

Flooding in Patapsco Valley State Park

Recommendations for Signage and Communication Materials

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Executive Summary

Patapsco Valley State Park (PVSP) and its surrounding areas have been subject to increased flooding in recent years. In 2016 and 2018, the area experienced two 1,000-year floods (Halverson, 2018) that significantly damaged the park. Flooding events of this severity and magnitude are expected to be exacerbated in the future due to rapidly increasing impacts from climate change (Denchak, 2019).

The park has found it challenging to communicate flood risks to visitors. The Maryland Department of Natural Resources (DNR), which manages PVSP, is concerned that visitors don't plan ahead when they attend the park, and don't know the risks involved in hiking through the park, which puts them at a greater risk of harm in the event of a flood. Additionally, many PVSP visitors don't speak or read English, which creates a significant communication gap between visitors and the park to convey safety messages about flooding.

This project aims to determine the most effective language for signage and communication materials to communicate flood risks and what to do if a flood occurs. The group reviewed academic and non-academic literature on the best ways to communicate risk, the best ways to educate youth, strategies used by other parks to communicate risk, as well as information about the Ellicott City area. The research and final deliverables aim to determine the most effective language for signs within PVSP, and the best education and communication materials to distribute to park visitors.

The project began with a client meeting to define expectations for the project. We determined three major aspects: creating safety signage, creating educational materials, and creating a video to be shown at the PVSP mobile ranger station. We also discussed the importance of improving communication with Spanish-speaking visitors.

Following this meeting, the group researched flood-risk education, risk communication in parks, risk communication with Spanish speakers, and best practices for park signage. A site visit gave the team a better understanding of the client's expectations. After this visit, the group divided into three teams; the first team was tasked with editing existing park signs, the second team was tasked with developing educational materials, and the third team was tasked with writing a detailed video script for use throughout the park and at the mobile ranger station. Each team conducted additional relevant research.

The result was three deliverables: recommendations and mock-ups of effective safety signage, educational pamphlets that inform park visitors about flooding risks, and a script for an educational video on flooding.

We hope this work can contribute to DNR's goal of providing accessible and appropriate flood communication materials for all park visitors.

Goals and Objectives

The project's goal is to research and present recommendations for flood-risk signage and educational materials for Patapsco Valley State Park (PVSP). All of these materials will be presented in cultural and language-specific formats to engage the Spanish-speaking community that frequents the park. This goal is completed through three objectives.

First, create mock-ups of general signage for the entire park and more specific signage for high-risk areas. The general signage will be used at trailheads to educate visitors about flood risks and safety precautions using text and graphics. Specific signage for high-risk areas will include protocol for escaping a flood using text and graphics that are attention-getting and accessible.

The second objective is to create innovative, engaging, and accessible educational materials to educate visitors of all ages and backgrounds. These materials will give visitors a deeper understanding of why flooding occurs and how it impacts the park and its ecosystem.

The third objective is to connect to the Spanish-speaking population through audio and visual learning, with a video that informs visitors of flood risks in the park. All of these materials will be accessible in both English and Spanish.

These objectives will address communication challenges of language barriers and government websites and help improve social networks for communication in the future. In this report and the deliverables, our findings and recommendations meet these objectives.

Introduction

Over the past 300 years, the area that is now PVSP has been shaped by the Patapsco River, both geographically and socially. Water is a powerful force and that shapes the landscape it moves through. The land that drains into a river from a higher altitude is known as a watershed; the precipitation that falls in a watershed flows downhill toward the river (U.S. Geological Survey [USGS], n.d.a). The movement of water over land causes erosion, meaning that surface particles such as soil and rocks are moved with the water (Evers, 2018). Over time, erosion changes a region's topography, forming features as significant as the Grand Canyon (USGS, n.d.a).

Rivers also shape the cultures of societies built along them. The presence of fresh drinking water has determined the location of human settlements for over 10,000 years, since humans first formed communities (Juuti et al., 2007). Ellicott City was established in 1772 by Joseph, Andrew, and John Ellicott, in the Tiber-Hudson watershed, where the Tiber, Hudson, Autumn Hill, and New Cut river branches flow into the Patapsco River (Poon, 2019). The Patapsco has supported innovations in technology, transportation, and conservation; the first steam powered boat in the United States was created on the Patapsco River, and the first Maryland state park, PVSP, was established along the river in 1907 (Patapsco Heritage Greenway, 2020).

While the Patapsco River has contributed to Ellicott City's successes, it has also been a source of destruction. The city's location in the Patapsco River's drainage basin makes it highly susceptible to flooding. When precipitation overloads any one of the river branches or streams leading into the Patapsco River, the excess water crashes through the city streets (Poon, 2019). Increased development in the region combined with climate change has caused powerful rain events to become more frequent, contributing to high-velocity water flows that damage both Ellicott City and the surrounding natural spaces, including PVSP (Denchak, 2019).

As flood events become more frequent and more severe, it is crucial to establish effective communication methods that convey flood risks to community members and PVSP visitors. Terms such as "100-year flood" and "500-year flood" have been used to describe recent flooding events in Ellicott City (Poon, 2019). However, these terms can mislead the general public into believing that these flood events are rare—occurring only every 100 or 500 years. The terms actually describe the percent chance of a particular magnitude flood occurring in any given year, 1% or 0.5% respectively (USGS, n.d.c). This terminology has contributed to lack of preparation in the region and is an example of the challenges to effective risk communication.

Due to the increased risk of flooding and challenges with risk communication in PVSP, there is an immediate need for accurate and accessible safety information to better protect visitors. These materials should be context and language-specific, accessible to the local community. Communities and cultures register information and alerts differently. Therefore, it is important to know how Spanish-speaking cultures respond to risk to better communicate flood risk. PVSP park rangers have found it difficult to communicate with Spanish speakers who visit the park, partly due to the lack of bilingual park rangers and bilingual signage, leaving this group at a disadvantage during high-risk flooding events.

Methodology

Sign Verbiage

A review of academic and non-academic literature in the UMD Libraries database began with established keywords—"flood risk communication" and "risk communication,"—but we found that "flood risk communication" often included information on how to convey evacuation from homes and not evacuation from a park. We addressed this issue by amending search criteria to include the keywords "risk communication in national parks," which yielded relevant information.

The information for effective signage was largely based on an article by Saunders et al. (2019) that outlined best practices in language and around flooding. We evaluated each existing sign and recommended adjustments based on the research. The sign mock-ups were created using an open-access online design program called Canva. All of the final designs were translated into Spanish by our lead translators and verified by our advisor.

Educational Pamphlets

A second review of academic and nonacademic literature for the educational pamphlets focused on articles from peer-reviewed scholarly sources based on the keywords “environmental education,” “youth environmental education,” “outdoor risk education,” and “education in parks.” For example, for best practices information to educate youth about the environment, we used the keyword, “youth environmental education” in the Academic Search Ultimate database. Furthermore, we used Google scholar searches for sources on environmental education approaches. Before gathering information, we checked that it was either peer reviewed or published by a credible organization such as Learning for Action, which partners with social sector organizations to advance knowledge and equity (LaFrance, 2017). We also collected information from government agencies such as the National Park Service and the Environmental Protection Agency.

We used our findings to develop pamphlets that incorporated the best practices. For example, the children’s pamphlet includes a hands-on, minds-on approach as well as a debrief that connects it to real world situations (Meredith et al., 2000). We created three pamphlets: about flooding risks and the power of water, about climate change, and one designed for children. Each pamphlet was translated into Spanish by our lead translators and verified by our advisor.

Video Script

Using information gathered from a site visit—detailed notes, observations, and questions—we created a video script. The delivered script also reflects DNR’s requirements and further direction. Our discussion generated a detailed list of DNR’s “must-haves” for the video script, and provided parameters for the work.

We also found information in a brief literature review of scholarly sources and similar engagement projects using keywords and search criteria for flood risk safety. Coincidentally, many databases focus on flash flood safety because of the severity of these incidents. For example, Zion National Park has an expansive database dedicated to flash flood information, which was especially helpful in writing the script to be easily understood by a park visitor with no knowledge about flood risk safety (U.S. National Park Service [NPS], 2019).

An additional literature review using phrases such as “Latino community involvement,” “Latino information retention,” and “Latino community engagement,” provided sources that gave insight into how information is shared in Latino communities.

We used this information to create an easily understandable video script. Due to COVID-19 restrictions, we were unable to film the video on-site, and instead created filming directions that include proposed time, scenes, images, and dialogue. Our translators on this project are fluent Spanish speakers and translated all the deliverables. Their work was corroborated by the graduate TA, whose first language is Spanish.

