Sun Protection without Ecological Harm: Promoting Reef-Friendly Visitor Behavior in National Parks

Executive summary

Background and motivation

- Sunscreen protects us from the damaging effects of the sun, but recent research suggests that **certain sunscreen chemicals are harmful to coral reefs and other aquatic life**. Water samples in several United States National Park Service (NPS) locations have shown the presence of these chemicals, often as a result of sunscreen washing off swimmers and snorkelers.
- NPS **encourages the use of reef-friendly sun protection**, which includes sun protective clothing and/or non-nanotized mineral-based sunscreen. The agency has developed a set of graphics and messaging that can be used by any park to encourage the use of reef-friendly sun protection methods.
- The objective of this report is to **apply behavioral science** to contribute to these efforts and **help build the foundation for an NPS strategy** that encourages visitors to use sun protection methods that are less ecologically harmful to aquatic life.
- This project was a collaboration between researchers at the National Parks Service, George Mason University, ideas42, and Haereticus Environmental Lab.
- The expected audience of this report is, first and foremost, **NPS staff, friends, and partners**. We hope the research and ideas outlined here will help drive efforts at the park, regional, and national level to encourage less harmful sun protection across NPS parks.

What we did

- Behavioral science offers **deep insights into human behavior, and helps drive social change by analyzing why people do what they do**, and using that knowledge in ways that help improve lives and build better systems.
- We applied our **behavioral design methodology** to define and diagnose the problem at stake, in order to come up with specific design recommendations.
- We then hosted a series of workshops with staff from parks, NPS offices, and local non-profit organizations to **refine our diagnoses by leveraging parks' staff on-the-ground knowledge** and experience, and identify any potential barriers we may have overlooked.
- We also conducted **co-design sessions to develop ideas into tangible interventions** that could be implemented by NPS staff, both in specific parks and at the regional/national level, and ranked ideas according to how feasible they would be to implement, how effective they might be in encouraging the desired behavior, and how exciting they were. All together, we identified **over 50 barriers and generated over 160 ideas**.

Behavioral barriers and design ideas

- The result of this process is 1) a list of **behavioral barriers** that may prevent visitors from adopting less ecologically harmful sun protection methods, and 2) a **playbook of ideas** to tackle these barriers.
- Our **behavioral barriers** are a diagnosis of why visitors behave the way they do. They include a list of 11 factors identified during our research that could be preventing visitors from adopting less harmful sun protection methods.
- Our **playbook of ideas** is a list of behavioral solutions for our barriers. Each idea card is split up into sections, including:
    - The **intervention idea**: This includes a description of the idea and some background information. Cards also include **variations**–ways to adapt or tailor the idea that may

make it more applicable to a specific context. This can also include suggestions for **combinations of ideas**.

- **Barriers to action** and **behavioral solution:** this section covers the **behavioral science reasoning** behind the barrier and solution. It includes both factors that prevent people from using less harmful sun protection options as well as behavioral design principles that may help in this particular case.
- **Make it happen:** this section covers how the idea might be designed and implemented. The purpose of the playbook is to make the ideas as easy to implement as possible. Here the reader can find information on **who to contact** (for funding but also guidance) and also **tips and examples** that include both past experiences within NPS and also samples of what the idea would look like in practice.

How to read this report

This report is not meant to be read from beginning to end. The issue of ecologically friendly sun protection is a problem that involves many different stakeholders and actors, and we expect the readers of this report to be diverse in their background, motivations, and interests. We encourage readers to jump to the section that interests them:

- In the **BACKGROUND** section, readers will find the motivation behind the report, an overview of existing NPS efforts, and a description of our applied behavioral design methodology.
- In the **BEHAVIORAL BARRIERS** section, readers will find descriptions of the barriers we identified that visitors face when considering ecologically friendly sun protection use.
- In the **IDEAS PLAYBOOK**, we outline 13 ideas that address and tackle the barriers. We intend this to spark creativity, encourage collaboration, and provide guidance on implementation.
- In the **SUMMARY TABLE OF IDEAS**, readers can find a high-level summary of all the ideas, as well as the barriers they attempt to tackle. Readers are encouraged to use this summary list as reference, and to share it with colleagues or whomever may find them useful.

