi*). In addition to control options, we want to provide information that would allow our audience to implement an integrated pest management (IPM) program that considers pest biology and risks to humans and non-target wildlife. An IPM approach encourages proper pest identification, routine monitoring, and the use of a combination of prevention and control techniques. To encourage proper identification and avoid harm to non-target wildlife, we will provide resources for distinguishing pest ground squirrel damage from other wildlife activity.

A previous UCCE website for ground squirrel BMPs was originally established in 2003. This informative

resource, aimed primarily at land managers, contained an overview of ground squirrel biology, management practices, laws and regulations, and publications. Though comprehensive in scope, the website has not been actively maintained in recent years, and some of the information is out of date. Additionally, many links within the website are no longer functional. There is a need to redesign this resource so that content is more navigable, current, and easier to update in the future.

The Statewide UC Integrated Pest Management program (UC IPM) offers a full webpage devoted to ground squirrels on their website (Salmon and Gorenzel 2010). This publication includes an overview of California ground squirrel biology, identification, damage, and management techniques. While thorough, the single web page on which it is presented is also text-heavy and lengthy in appearance. This could hinder some users from quickly finding the specific content that they need. The web page also directs users to the Ground Squirrel Quick Tip page, a pithy fact sheet that uses approachable bulleted lists to share information. Both the UC IPM Pest Note and the Quick Tip, though titled "Ground Squirrel," focus primarily on *O. beecheyi* and do not provide resources specific to *U. beldingi*. As part of a larger Pest Note series, they are not as in-depth as the aforementioned UCCE website for ground squirrel BMPs – in fact, UC IPM directs users to this website for more information.

Building a Site Map

A clear, logical site map helps users to efficiently locate the information that they need. We began our design process by listing the individual topics that we wanted to include on the website and categorizing those topics under our main parent pages. We want the options in our navigation bar to be as simple and self-explanatory as possible so that visitors can quickly scan and make selections from the main menu.

It can be helpful to sketch the basic site map before actually building the pages and writing content. This allows content developers to write for a specific page and avoid unnecessary introductory text and tangential topics. Supplemental links can be included on the page for readers who want to learn more about a related subject. Having a well-organized site map will help website designers to easily redirect the user to the right page.

Adjustments will be made to the first draft of the site map. After writing and editing our ground squirrel content, we restructured many of our original child pages and added and removed others. It is useful to finalize content before finalizing the site map. Both will inevitably evolve over time, but it is much easier to reorganize pages before they contain content. By building a strong foundation before constructing actual pages, we hope to avoid the maze of links that could otherwise develop.

Writing for the Web

Web language is generally less formal than in other media. Material can be developed or revised so that it fits logically into the website architecture. In writing for the audience, consider why they have arrived at a webpage and address the topic that they have chosen to read about. On a webpage dedicated to physical ground squirrel characteristics, a paragraph about the Belding's ground squirrel does not need to be accompanied by a description of the type of crops it damages. It is still important that related content be available somewhere on the site, but it does not all need to be one page.

We pulled material for our ground squirrel website from various sources, but the actual text we developed is original. It was drafted and reviewed by UCCE advisors, then revised and re-packaged by Extension staff. Input from individuals who are not experts on the website topic can greatly improve the accessibility of the text.

Solutions for Text-Heavy Content

Web-user tendencies to scan or skim, rather than read, can be problematic for text-heavy websites like our ground squirrel project. This issue can partially be mitigated in the content development stage, when writers and editors consider where the content will be on the site map. On individual pages, a number of design choices can make text more conducive to web reading.

Lists and Tables

Utilize bulleted lists or simple tables wherever possible, particularly when repetitive, extraneous text is found within a single-subject paragraph. For example, descriptions of the physical characteristics of two pest ground squirrel species were originally presented in paragraph form. But this type of information does not need to be detailed in complete sentences. We placed California ground squirrel and Belding's ground squirrel in separate column headings and listed characteristics like length, weight, and coloring in the rows below. This simple solution condenses two paragraphs into one table, reducing word count and allowing users to easily compare the two species.

The pros and cons of two toxic baits were originally presented in individual bulleted lists. This is better than paragraph form, but we can make further improvements to this presentation. The pros and cons lists covered the same subjects: one material has an antidote, the other does not; one has a high risk of non-target toxicity, the other does not. Placing the information side-by-side in a table, where materials constitute the headers and criteria are listed in rows, enables users to easily weigh one material against the other.

Links to Supplemental Material

When writing new content for a webpage, it can be tempting to include as much related information as is available. But even if this extra material is related to the page topic, it is important to ask whether it is essential or merely supplemental.

Users reading a page about zinc phosphide baits, for example, may be curious as to why we recommend a certain bait application method. Some users may also want to read about other available methods. This is optional, supplementary material that will not influence their ability to use the recommended application method. For users who wanted to focus on zinc phosphide, the inclusion of extra text increases the page's word count and makes it less

readable. Instead, a hyperlink within the text or in the right-hand column can direct users to a page that specifically discusses different bait application methods. Users can then decide for themselves if they are interested in more detail. Many websites employ these "learn more" or "related content" links to avoid cluttering pages with non-essential material, to minimize large blocks of text, and to promote greater connectivity within the site.

Subheadings

For some topics, it may be more practical to keep users on a single page. Use subheadings to break up multi-paragraph pages, and design these subheadings to stand out from the paragraph text. Bold and or larger type is often used to distinguish subheadings – just make sure that this format is used consistently throughout the website. Consistency allows users to become more familiar with the site and improves usability.