Findings

Communication with the Latino Community

The engagement of Latino communities has been a recent research focus as Spanish speaking populations increase in the United States (Clarke et al., 2015; Wills, 2012). To best communicate information and engage local Latino communities in different projects, activities, and civic participation, it's important to understand the cultural, social, and linguistic differences that may exist and that might require different communication techniques (Wills, 2012). The research findings can help PVSP reach the Latino community and better communicate flooding risks and safety measures.

An Oregon State University study showed that engagement is facilitated through relationships (Wills, 2012). For a successful project, managers must listen to the community's interests, needs, and values. An investment of time and interest helps create an atmosphere of trust and respect, which is beneficial in further engagement efforts (Clarke et al., 2015). Along with an increased knowledge of the community it helps to understand available resources and obstacles that limit engagement. Knowledge about a community can be gained by attending community meetings, engaging at local churches or community centers, and hiring individuals from the community to work on the project (Wills, 2012). A study on engaging rural coastal communities about the threats of climate change found that engaging the community through a trusted institution, such as a local church, can be an effective method of communicating information (Miller Hesed et al., 2020).

Another important finding was that programs should adopt a family outreach approach, that is, create programs that engage the whole family. A report by the National Latino Children's Institute showed that Hispanic and Latino community members are more likely to engage as a family rather than as an individual (Wills, 2012). A study on Latino engagement in national parks found that family and group welfare is a focal point of Latino and Hispanic culture and so activities that engage groups rather than individuals are more successful (Clarke et al., 2015). According to the Oregon State University study, the importance of multigenerational families is also a key component of Latino culture, so educational materials, meetings, and activities should accommodate children and the elderly (Wills, 2012). It was also shown that disaster information travels farther in Hispanic and Latino communities through social networks, such as face-to-face interaction at community events and gatherings like churches or community centers (Maldonado et al., 2015).

These findings show that outreach to Latino communities would be most successful if educational programs were targeted toward families and accounted for the needs and interests of that community (Wills, 2012). By engaging at social centers, such as churches or schools, information spreads more easily through social networks, and is better understood and accepted (Maldonado et al., 2015). These techniques could help PSVP engage the local Latino community and better protect it from dangers such as flooding.

Risk Communication in Parks

PVSP, like many other parks, relies on signage to communicate safety messages to visitors. It is not feasible to have staff present in all areas of the park at all times, so it is imperative to use signs effectively to ensure visitor safety in an emergency. Research on risk communication has shown that people are often unconcerned about natural hazards and therefore are ill-prepared to deal with them when they occur (Maidl & Buchecker, 2015). Additionally, inadequate warning signs can be seen as negligence on the part of the park (Saunders et al., 2019). We used Saunders et al.'s best practices (see Table 1) to evaluate PVSP's existing signs and make suggestions for improvements. Some of the most important guidelines we focused on include using short and familiar signal words, providing examples of consequences, and using high contrast colors and graphics. The existing signage lacked these features or used them ineffectively. We decided to simplify signs and add universal hazard symbols based on research indicating that the public's understanding of flood risks varies greatly (Lazrus et al., 2016).

Saunders et al. (2019) also suggested including additional languages on safety signs when possible. Because many PVSP visitors are Spanish speakers, it is appropriate to include multiple languages on each sign. For signs with shorter messages, we opted to put Spanish messages on the same sign. For signs where Spanish would not fit or would distract from the message, we suggest an additional sign placed directly underneath the English version.

Using Zion National Park as a case study provided extensive information outlining what should be included on park websites, educational materials, and warning signs to ensure maximum preparedness for flash floods (NPS, 2019). This material explained that visitors should be informed that they always need to be aware of their surroundings when they are in the park and practice preparedness. They explained that flash floods can appear quickly and cause waters to rise fast and become increasingly aggressive (NPS, 2019). They suggest that visitors should always be prepared for a flood in the park by having the right supplies and being aware of the best exit route (NPS, 2019). This material used images and graphics, as well as extensive education on flood risks, to increase the safety of parks.

Communication strategies to investigate in the future include flood sirens throughout the park, weather alert systems on the park website, and a flood-gauge system to clearly rate flood risk on a daily basis.

Table 1
Best Practice Principles for on-site safety signs in national parks.

Component	Guidelines
Noticeability	<i>To be noticed, safety signs should be:</i> 1a) Of a shape, size and colour that contrasts with surroundings and attracts attention; 1b) Separated from surrounding information; 1c) Located close to the centre of vision as visitors approach; 1d) Orientated perpendicular (rather than parallel) to major visitor pathways.
Encoding	<i>To be readily translated into an internal representation, safety information should include:</i> 1e) A graphic visual demonstration of the hazard; 1f) Short, familiar words including signal words (DANGER, WARNING, CAUTION) denoting the level of hazard; 1g) Large and well-spaced text which can be read from a comfortable viewing distance, with a mixture of upper and lower case in easily read fonts (such as Helvetica or Times). Signal words should be larger than text, and in colour; 1h) Languages in addition to English where appropriate.
Comprehension	<i>To ensure comprehension, safety signs must have four key elements:</i> 1i) The signal word DANGER, WARNING or CAUTION, highlighted in specific colours to denote the level of hazard. Red and yellow are standard risk level indicator colours which should be used consistently; 1j) A statement of the hazard (with symbol if possible). Messages should be limited to a small number of issues, perhaps as few as two; 1k) An example of the possible consequences. The potential severity of outcomes is critical to risk perception; 1l) Simple instructions on how to avoid the hazard. Use injunctive (ought) or proscriptive (do not) messages.
Compliance	<i>To encourage compliance, safety signs should:</i> 1m) Be located near the site of the hazard; 1n) Be authorised by a credible source; 1o) Include circle slash negation symbols, however these must not conceal critical features of symbols with the slash; 1p) Describe the intended behavioural response.

Table 1: Best practices for safety signs, used to evaluate current signs at PVSP, from Saunders et al. (2019)

Education in Parks

We analyzed different public education materials to determine the best ways of reaching the public and effectively informing them. One approach is to create programs that are continual, meaning at least once a week or once a month (LaFrance, 2017). Continued education allows participants to remember and reflect on the information being taught. If the educational program was given just once or out of context, it is more likely to be forgotten. Additionally, finding an overlap between what school curriculums and the park’s curriculum has proven to be more effective in long-term retention of information (LaFrance, 2017). Furthermore, creating programs that use a “hands on, minds on” approach has also been shown to be effective (Meredith et al., 2000). Such activities allow children to actively engage their bodies and minds, and can include acting out scenarios or discussing real world scenarios (Meredith et al., 2000). For example, in the children’s education pamphlet includes an activity that aims to represent flooding, followed by a debrief to talk about how floods happen, why they may be dangerous, and how they are bad for the environment.

Humans have three learning styles: visual, aural, and tactile (Csapo & Hayen, 2006). People learn information differently and respond to different presentation styles. A visual learner gathers information best from seeing what they are learning; a visual representation of the information being taught. Aural learners need to hear what is being taught to understand the information. Tactile learners gather information through touch and experience (Csapo & Hayen, 2006). Educational programs for flooding communication should incorporate multiple learning styles to be most effective in engaging visitors who learn differently.

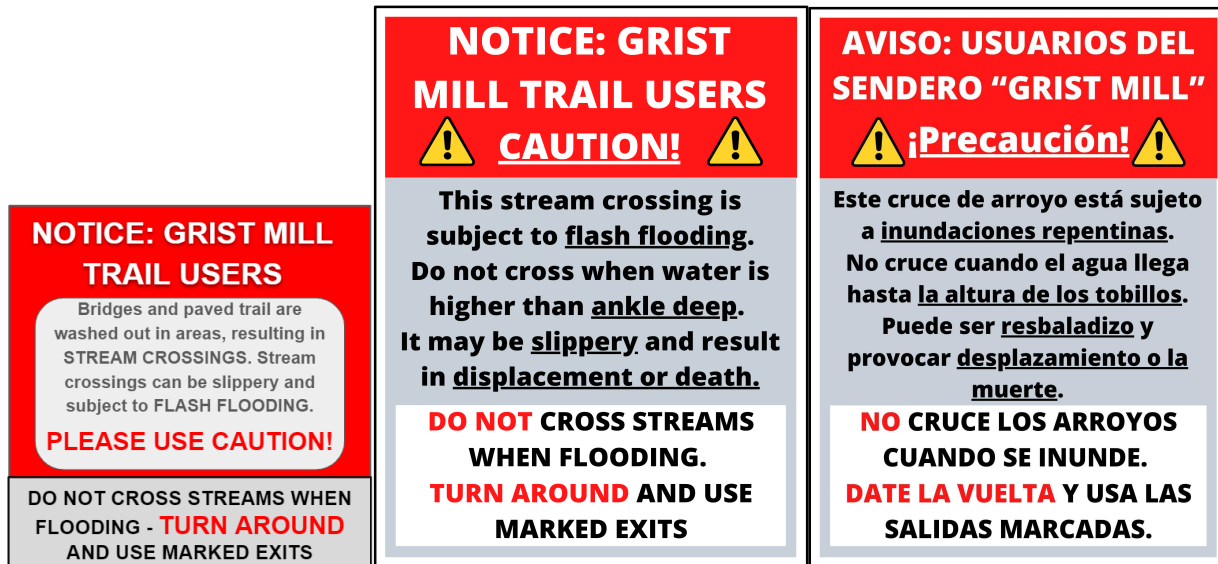
Finally, incorporating group work and community engagement has proven to be effective in public education (LaFrance, 2017). The best way to engage a community is by bringing people together to collaboratively create solutions to real world problems (Stern et al. 2014).