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Tags used

Quick and easy to implement	Good for tourists or other temporary visitors	Good for kids and families	All parks	Marine and freshwater parks with water-based recreation
				

Background and motivation

The problem statement and background

In recent years, a handful of states and local governments—including Hawaii, Florida, and the U.S. Virgin Islands—have instituted bans on the use and/or sale of sunscreens containing certain organic chemicals. There is increasing recognition among researchers that these chemicals may have harmful effects on marine species. However, these bans are by no means comprehensive; some only prevent the local sale of banned sunscreens but do not prevent travelers from bringing in already-purchased sunscreens, and all of them are limited in the number of chemicals they ban, frequently allowing the continued use of some organic chemicals thought to be harmful. The prevalence of these chemicals is widespread: an estimated 70-80% of sunscreens on the market contain oxybenzone and/or octinoxate, two of the chemicals targeted in the bans.[1] The National Park Service (NPS) has detected high concentrations of oxybenzone, octinoxate, and avobenzone around coral reef sites, and has identified ecologically friendly sun protection as an area of focus.[2]

NPS encourages the use of reef-friendly sun protection that includes sun protective clothing and/or non-nanotized mineral-based sunscreen. The agency has developed a set of graphics and messaging that can be used by any park to encourage the use of reef-friendly sun protection methods. The full set can be found on their website. While these materials are best suited for parks with coral reef resources, they provide a foundation for clear communication strategies for any park. (Below, in **Idea #A1 - Standardize language around sun protection that is inclusive of all types of parks,** we explore standardizing and expanding this language and recommendations to make them inclusive of all types of parks.)

This project is a collaboration between NPS, and researchers at George Mason University, ideas42, and Haereticus Environmental Laboratory (HEL), with the aim of building the foundation for a strategy that encourages visitors' use of ecologically friendly sun protection.

What we did

Why behavioral science?

Simply put, behavioral science is the study of *why people do what they do*. It sits at the intersection of economics, psychology, and evaluation sciences, seeking to answer questions like, "How do people make decisions? How do people's actual actions differ from their intended actions? How can we better design programs, products, and policies to respond to people's real lives and challenges?"

[1] Raffa et al (2019).
[2] NPS (2020).

Behavioral scientists often think about the forces that shape human decision-making as existing on a spectrum from structural to behavioral. No single issue is purely one or the other; rather, both structural and behavioral elements contribute to how people evaluate choices and make decisions. Whenever a process depends on people's decisions and actions, there is room for behavioral design to add value.

Here, for instance, prohibitively high costs of non-nano mineral sunscreen may be a structural barrier to choosing it as a sun protection method. But a behavioral barrier might be the *perception* that non-nano sunscreens are prohibitively expensive, or never considering the option in the first place. The lack of UPF clothing sold at local stores may be a structural barrier; a behavioral barrier might be the social pressure a person might feel to wear a bikini instead of a rash guard. As long as there is no comprehensive nationwide ban on the chemicals in question, nuanced behavioral factors will influence people's choices, and are worth considering.

Behavioral questions we might ask include:

- How do people think about their activities in national parks and how to protect themselves from the sun?
- How might a person's social identity and relationship to a specific place affect their receptivity to messaging around sun protection?
- What sways someone to purchase one sunscreen over another, even if they cost the same and offer the same sun protection?
- How do people's contexts—what they see their friends, family, and peers doing, what they see and hear in the media, what has been taught to them by caretakers and educators—affect their choices?

The answers to these questions inform how people ultimately choose sun protection for themselves and their families—and it is these dimensions of sun protection behavior that make it a good candidate for exploration through a behavioral lens. Through this project, we sought to answer questions like these to inform NPS's strategy on promoting ecologically friendly sun protection practices.

Our methodology

ideas42 combines behavioral science, design thinking, and impact evaluation to develop interventions rooted in people's real-life experiences. We approached this problem in three key phases: Define, Diagnose, and Design.