When formatting subheadings, page titles, and other distinctive text, avoid adding text properties that increase visual complexity. This may include decorative typefaces or brightly colored text. Subheadings should be able to catch the user's eye without distracting or inhibiting them from focusing on content.

Navigation

Navigation within the website should be simple and logical. This is greatly improved by a thoughtful site map design, as discussed above, as well as effective link and page titles that balance clarity and brevity.

Web designers also have a choice between top-navigation (horizontal menu at the top of the page) and left-navigation (vertical menu on the left-hand side). There are arguments in favor of each, but ultimately, page structure should be designed based on its content. Some designers argue that a long left-nav menu works better for more widespread audiences with a broad range of topics and interests. A subject with a very specific target audience – i.e., Californians who want to manage ground squirrels – benefits from top-nav menu, which allows users to spot high priority items more quickly and effectively (Nielsen 2010a).

We use a top-nav menu, primarily because this keeps users from encountering a long and unnavigable list of sub-pages to scroll through. Long side bars also take up unnecessary visual space in one of the most valuable on the webpage: studies have shown that users spend twice as much time looking at the left side of a page as the right (Nielsen 2010b).

Cohesive Design for Lower Visual Complexity

Users prefer websites with higher prototypicality because they look and feel more familiar, and thus are easier to use. This does not mean that all prototypical websites look identical. But a familiar website structure does encourage cognitive fluency, i.e., the ease with which we process information. Cognitive fluency can also be improved within a website by using consistent color and graphic themes. It is important to be selective when using graphics and other visual elements; they are meant to enhance, not decorate, website content. Purposeful employment of graphic elements also helps to minimize visual complexity. For our ground squirrel website, we aimed to establish a cohesive design of low visual complexity through the use of recurring design elements and well-curated graphics and images.

Visual Themes

Color is an easy way to establish a site-wide visual theme. However, it should be used sparingly. Multiple colors can make a website feel more cluttered (Reinecke et al. 2013). In text, color is most often used to distinguish hyperlinks, which should be distinct and obvious to the user. Color can provide emphasis for other text elements (e.g., headings, warnings) as long as that particular color consistently sends the same message throughout the entire website.

The graphics designed for the ground squirrel website draw from the same color palette. "Timing wheels" were created for each control method, mating and hibernation periods, and seasonal changes in diet (Figure 1). The information featured in these individual wheels was compiled into one "timing chart." In both the wheels and the summary chart, "effective" treatment periods for the control methods are indicated by the same shade of green. While the graphics are also labeled and accompanied by a legend, we hope that users who visit multiple pages will become familiar with the wheels, associate the color with the attribute, and process the information offered in the chart with greater ease and speed.

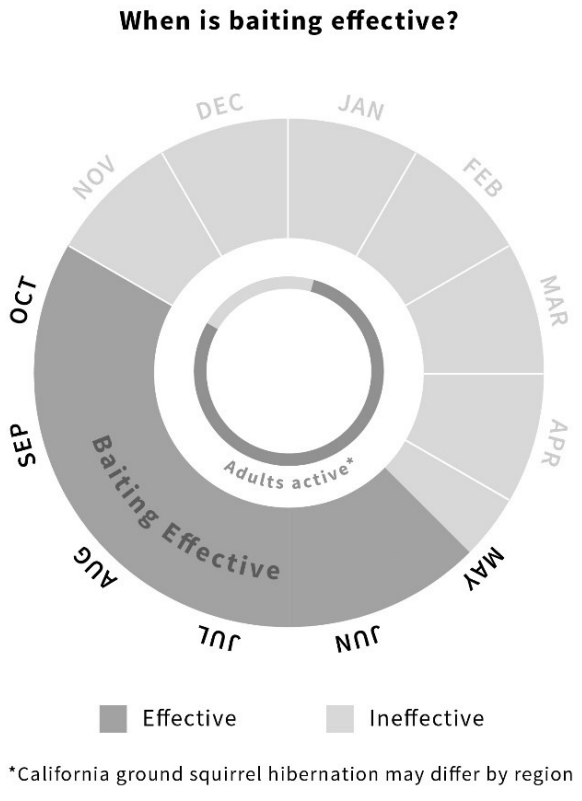

Figure 1. Graphic illustrating when toxic baits are effective for California ground squirrel control.

Curating Visual Content

If too much color is distracting to users, then an excess of graphics and photographs could be overwhelming as well. Avoid visual distractions to minimize visual complexity. Every image on the page should have a clear function. ClipArt is problematic because it is often used decoratively, rather than for explication. It also tends to clash with other images and with the visual theme on the rest of the website.

Graphs and images should be carefully curated and correctly formatted so that they complement, rather than distract from, the informational content. Unless a page or section is specifically intended to be a photo gallery, it is more effective to select one or two high-quality, impactful images to display rather than a collection of tiny, pixelated thumbnails. Take advantage of the lightbox options (clicking on an image to view a larger version) available in most site builders.

A WORK IN PROGRESS

Our ground squirrel website is still under construction. So far, our efforts to maximize site usability have focused on content development, site architecture, and cohesive visual design. We would still like to address responsiveness (website's ability to be viewed on multiple devices, e.g., smartphones), accessibility for dyslexic users, and resources for Spanish speakers. Upon completion, we hope to receive feedback from a test audience, develop Frequently Asked Questions based on their experience, and continue adapting the website to the needs of its audience. In a sense, Extension websites are interminably "in progress."

Extension websites are not a mere digital copy of print publications. They are dynamic documents that have the ability to more efficiently reach a wider audience. But as the internet audience continues to grow, so to do their expectations for the websites they use. Effective web extension requires both well-designed content and informative design, which are best achieved by considering the specific needs of the end-user.

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