Deliverables

Signage

Trail Entrance Signs

Located at all trails leading to Grist Mill Trail.



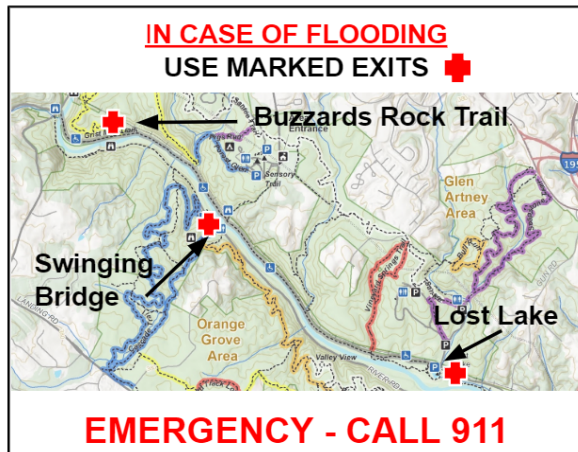
Existing

Proposed: English

Proposed: Spanish

These sign changes define flooding—when water is higher than ankle deep—giving context to what is higher than normal. The proposed changes also communicate the dangers of crossing this stream when it is high by indicating the water’s danger and warning people of the risk of crossing. Using the caution symbol, a universal sign, conveys danger at a glance, even if patrons don’t read the whole sign. Underlining font, using bold lettering and white accents, makes it easier for patrons to read from a distance and understand the need for caution. The amount of information warrants both an English and Spanish sign.

Trail Marked Turn-Around Signs



Existing



Proposed: Bilingual

This sign maximizes effectiveness by including Spanish and English messaging on the same map. This minimizes signage on the trail while increasing risk communication to the Spanish-speaking population. Bold fonts and color blocks highlight messaging and grab attention.

High Water Exit Signs

These signs will be located on either side of the blown-out bridges. They show the sign location and the location and description of the nearest and safest exit, e.g. Swinging Bridge, Buzzards Rock, or Lost Lake.



Existing

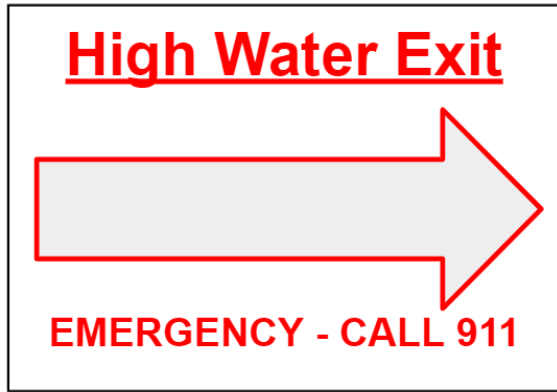


Proposed: Bilingual

This sign maximizes effectiveness by including Spanish and English messaging on the same map. This minimizes signage on the trail while increasing risk communication to the Spanish-speaking population. It also indicates that “seeking higher ground” is a viable safety option if they are unable to exit the trail. Bold fonts and color blocks highlight messaging and grab attention.

High Water Exit Signs

These signs will be located to direct users to safe exits during floods—from the red triangle to the appropriate white Xs.



Existing

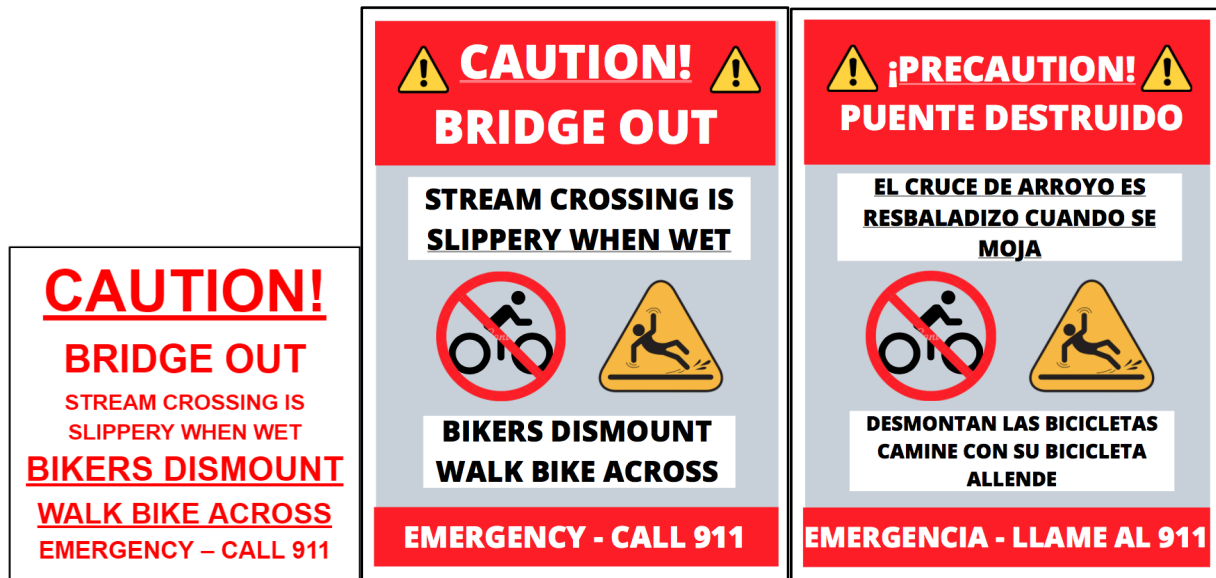


Proposed: Bilingual

This messaging uses a bold font, color blocks, and caution symbols to mark the exit route. Using symbols and one sign with Spanish and English messaging maximizes communication without causing sign congestion.

High Water Bridge Signs

Located at red triangles, these signs will be placed under the “in event of high water” signs.



Existing

Proposed: English

Proposed: Spanish

The original sign has effective language but was hard to read quickly. Including a visual demonstration of risk makes it easier to quickly comprehend the message. Universal visual symbols like the hazard sign, slip sign, and circle cross can be understood even by those who can't read and across cultures. The color contrast ensures that the sign will stand out against its surroundings. The amount of information warrants both an English and Spanish sign.

High Water Exit Bridge

These signs will be located at the white stars on the map.



Existing

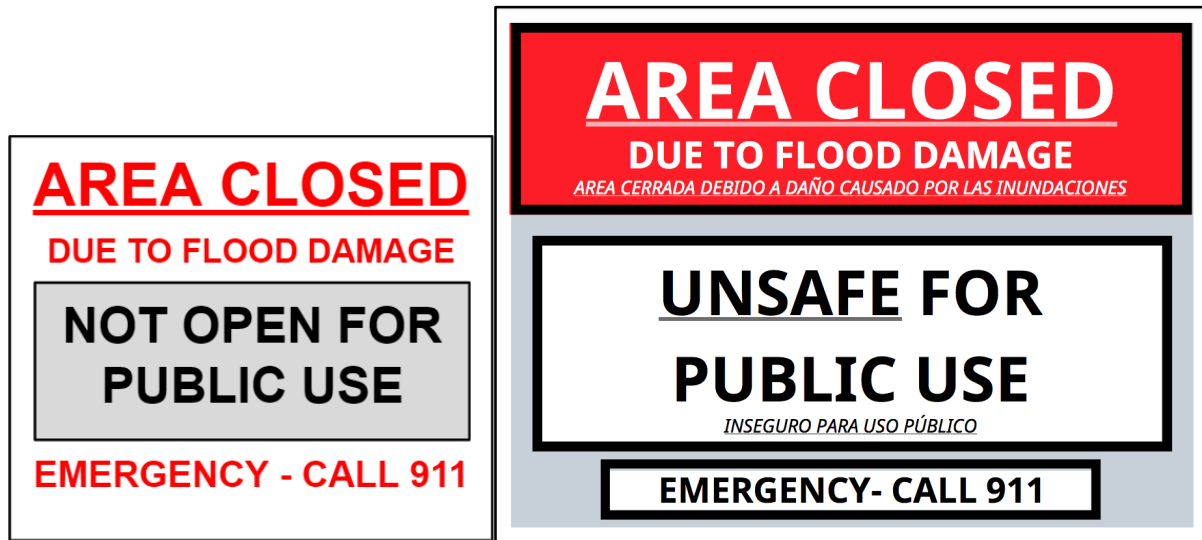
Proposed: English

Proposed: Spanish

This sign doesn't change the information, but makes formatting changes to improve comprehension. Bright colors create greater contrast with surroundings; red signifies risk and will stand out against the colors of the park. Non-readers understand the universal hazard symbol and underlining and capitalization help emphasize directed actions. The amount of information warrants both an English and Spanish sign.