Define. We first accurately and concisely define the behavior we would like to change, eliminating assumptions about what may be contributing to the problem and possible solutions. Here, we identified the following problem definition:

> *Many NPS visitors use sunscreen containing chemicals that have been found to be harmful to aquatic life. We want them to reduce their use of these products and use sun-protection methods that are less harmful to aquatic ecosystems.*

Diagnosis and Design. Diagnosis aims to answer the question: "If the desired behavior is such a good idea, why aren't people already doing it?" We drew from previous scientific literature and analytical

frameworks to formulate hypothetical answers. We developed a shortlist of possible factors in park contexts—structural, economic, social, or psychological—that account for the behaviors we observe.

In the absence of other barriers, we would typically then conduct site visits to assess our hypotheses by observing and interviewing park visitors in the park context. Because the COVID-19 pandemic prevented travel, we instead hosted a series of workshops with staff from parks, NPS offices, and local non-profit organizations. Through the workshops, we refined our diagnoses by leveraging parks' staff on-the-ground knowledge and experience, and identified any potential barriers we may have overlooked. We also conducted co-design sessions to develop ideas into tangible interventions that could be implemented by NPS staff, both in specific parks and at the regional/national level, and ranked them according to how feasible they would be to implement, how effective they might be in encouraging the desired behavior, and how exciting they were. All together, we identified over **50 barriers and generated over 160 ideas.**

The workshops represented a unique opportunity to leverage participants' understanding of their park and its visitors in developing ideas that are applicable across the Park Service. We extend a huge thank you to all of those who participated. The input and ideas shared directly inspired many of the ideas described in the **playbook** and also informed our assessment of their feasibility.

Participating parks, offices, and organizations in the Sun Protection Workshop series
Cape Hatteras and Lookout National Seashores (North Carolina)
Dry Tortugas National Park (Florida)
Kalaupapa National Historical Park (Hawaii)
Kaloko-Honokōhau National Historical Park (Hawaii)
Pacific West Regional Office
Puʻuhonua o Hōnaunau National Historical Park (Hawaii)
Reef Relief (Educational non-profit based in the Florida Keys)
South Atlantic Gulf Regional Office
War in the Pacific National Historical Park (Guam)

The result of this process is 1) a list of **behavioral barriers** that may prevent visitors from adopting less ecologically harmful sun protection methods, and 2) a **playbook of ideas** to tackle these barriers.

The list of behavioral barriers is shown below. These are contextual or psychological factors that emerged as likely important to the success of any idea that aims to promote our desired behaviors.

Behavioral barriers

#	Name	Behavioral Barrier What contextual or psychological factors prevent people from engaging in the desired behavior?
1	**Sunscreen is healthy**	There is substantial evidence demonstrating the harmful effects of sun exposure on human health.[3] People are trying to protect themselves—and their families—from these harms. The prevailing message from health professionals and public health experts has been to use sunscreen. Comparatively, little messaging has addressed potential environmental risks of sunscreens.
2	**Sunscreen is the norm**	In the U.S., discussions of sun protection focus on sunscreen products, not other methods like clothing, hats, or staying in the shade. When considering sun protection methods, people purchase sunscreen by default, and do not consider other options. Furthermore, people have negative mental models of ultraviolet protection factor (UPF) clothing; they may think it is expensive, inconvenient, uncomfortable, or unattractive. It can be perceived as less convenient as there is no one-size-fits-all and can be more expensive than sunscreen.
3	**Tanning is the norm**	There are strong social norms around exposing skin and tanning at the beach. As a result, wearing UPF clothing or going to the shade may be perceived as going against the norm.
4	**Sunscreen choice is invisible**	The decision and action of purchasing sun protection is not typically one that is overtly social, and overtly visible. Even if the intention is formed to buy an alternative sun protection method, people may not follow through because there is no social accountability. There's no mechanism for public or peer shaming as a consequence of failing to use ecologically friendly sun protection methods.
5	**That's not me**	In the U.S., environmental issues are often highly polarized and linked to different identities. People may resent, reject, or ignore the messaging because their own perceived identity does not match the perceived identity of the messenger or the recipient of the message.
6	**Never crossed my mind**	People have a default sunscreen they buy, and automatically restock once they run out. People also choose their sunscreen not based on environmental impact, but some other preference about the product, including color, brand, scent, or price. People may also use some heuristic—for example, choose whatever is cheapest, sounds safest, seems most convenient, or what has been purchased before.