Area Closed Signs

These signs will be located around Lost Lake.



Existing


Proposed: Bilingual

This sign clarifies the existing content to emphasize that the area is closed and unsafe. Using “unsafe for public use” rather than “not open for public use” in the middle of the sign more strongly indicates risk. The visitor knows that the area is not open from the “AREA CLOSED” statement at the top of the sign and will know why the area is closed—“UNSAFE FOR PUBLIC USE.” The bright colors help the sign stand out from its surroundings.

Trailhead Signage

Existing





Welcome to the Grist Mill Trail *¡Bienvenido al Sendero Grist Mill!*

Trail Description: This paved trail follows the Patapsco River and is a great place for an afternoon run or bike ride. It connects to many trails and points of historical and natural interest. The mostly flat terrain of the Grist Mill Trail and its many access points makes it a great hike for people of any age!

Length: 2.4 miles

Connects to: Vineyard Spring Trail (0.3 miles away)
Cascade Falls Trail (1.31 miles away)
Buzards Rock Trail (1.61 miles away)
Sawmill Branch Trail (1.61 miles away)
Forest Glen Trail (1.61 miles away)

Sights to See: 1. The Swinging Bridge rocks gently and connects the trail to the Cascade Falls Trail.
2. Bloedes Dam, a historical dam, is a great spot for fishing.
3. Ichester Bridge connects to Ichester Road and offers a great view of the Patapsco River

PLEASE OBEY ALL SAFETY SIGNS ALONG THE TRAIL. IN THE EVENT OF AN EMERGENCY, SEEK HIGHER GROUND AND FOLLOW EXIT SIGNS

For more information go to the Contact Station at the Avalon Area of Patapsco Valley State Park 5120 South St., Halethorpe, MD 21227

Or call: 443-534-1766 or 410-461-5005

Patapsco Valley State Park is open **9am to sunset**


Trail guides can be found on our website: www.dnr.state.md.us

Maryland Park Service General Information: 1-800-830-3974


Please report any problems to an employee or call **Park Watch 1-800-825-7276 or 410-260-8888**

Remember Maryland State Parks are trash-free. Pack it in, pack it out!

Recuerde, en nuestro Parque Estatal no tiramos la basura. ¡Así es que Empaqueta y Llévesela!



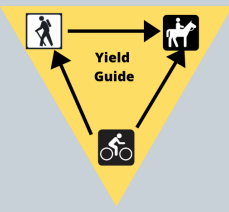
Proposed: Trail Information



While you are on the trails, please follow Leave No Trace Outdoor Ethics. Protect natural and cultural resources, yourself, and your family.

For more information, please visit www.lnt.org

<p>HELP US MAINTAIN OUR TRAILS</p> <p>Trails are extremely vulnerable to damage during and after rain events. Please allow at least one day for trails to dry after rain.</p>	<p>BE PREPARED!</p> <p>Poor planning and unexpected conditions degrade outdoor resources and put you at risk.</p>	<p>STICK TO THE TRAIL</p> <p>Shortcutting trails causes erosion, degrades the beauty of the place, replaces native plants with weeds, and affects wildlife.</p>	<p>BE CONSIDERATE</p> <p>You probably don't like being disturbed when you're having fun. Neither do other people. Please be courteous to others on the trails.</p>
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Yield Guide

Proposed: Ethics Information

The original sign had too many messages to read quickly. Separating information into two signs (to be placed side by side) allows for better flow of reading. The Leave No Trace Outdoor Ethics should be placed alongside Trail Information so they can be understood as a unit, without distracting from safety information. We considered a sign trail for the Outdoor Ethics but believe that it would congest the area with too many signs. The red font on a yellow

background at the top and bottom of the existing sign is hard to read and was changed to a white background. Safety messages were included on the Trail Information sign in bright red signaling visitors to notice safety signs farther down the trail. An enlarged yield sign on the Outdoor Ethics catches attention.

New Sign Idea: Parking Lot Sign



Proposed: English

Proposed: Spanish

This sign warns people of risks at parking lot and how to prioritize their safety over their belongings in an emergency. Since some visitors park and then spend the day at the river, they might miss flood risk information at trailheads and on trails. It also indicates that driving out of the park is not the safest exit strategy in an emergency and encourages visitors to seek higher ground to keep out of compromised road areas.

Educational Pamphlets

Climate Change Pamphlet



Climate change refers to the gradual change in average conditions around the globe.



- This can include:
- Rising temperatures
 - Rising sea levels
 - Changes in precipitation and rainfall
 - Increase in extreme weather events

How does this impact me?

Climate change impacts everyone.

- Increases in extreme weather events could increase the risk of flooding in Ellicott City and Patapsco Valley State Park
- Waterfront cities like Baltimore will experience more flooding, and may eventually be submerged under the ocean.



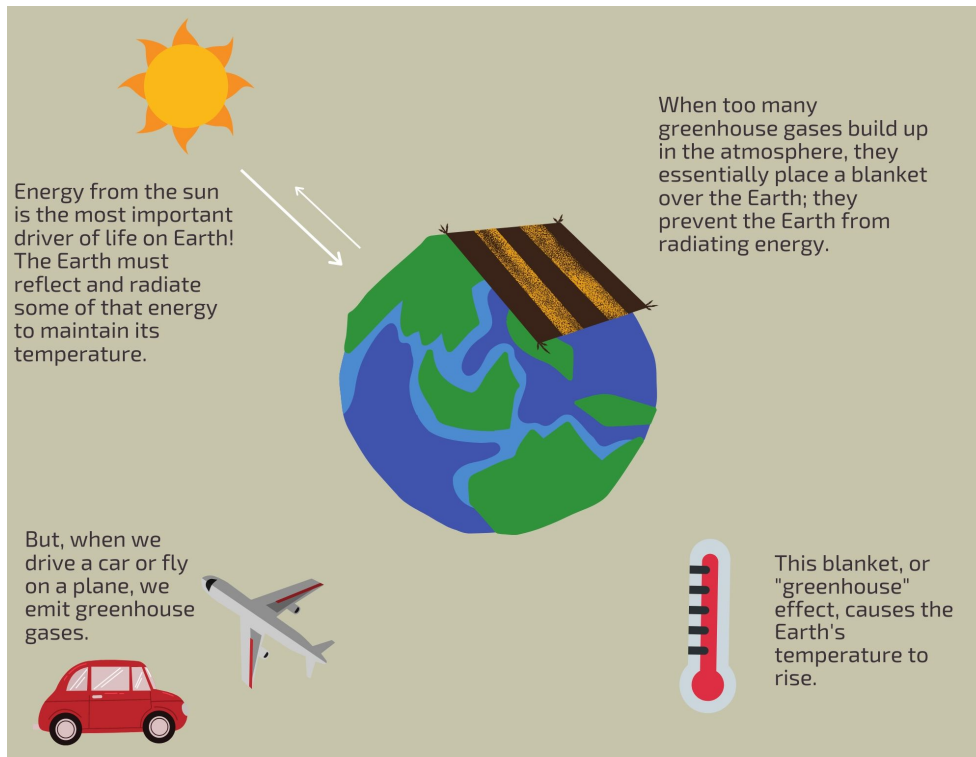
What can I do about it?

Even small actions can help reduce climate change!

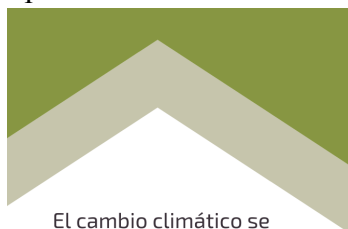
- Recycle
- Avoid single-use plastics
- Use public transportation when possible
- Contact your local representatives to express your support for green initiatives

What is Climate Change?

Patapsco Valley State Park
Maryland DNR



Spanish version:



El cambio climático se refiere al cambio gradual en las condiciones promedio del planeta.



Esto puede incluir:

- Subidas en temperatura
- Aumento del nivel del mar
- Cambios en la precipitación
- Aumento en eventos climáticos extremos

¿Cómo me afecta esto a mi?

El cambio climático afecta a todos.

- Un aumento en eventos climáticos extremos puede resultar en más riesgo de inundación para Ellicott City y El Parque Estatal de Patapsco
- Las ciudades costeras como Baltimore experimentarán más inundaciones, y eventualmente se sumergirán bajo el océano





¿Qué puedo hacer al respecto?

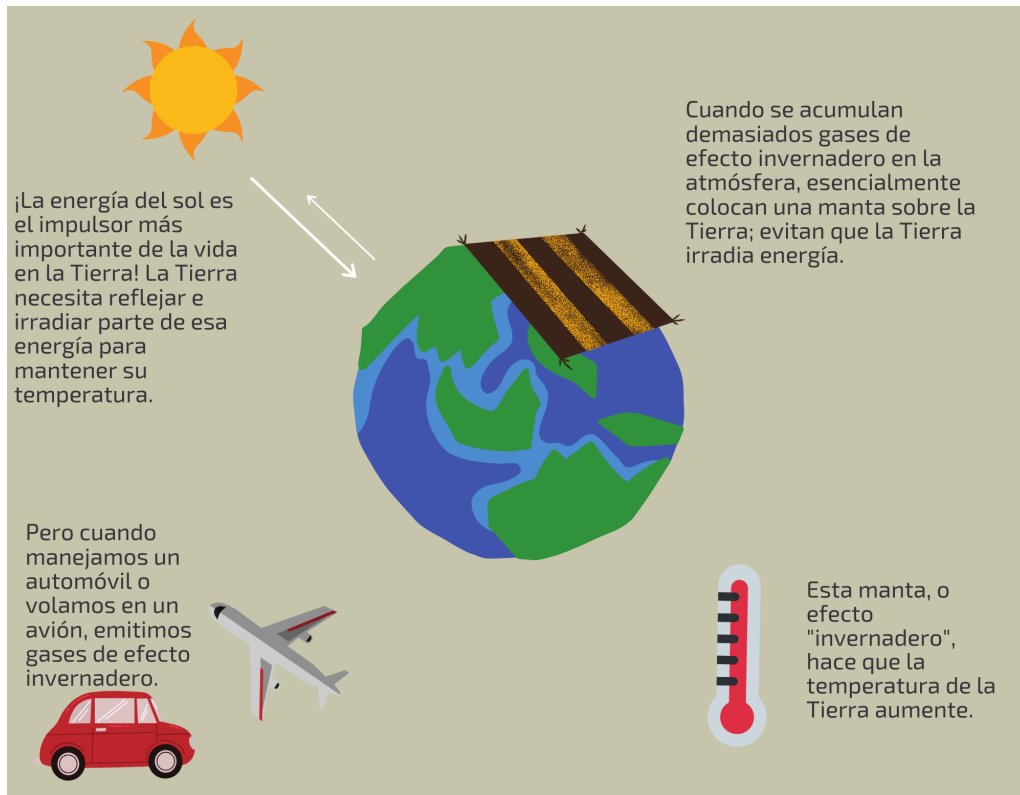
¡Incluso pequeñas acciones pueden ayudar a reducir el cambio climático!

- Reciclar
- Evitar plásticos de un solo uso
- Usar el transporte público cuando sea posible
- Póngase en contacto con sus representantes locales para expresar su apoyo a las iniciativas ecológicas

¿Qué es cambio climático?

Patapsco Valley State Park
Maryland DNR



This pamphlet provides information on climate change: what it is, why it’s happening, and what can be done about it. The pamphlet follows the narrative structure of “and, but, therefore,” described by Randy Olson *Don’t Be Such a Scientist* (2018).

The pamphlet begins by providing information: defining climate change and its consequences. It continues by describing how the Earth receives energy from the sun. It then identifies a source of conflict: “but, when we drive a car or fly on a plane, we emit greenhouse gases.” This allows the reader to see where they fit into the equation and makes the topic more interesting than just a list of facts. Finally, the “therefore” is the pamphlet’s conclusion with a list of actions that readers can take to reduce their contribution to climate change. This conclusion is also in accordance with the findings of Strife (2012), who found that when environmental messages focus too much on “doom and gloom,” and not enough on actionable solutions, they can lead viewers to feel powerless, apathetic, and even ecophobic.

Additionally, this pamphlet uses visual elements to convey information, which can help make information easier to comprehend (Olson, 2018). While this pamphlet provides valuable information on climate change that may interest PVSP visitors, it doesn’t contain flood risk information. We recommend that it be distributed at the visitor center to visitors who would like to learn more about the park and its natural systems.

The information used to construct this pamphlet was gathered from Shaftel et al. (2020).

Flooding Pamphlet



"Water is the driving force of all nature."
- Leonardo da Vinci

DO YOUR PART

While we can't control the weather we can do our part to help protect our streams and watershed. By making better choices you can be a clean stream hero! Here's how you can help:

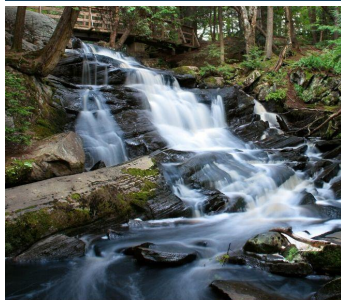
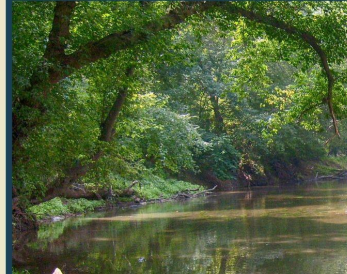
1. Reduce the amount of fertilizer you put on your lawn.
2. Never litter and always trying to pick up trash that was improperly disposed of.
3. Plant a rain garden.
4. Follow the leave no trace way and stay in marked areas of the Park..

By doing these 4 things Y-O-U can help prevent harmful stormwater runoff!



FLOODING AND FLOOD RISK

In Patapsco Valley State Park



THE POWER OF WATER

Water is stronger and more dangerous than many of us realize! Fast moving water is strong enough to carry:

- cars
- bicycles
- petroleum tanks
- manhole covers & more!

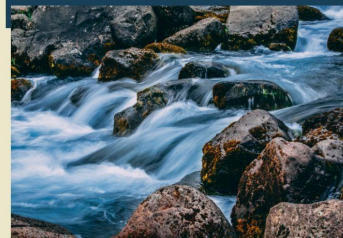
In addition the rocks in the bottom of the streams can become very slippery and cause an individual to lose their footing and get swept away by the current. While the beauty of water is here to be appreciated it should not be enjoyed during a flooding event.

FLOODING WARNING SIGNS

1. Are there dark clouds?
Check your local weather app for storm warnings.
2. Consider if it has been raining all day or rained heavily the day before.
Flash floods can even occur on a sunny day if it had rained heavily the day before!
3. Use your senses! Does the water look more brown in color? Is there debris in the water? Is the water loud and roaring? These are potential signs of flooding.
Be cautious.

WHAT HAPPENS TO OUR STREAMS WHEN FLOODING OCCURS?

When flooding occurs we aren't the only ones that are affected by it! As rainwater washes over surfaces like roads and sidewalks it carries all the trash and chemicals with it. This runoff water carrying pollutants impacts our drinking water and the whole ecosystem.



ALWAYS BE PREPARED AND BE AWARE!

- Take note of the signs that are posted near you related to flooding.
- Always pay attention to your current surroundings and have an emergency plan prepared!



Note: We were unable to find an image of floating debris for the “power of water” section, but feel this would be a great addition.