[3] Coups et al (2008).

7	**Oxy-*what*?**	The list of chemicals to avoid is long and the names are complex and unfamiliar to the layperson. It's difficult to remember exactly which chemicals should be avoided. People may get confused and buy the wrong one despite good intentions, or give up and go with other criteria of preference (such as price, label, SPF, or scent).
8	**Relationship to location**	Visitors may not feel a particular connection to the place, and therefore may not view their role as being stewards of the park's resources. The connection between their actions and the park's ecology may not seem salient or important.
9	**Mental model of location**	Sunscreen with organic chemicals is most strongly associated with damage to coral reefs. As a result, even if visitors to a park without coral reefs are aware of sunscreen's negative impact, they may feel like it does not matter at the particular site they are going to.
10	**The timing's off**	People may hear about the harm of sunscreens through word of mouth or on the internet, but not necessarily at the point in time when they are able to make decisions about acquiring alternative methods. There is a mismatch between when the message is most salient and when people are able to take action.
NPS staff and partner barriers		
11	**Hassles of emulation and dissemination**	NPS staff independently think of ways to tackle visitor behavioral barriers, but face hassles when trying to disseminate their ideas or emulate what others are doing. There is no forum or mechanism in place to share effective interventions.

Key dimensions

Before jumping into the **ideas playbook**, it is worth highlighting four key dimensions that are directly relevant to the potential effectiveness of ideas: a park's audiences, its ecological diversity, difficulties in idea implementation, and dissemination of models of successful interventions within NPS.

Audiences: Park visitors

In parks with significant water-based resources, the largest audience is often infrequent beachgoers. These beachgoers are more likely to be unaware of the effects of sunscreen on aquatic ecosystems, and also more likely to wear sunscreen that is considered harmful.[4] From a behavioral perspective, they may be more prone to automaticity, choosing a default sunscreen option, or perhaps following price signals rather than evaluating product quality. As a result, it is likely that the topic of ecologically friendly sunscreen

[4] See Levine (2020) for a recent survey of beachgoers in Hawaii, as well as Akerlof and Belman's (2020) literature review for more information.

protection does not feel salient to these visitors, which may pose a barrier when engaging in messaging efforts.[5]

This issue came up during the workshops and conversations with NPS. For example, frontline staff from Hawaii parks suggested that locals were more likely to know about the state's incipient ban on certain sunscreen chemicals and to feel a connection with the local resources. A recent survey of NPS visitors in Hawaii found something similar: locals were more likely to be acquainted with the topic, and to be wearing sunscreen not containing oxybenzone or octinoxate.[6]

Since the issue of **audience** profile is critical, the playbook includes a special tag (see below) for ideas that may be more effective for this infrequent visitor, who may also be less acquainted with the harmful effects of sunscreen on aquatic life.

Good for tourists or other temporary visitors	These design ideas may be amenable to tourists, temporary visitors, or other visitors who are not familiar with the park or context.	

Families with children are another critical audience who have needs and preferences of their own. Family members also often share sunscreen, and recent research has found that families can be an important source of information on ecologically friendly sun protection methods, which can presumably contribute to habit formation.[7] Parks already have a whole set of activities dedicated to families and children, which may allow for ideas to be tailored towards them. For example, **Idea #7 - Design a Junior Ranger "Sun Protection" badge** would involve creating a new sun protection badge for inclusion under the NPS Junior Ranger program. Ideas that are particularly suited for families and children are tagged with the icon shown below.

Good for kids and families	These design ideas will likely work well for families with kids.	