Spanish Translation:

	<h2>HAGA SU PARTE</h2> <p>Mientras no podemos controlar el clima, podemos hacer nuestra parte para ayudar a proteger nuestras corrientes y cuencas. ¡Al tomar mejores decisiones, usted puede ser un héroe de transmisión limpia! Aquí es cómo usted puede ayudar:</p> <ol style="list-style-type: none"> 1. Reduzca la cantidad de fertilizante que pone en su césped 2. Nunca tire basura y siempre recoge la basura suelta 3. Plante un jardín de lluvia 4. No deje rastro y permanezca en áreas marcadas del parque <p>¡Al hacer estas 4 cosas, U-S-T-E-D puede ayudar evitar la escorrentía de aguas pluviales!</p>	<h2>INUNDACIONES Y RIESGO DE INUNDACIÓN</h2> <p>en el Parque Estatal Patapsco</p> 
<p>"El agua es la fuerza motriz de toda la naturaleza" - Leonardo da Vinci</p>		
 <h2>EL PODER DEL AGUA</h2> <p>El agua es más fuerte y peligrosa de lo que muchos de nosotros pensamos. Agua con corrientes rápidas tiene la fuerza suficiente para transportar:</p> <ul style="list-style-type: none"> • automóviles • bicicletas • tanques de petróleo • tapas de pozos y mas! <p>Además, las rocas en el fondo de las corrientes pueden volverse resbaladizas y hacer que un individuo desliza y sea arrastrado por la corriente. Mientras que la belleza del agua es algo para apreciar, no es algo de debemos disfrutar durante una inundación.</p>	<h2>SEÑALES DE INUNDACIÓN</h2> <ol style="list-style-type: none"> 1. Hay nubes oscuras? Verifique una app de la clima local para avisos de tormentas 2. Considera si ha llovido todo el día o si había fuertes lluvias el día anterior. ¡Inundaciones pueden ocurrir incluso en días soleados si ha llovido mucho el día anterior! 3. ¿Usa sus sentidos! ¿El agua se ve más marrón en color? ¿Hay escombros en el agua? ¿El agua es ruidosa y rugiente? Estas son posibles señales de inundación, tenga cuidado. 	<h2>¿QUÉ SUCEDE CON NUESTRAS CORRIENTES CUANDO OCURREN INUNDACIONES?</h2> <p>Cuando ocurre una inundación, ¡no somos los únicos afectados por ella! A medida que el agua de lluvia se lava sobre superficies como carreteras y aceras, lleva basura y productos químicos. ¡El agua de lluvia ahora contaminada se llama "escorrentía" y no solo contamina el agua potable, sino que afecta negativamente a todo el ecosistema!</p>  <h2>¡ESTÉ SIEMPRE PREPARADO Y ATENTO!</h2> <p>Al entrar al parque, siempre debe tomar nota de los letreros que se encuentran cerca de usted relacionados con las inundaciones. ¡Siempre preste atención a su entorno y tenga un plan de emergencia preparado antes de venir!</p> 

The purpose of this pamphlet is to educate PVSP visitors about the dangers and causes of flooding. In both Spanish and English, it meets the needs of most park visitors. One of its goals is to engage with visitors in ways that can often be difficult for park rangers. All the proposed pamphlets are meant as accessible materials that can be easily handed at park entrances.

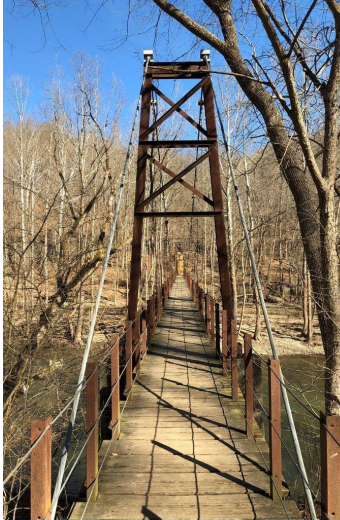
The flood risk communication elements of this pamphlet were derived from resources that Zion National Park uses to inform its visitors about flooding dangers (NPS, 2019). That material was particularly relevant in sections describing how to prepare for floods and how to predict if a flood will occur nearby (NPS, 2019).

This pamphlet also explains the negative environmental effects of flooding, beyond risk to human safety (USGS, n.d.b). This information was derived from the USGS and their description of runoff effects on water quality and ecosystem health (USGS, n.d.b).

The pamphlet's action piece lets community members know they can make a meaningful difference in their watershed and eliminate some of those negative impacts. Some of these recommendations are suggestions from the EPA (U.S. Environmental Protection Agency, 2020) and some are from the Audubon Naturalist Society, an organization that educates on combatting stormwater's impacts on waterways (Audubon Naturalist Society n.d.).

Children's Pamphlet

https://www.canva.com/design/DAD49XhW1BY/share/preview?token=T8HSKcNcGAp9vsIcH1yn9g&role=EDITOR&utm_content=DAD49XhW1BY&utm_campaign=designshare&utm_medium=link&utm_source=sharebutton



WORD SEARCH

RUPAQXGSFDUVBFD
 DTRZFLASHFLOODR
 UJCHANNELZCTRDA
 DYECFZTJDJEUOBI
 FLOODZTCSFYVDFN
 POLLUTIONZXQIYC
 PNEHDJRIZLSKSP
 XQGMHKDRZDXFCOV
 YVXKDWBVMLZFHJY
 RXQXDRVJHBUXAVR
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 RUDVBEOBJJQKBIF

Key:

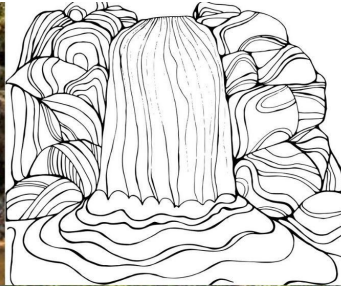
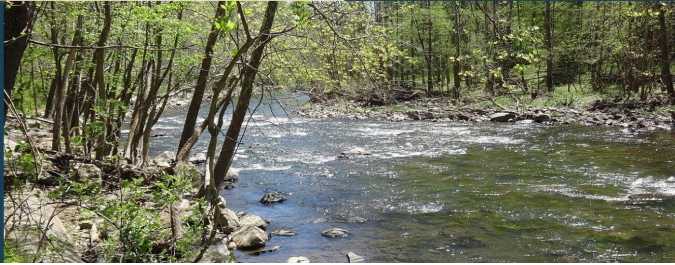
Flood channel rain
 pollution discharge
 runoff flashflood
 climatechange



PATAPSCO VALLEY STATE PARK

Kids Guide

Fun Fact: PVSP was founded in 1907 and is Maryland's Oldest State Park



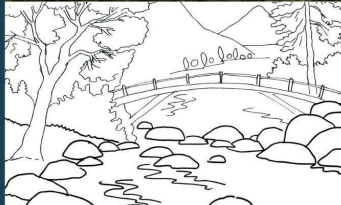
UNSCRAMBLE THE LETTERS!

emcilaet gehnca
 hfals olofd
 cpttniipieora
 soptapac
 olofd agdnre

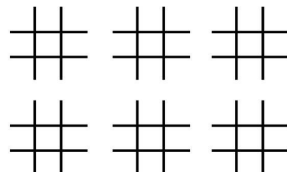
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ACTIVITY TIME

With a group of family and/or friends, sit in a circle. One person will be 'it' and drip water on each person's head. When the 'it' person is ready, they will drop a bunch of water on someone's head. That person then gets up and tries to chase the person around the circle and the "it" person either tags the individual and the person tagged becomes it or the individual sits in their seat without getting tagged and is safe. The purpose of this game is to represent that a flood happens very fast.



TIC TAC TOE



Spanish Translation:



WORD SEARCH

K V A R H W F M J C X O L I R P L K O L D A T Z K N C I N N
 T X K A E L S P N N O I P N H P D O Z O F W A K G A P E V C
 B M V O S Z I C S R L M W Z T M E A F A I P A I P G A A
 W N L O X P Z D A M U M A E N H P I X H R J D S D W V A D
 D F F C B H V H R H O K R K C A F A D W O L D P Z A
 N A T T A I U L I X J B G M P D L F B E Y B L O P I U X S
 Y R C G A I F N E Z K I U S F Q A V I X O B I P Q C
 I M X C L N P Y U H I Y Z O D I K M L H G O I M A M V F Z A
 P J R G A I F N E Z K I U S F Q A V I X O B I P Q C
 R Z N E W E A K D F P W R A L S F N X X D D R P V H D R G
 Q L H W O P N A A C Y F A M Y F S F S T R T K V J P A N
 P M P P E A Q H C O N Z L Y O D B M U V W S A D I U L V X J
 D V M D T H P I B O O D I M C Y O B I F A U I P A N
 Y T B F R K L Z G V Z Y E M A W U A P T L Y W D L U N W W X
 U T M K L I P N T M P A G I S I R L I V A I L H G I P T
 W G B C C O N C R K Z E H V V O M N W A C K R U E Y U X
 C A G W T Q R E L W I O M D I F O T J Y J O I V C E D D L
 I O D B D P Z V F G E W R W V V Y K V H C N V D U I S T O T Y
 B T M E F G E T C T J F Z F Z C S O U V A D A Y O
 Q W E T T O I D N Q W I J O O U B J A W J Z A C S Z J F A J
 X G S C A I F E T R O Z W H O M S Y Z O A I K A P O
 O Z C K Z M J S I N T R T W S P P H I J A T U M I P U Z I O
 G O D D V I M A N K I B R R E I C T W S T I M A R U O
 H W R S O S H N A D P H L F C P F C K Y V G C L N H N N
 K R L H V K A D Z K M F C S F F U C H G G O L
 O T E I X T I N P C I J X Y D K N C M P O T S F S H X P Z
 Y H G V O C T I J C H V P C A R N S A G C A N A I J
 B O T W S Y J W V L M G O A L X G O E P Y C L W O R M Y W
 M L I S Y Z O R B P H N F O S T L U M B O U N C T I
 J J A Q T U S K S A H J S M Z W F U I K P F K Z M A R I B

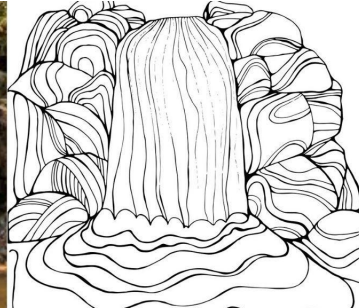
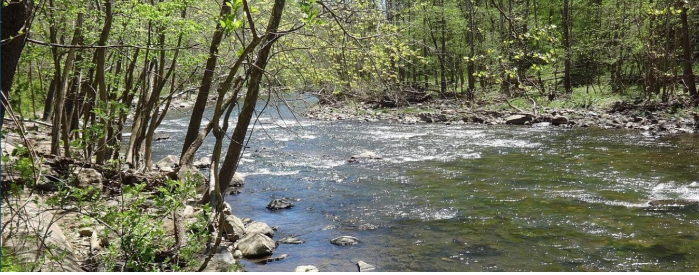
Clave:
 inundación, canal, lluvia,
 contaminación, descarga,
 escorrentía, inundación
 repentina, cambio
 climático



**EL PARQUE
 ESTATAL
 PATAPSCO**

Guía para
 niños

Dato curioso: El
 parque fue fundado
 en 1907 y es el
 parque estatal más
 antiguo de Maryland



**ORDENA ESTAS
 LETRAS**

irogple ed doncaiinnu

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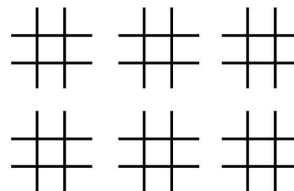
clave de Respuestas:
 peligro de inundación,
 precipitación

**TIEMPO DE
 ACTIVIDAD**

Con un grupo de familia o amigos,
 siéntense en círculo. Se seleccionará una
 persona y serán responsables de gotear
 agua en la cabeza de cada persona.
 Cuando la persona seleccionada esté lista,
 arrojará un montón de agua sobre la
 cabeza de alguien. Luego, esa persona se
 levanta e intenta perseguir a la persona
 alrededor del círculo y la persona
 seleccionada etiqueta al individuo y la
 persona etiquetada se convierte en él o el
 individuo se sienta en su asiento sin ser
 etiquetado y está a salvo. El propósito de
 este juego es representar que una
 inundación ocurre muy rápido.



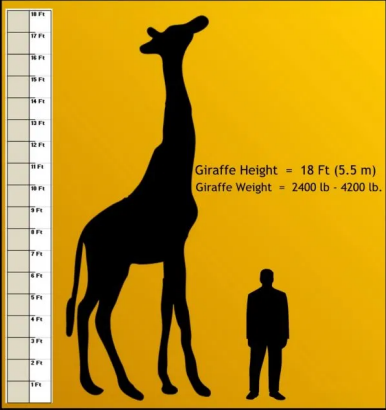

TIC TAC TOE



This pamphlet is designed for children aged 5-12, in English and Spanish versions. It includes a fun fact about PVSP, coloring sections, a word search, tic-tac-toe and more. These expose children to words associated with flooding and flood risks and can actively engage them the outdoors and environmental education. They should be distributed throughout the park and to family groups.

Video Script

English

Minutes	Script	Visual
0:00-0:13	<p>INTRO:</p> <p>Welcome to Patapsco Valley State Park! We are so glad that you chose to spend your day here with us!</p> <p>Before you get on the trails or enjoy a picnic with your family you need to know some important information that will keep you safe.</p>	(Terrapin mascot waving and speaking)
0:13- 1:00	<p>BACKGROUND:</p> <p>Did you know that Patapsco Valley State Park has a long history of flooding? In 1868 water rose 20 feet, that is approximately the height of an adult giraffe! The powerful and relentless water wiped out an entire town that was located alongside the Patapsco River!</p> <p>Unfortunately, many lives were lost. But the strangest thing is that it was not even raining! We will explain why later.</p> <p>The park has been experiencing a surge in flooding events and intensity with our most recent flooding events occurring in 2016 and 2018, leading the Washington Post to name nearby Ellicott City “Flood City, USA.” This is why we want to communicate flooding guidelines to keep you, your family, and your friends safe.</p>	  <p>(Image of Flood City, USA News article)</p>

		(Image of a family smiling in a park)
1:00- 1:05	Here are some facts about flooding you should know:	(Image of the word “flooding” in large)
1:05-1:27	(1) Flooding can occur when there is heavy rainfall. There is a point where the ground cannot absorb any more water and so the water instead travels along the surface of the ground. It follows gravity and accumulates in valleys and streams and when there is a lot of rainfall this accumulation of water can create major flooding events.	(animation of rain falling and accumulating into valleys) (footage of Patapsco flooding)
1:27- 1:49	(2) It can flood in your area even if it is not raining where you are! Seems odd right? But this is what happened in the 1868 flood. Regions upstream of the Patapsco Valley experienced heavy rains and the so much water accumulated that it rushed into the park area and caused massive destruction.	(animation of rain falling on upper watershed region of Patapsco Valley State Park)
1:49- 2:15	(3) Don’t underestimate the power of water! Water can be dangerous and should be respected. It can rise quickly and unexpectedly so keep your distance from rising water. Water carries strong currents, some that you can’t see on the surface. Those currents can move cars, buildings, and especially people. Underestimating the power of water is how some people can lose their lives.	(video footage of powerful water in Patapsco)
2:15- 2:23	Now you know how flooding happens and the dangers you can face. But here are some safety guidelines you should remember and follow:	(speaking terrapin)
2:23-2:35	(1)	(footage of doppler radar, with storm near Patapsco)

	<p>Know before you go! Check the weather before you leave your house, especially doppler radar to see if there are any storms upstream from the valley. Plan ahead and be prepared.</p>	
2:35-3:01	<p>(2) If you're in the park during a flooding event, follow the signs posted along the trails and at trailheads to find the closest and safest exit to higher ground. If you can't reach our safety points, just go up to avoid the rising water.</p> <p>Even when it's not flooding, note where you should go in an emergency> Remember flooding can happen even if it isn't raining and can come unexpectedly.</p>	(Show images of new park signage)
3:01-3:17	<p>(3) If you're at one of the pavilions or are in a parking lot, stay where you are and shelter in place until flooding subsides. DO NOT go in your car and try to drive through running water, your car can be swept away in the force of the current.</p> <p>As little as 6 inches of water can sweep you off your feet, and your car can be swept away in only one foot of water.</p>	<p>(Image of Terrapin under a pavilion sheltering in place)</p> <p>(Footage of flooding with animated car trying to cross and being swept away)</p>
3:17-3:41	<p>If you follow these simple rules, you'll be safe even in times of panic and uncertainty.</p> <p>Remember what we learned today: (1) Know before you go (2) Read the safety signs, and (3) Shelter in place until flooding subsides. DO NOT drive through water.</p> <p>You can learn more about flooding on our webpage or just ask one of our rangers, they're happy to speak to you!</p>	<p>(image of doppler radar)</p> <p>(image of safety signs)</p> <p>(image of shelter in place)</p> <p>(image of a car driving through water with an X over top)</p> <p>(Terrapin mascot with a ranger waving)</p>

3:41-3:45	Have a great day and enjoy your time at Patapsco Valley State Park!	(Terrapin and ranger waving)
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Spanish