Park ecological diversity

A second source of diversity is the ecology of the parks themselves. Parks with abundant water-based resources and coral reefs may choose to use different strategies to promote environmentally friendly sun protection behavior than parks with little to no water-based recreation. For example, a strategy focusing on connecting aquatic life to local and regional identities in park interpretation (see **Idea #8 - Create pop-up interpretation stations** for an example) may work better in the former, whereas light-touch

[5] See Schuldt et al. (2016), for example.
[6] Levine (2020).
[7] Levine (2020).

interventions (for instance, see **Idea #5 - Use signage in high-visibility areas to highlight the issue** for guidance on how to use signage to encourage behavioral change) may work better in the latter.

To help guide readers, every idea includes a tag that indicates what kind of park it may be particularly suitable for. It is worth remembering that these are just suggestions, and good ideas can be tailored and tweaked to fit in many different contexts. We will talk about this later on.

Difficulties in implementation

Park staff have to juggle many different responsibilities, which can make it hard to find time and resources to think about (and implement) ideas encouraging ecologically friendly sun protection behaviors. Funding and limited resources can become important constraints, making it harder for entrepreneurial staff and partners to take action. Behavioral science shows that these hassles, both real and perceived, can become obstacles to following up on intentions.

As a result, this playbook incorporates three elements that could help make things simpler. The first is that we have marked ideas that are **quick and easy to implement** with a visual tag, which makes them easier to find.

Quick and easy to implement	These design ideas are fairly easy to implement, or they can be tweaked to fit most park contexts.	

The second is that we have added **variations** of most design ideas. Variations are changes to the idea that take it in a different direction, simplify it, or combine it with a different idea. The objective of this is to acknowledge that parks vary along many different dimensions, and ideas may need to be tweaked to work in a different location (or for a different audience). These variations can help the reader envision what the idea would look like in their own context.

Finally, the playbook also contains a section called **make it happen.** We will discuss this in the next section.

Dissemination of successful interventions across the Park Service

NPS employs thousands of skilled and creative individuals, some of whom are already coming up with excellent ideas to encourage more ecologically friendly sun protection methods. However, during our research we realized that **existing efforts are not well known across the Park Service**. For example, several staff members reported not being aware of existing NPS language and communications material around reef-friendly sun protection. One of the design ideas that were included in the playbook—a sunscreen bar to provide visitors with samples of ecologically friendly sunscreen—had already been tried successfully in Guam.[8]

[8] Workshop notes and personal communications.

This lack of dissemination makes it harder for parks to learn from each other, and it increases barriers to change. It is much easier to implement an idea when others have done it before and when they can provide advice and guidance.

The **make it happen** section includes two things: the first is a set of **tips and examples** based on our research and workshops. These include implementation advice and factors to consider, as well as existing examples from others in NPS—and beyond—who have already implemented similar ideas. The second is **who to contact**. Here, the reader will find suggestions on where to seek funding (for example, from NPS regional offices) and partnerships to implement the idea as well as contact details.

Playbook of ideas

Below, you can find our **playbook of ideas**. Here is how to navigate it. Each idea has its own card, which is split up into sections, some of which were introduced in the previous section. For each idea, we describe:

- **Intervention idea:** or what the idea consists of. This includes a description of the idea and some background information.
- **Variations**: ways to adapt or tailor the idea that may make it more applicable to a specific context. As previously mentioned, this can also include suggestions for **combinations of ideas**.
- **Barriers to action** and **behavioral solution:** this section covers the **behavioral science reasoning** behind the barrier and solution. It includes both barriers that stop people from using ecologically friendly sun protection options as well as behavioral design principles that may help in this particular case.
- **Make it happen:** this section covers how the idea might be designed and implemented. The purpose of the playbook is to make the ideas as easy to implement as possible. Here the reader can find information on **who to contact** (for funding but also guidance) and also **tips and examples.** These include past experiences within NPS as well as samples of what the idea would look like in practice.

As previously mentioned, each idea also includes a number of tags based on some of the key themes that emerged during the research process. The first three tags are geared towards whether the idea is **quick and easy to implement**, whether it is **good for tourists and other temporary visitors**, and whether it is **good for kids and families**.

Tags	Description	Icon
Quick and easy to implement	These design ideas are fairly easy to implement, or they can be tweaked to fit most park contexts.	
Good for tourists or other temporary visitors	These design ideas may be amenable to tourists, temporary visitors, or other visitors who are not familiar with the park or context.	
Good for kids and families	These design ideas will likely work well for families with kids.	