Minutes	Script	Visual
0:00-0:13	<p>¡Bienvenidos al Parque Estatal Patapsco! ¡Estamos contentos de que hayáis elegido este parque para pasar su día aquí con nosotros!</p> <p>Antes de comenzar a caminar o disfrutar de un agradable picnic con su familia, hay información importante que nos gustaría compartir con usted para mantener su seguridad.</p>	(Terrapin Mascot waving and speaking)
0:13-1:00	<p>¿Sabías que el Parque Estatal Patapsco tiene una larga historia de inundaciones? ¡En 1868 el agua se elevó 20 pies, aproximadamente la altura de una jirafa adulta! ¡El agua poderosa e implacable aniquiló un pueblo que estaba ubicado junto al río Patapsco! Lamentablemente, muchas personas murieron. ¡Pero lo más extraño es que ni siquiera estaba lloviendo!</p> <p>Explicaremos el por qué más tarde.</p> <p>Hemos experimentado un aumento de inundaciones e intensidad de éstas con los más recientes eventos ocurriendo en 2016 y 2018, lo que llevó al Washington Post a nombrar la cercana ciudad de Ellicott "Flood City, USA." Por eso, queremos</p>	  <p>(Image of Flood City, USA News article)</p>

	comunicarles pautas de actuación ante inundaciones para mantener a usted, su familia y amigos seguros.	(Image of a family smiling in a park)
1:00- 1:05	Estos son algunos datos sobre inundaciones que debes conocer:	(Image of the word "Inundacion" in large)
1:05-1:27	(1). Las inundaciones pueden ocurrir durante eventos de fuertes lluvias. Llega un momento en el que el terreno alrededor del parque no puede absorber más agua y, entonces, el agua viaja a lo largo de la superficie del terreno. El agua se acumula en valles y corrientes a través de la fuerza de la gravedad y, cuando llueve mucho, esta acumulación de agua puede crear grandes inundaciones.	(animation of rain falling and accumulating into valleys) (footage of patapsco flooding)
1:27- 1:49	(2) ¡Puede inundarse en su área incluso si no está lloviendo! Parece extraño ¿verdad? Pero esto es lo que sucedió durante la inundación de 1868. Las regiones arriba del valle de Patapsco experimentaron fuertes lluvias que causó una gran acumulación de agua que se precipitó en el parque y causó destrucción monumental.	(animation of rain falling on upper watershed region of patapsco valley state park)
1:49- 2:15	(3). ¡No subestimes la fuerza del agua! El agua es muy peligrosa y debe ser respetada. El agua puede subir rápidamente e inesperadamente, así que manténgase alejado del agua que sube. El agua transporta fuertes corrientes, algunas de	(video footage of powerful water in patapsco)

	<p>las cuales no se puede ver desde el superficie. La fuerza del agua puede mover automóviles, edificios y especialmente personas. Nunca subestimes la fuerza del agua, podría ser un error fatal.</p>	
2:15- 2:23	<p>Ahora que sabemos cómo se producen las inundaciones y los peligros que puedes enfrentar en caso de inundación, aquí presentamos algunas pautas de seguridad que debes recordar y seguir:</p>	(Speaking terrapin)
2:23-2:35	<p>(1). ¡Infórmate antes de salir! Verifica el tiempo que va hacer ese día antes de salir de tu casa, especialmente el radar doppler para la parte de Norte de Ellicott City a ver si hay tormentas que traen fuerte precipitación sobre todo las tormentas norte de Ellicott City. Planifique con anticipación y prepárese adecuadamente.</p>	(footage of doppler radar, with storm near Patapsco)
2:35-3:01	<p>(2) Si te encuentras en el parque durante un evento de inundación, sigue las señales que se encuentran a lo largo de los senderos y en las cabeceras de los senderos para encontrar la salida más cercana y segura a un terreno más alto. Si no puedes llegar a nuestros puntos de seguridad, simplemente suba. Evitar el agua creciente. * Incluso si el parque no está inundando, tome nota de dónde debes ir en caso de una emergencia, recuérdese que</p>	(Show images of new park signage)

	una inundación puede ocurrir incluso si no está lloviendo y puede llegar inesperadamente.	
3:01-3:17	(3) Si te encuentras en uno de los pabellones o te encuentras en los estacionamientos, refugiese donde estas hasta que disminuya la inundación. NO entres en su automóvil o intentas conducir a través del agua corriente, su automóvil será barrido de la fuerza de la corriente. FEMA declara que 6 pulgadas de agua pueden arrastrarlo a sus pies, y su automóvil puede ser barrido en solo un pie de agua.	(Image of Terrapin under a pavilion sheltering in place) (Footage of flooding with animated car trying to cross and being swept away)
3:17-3:41	Si podemos seguir estas simples reglas, podemos mantenernos a salvo incluso en momentos de pánico e incertidumbre. Así que recuerde lo que aprendimos hoy: (1) Infórmate antes de salir, (2) Lea las señales de seguridad y (3) Refúgiase en un lugar seguro hasta que disminuya la inundación, NO conduzca a través del agua. Si desea obtener más información, visite nuestra página web o pregunte a uno de nuestros guardabosques, ¡estarán encantados de hablar con usted!	(image of doppler radar) (image of safety signs) (image of shelter in place) (image of a car driving through water with an X over top) (Terrapin mascot with a ranger waving)
3:41-3:45	¡Que tenga un gran día y disfrute de su tiempo en el Parque Estatal Patapsco!	(Terrapin and ranger waving)

Recommendations

Signage

All signs and emergency information should be presented in both English and Spanish to reach a wider audience.

The park's main entrance points should be surveyed, including unofficial park entrances, to identify new target areas for flooding information that are not being reached by the main trail signs.

All signage should use cohesive font, capitalization, colors, and warning symbols to emphasize important information. Signs should be communicative even if visitors are far away, can't read, or are moving quickly. Separating messages based on importance and content will improve communication and make people more likely to engage with the messaging.

Education

Create engaging educational activities that could be operated from the Mobile Park Ranger Station. These activities would help attract the public to learn about flooding in the park.

Consider presentations that include visual representations and verbal presentation of the information, along with a hands-on activity.

Engaging with the community on a regular basis through activities for a wide range of ages could be extremely beneficial, not only creating a greater sense of community within the park but encouraging regular visitors to take ownership and responsibility for the park. This could be particularly beneficial in educating about stream health and reducing flooding impacts on water quality.

Video

Covid-19 restrictions made it impossible to film the PVSP educational video. Instead, the script with visual recommendations as well as time estimates for each section will be a starting point. Its information can be worked into other material until a film can be made. This information can be shared with park visitors at the mobile ranger station.

Consider splitting the 3 minutes and 45 second video into two videos—one on education and another on safety. Two shorter videos can be distributed to the audience when desired. Alternatively, the video could be kept intact and a shorter film of only essential information could be created.

The script's visual suggestions include a park mascot. Using a mascot as the narrator can help engage younger audiences and better communicate important information. It might also be useful to include images and videos from past PVSP flooding events to show visitors what flooding looks like within the park. Showing actual images of past flooding can help visitors can familiarize themselves with what flooding looks like in this environment and how to respond.

Of course, the video should be made in English and Spanish. If there is a demand, future work could create the video in other languages.

General Suggestions

Further research should look into building social networks and social media platforms that allow Latino visitors to access important information more dynamically. More research into creating community events might help reach Spanish speaking visitors, which should be a major goal.

The park should consider designing and deploying a mascot, similar to Smokey the Bear used by the National Park Service. The mascot could serve as a voice for PVSP and facilitate flood risk communication to visitors. This mascot would perform especially well with children, providing a friendly face that keeps them informed of flood risk.

PVSP should connect with the USGS flood monitoring system to provide visitors with up-to-date flooding information and better prepare them for their park visit. This technology could implement QR code links that can be posted on signage and linking to the USGS monitoring site. It could also be used to create a system that would alert visitors of low, medium, and high-risk flood alerts.

To further in-person safety communication the park should implement audio alerts projected through speaker systems at the pavilions. A program should be created in both English and Spanish that warns of risk and provides instructions to move to safety.

Weather alert systems on the park website can reach visitors before they arrive. This is an effective flood risk mitigation method because, pending a severe weather event, visitors will be discouraged from using the park until weather passes. There are limits to what can be placed on a government website, but a simple weather alert in severe weather events can mitigate risk and potentially save lives.

Lastly, a survey should be created, distributed, and analyzed to assess the success of the proposed signage and educational materials. It could reveal the effectiveness of the park's educational and safety materials.

Conclusion

This project's goal was to research and present recommendations for flooding signage and education materials for PVSP. This goal was accomplished through researching best practices and developing creative solutions based on these findings. The resulting report suggests signage, educational materials, and general recommendations including a video script to communicate with English- and Spanish-speaking visitors about the risks of flooding.

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