Finally, readers can look for the following icons to locate ideas that may be suitable for their **park context**. Ideas tagged with the first icon are generally suitable for most park contexts, whereas ideas tagged with the second icon may be better suited for parks with water-based resources and recreation. Again, this is just indicative. Most ideas can be just as effective if tailored to different contexts.

Tags	Description	Icon
All parks	This idea will likely work well in all park settings, regardless of the natural resources available. For example, a park with no significant water-based recreation, such as *Badlands National Park*.	
Marine and freshwater parks with water-based recreation	This idea will work well in parks with significant marine or freshwater resources where water-based recreation is permitted. For example, a park with abundant coral reef populations, like *Dry Tortugas National Park*.	

Ideas: Park Level

#1 - Use individual park websites as a channel

Simple

Tourists

All parks

Intervention idea:
Parks have leeway to create and edit pages in their individual websites, and this can be a powerful tool that parks can use to connect with potential visitors searching for information while they are planning their trip. On the website, consider having a page or a section that **provides information on ecologically friendly sun protection options and a checklist of things to keep in mind** when planning a visit. The information provided will be useful to the visitors who may not be aware of the effects of sunscreen on health and the environment.

Variations

1. Include an option to **pre-order ecologically friendly sunscreen** and pick it up upon arrival at the visitor center or other designated area. We know that pre-committing to a behavior using a commitment device can make it more likely that we end up engaging in the behavior.

2. **Target the ticket purchase process.** Not all parks use online ticketing through recreation.gov, but those who do could include alerts or messages under the facility information section.

3. **Create a web plug-in** where users can type in their addresses and find stores within a given radius that sell non-nano mineral sunscreen, UPF clothing, and other ecologically friendly sun protection methods. For areas with a pledge that business can take (see **Idea #10 - Encourage visitors to take a "Friendly Sun Protection Pledge"** for more thoughts on visitor and business pledges), it would display the businesses that have taken the pledge.

Barrier to action:

- While planning for their trip, visitors **may not even be aware of the fact that sunscreen can have deleterious effects** on animals and water resources in the park. By the time that they make it to the park, they may have already bought sunscreen and feel like it is a waste to throw it away. In other words, the **timing between the messaging around the importance of ecologically friendly sunscreen and the action of buying ecologically friendly sunscreen is misaligned**.
- Since non-nano mineral sunscreen is not yet widely available at grocery stores and pharmacies, it can be a **hassle** to search for and purchase.
- People often have a **default** sunscreen they buy, or make sunscreen decisions around product features outside of environmental impact (like color of packaging, brand, scent, or price). People may also use some heuristic—for example, choose whatever is cheapest, sounds safest, seems most convenient, or what has been purchased before.

Behavioral solutions:

- **Checklists** help turn complex tasks into more manageable ones and increase the likelihood of carrying out an action.
- Pre-ordering sunscreen is a **commitment device.** Commitment devices help us to follow up on future behaviors that we know will be positive for us in the long run but we tend to procrastinate on because of the present costs.
- An intuitive search tool makes it easy to find and buy ecologically friendly sun protection methods at local retail stores. It also draws people's attention to a feature that may otherwise be overlooked, **making it more salient**.

Make it happen:

Who to contact

- The NPS WASO (Washington Office) has created **shared templates and language** on sun protection and coral reefs (see here), and can provide shared content that could be included in individual park websites. This would help keep the message consistent across parks while allowing them to tweak the implementation to local needs. See **Idea #A1 - Standardize language around sun protection that is inclusive of all types of parks** on why this is important.

Tips and examples

- Some parks are already using their individual websites as a channel to share guidance on sun protection. For example, Kaloko-Honokōhau NHP recently added a page to their *Plan your visit* section providing useful tips on choosing sunscreens that are respectful of coral reefs and disposing of harmful sunscreens. They have also tweaked the language in their visitor pledge to include "using reef-friendly sun protection," an option we explore under **Idea #10 - Encourage visitors to take a "Friendly Sun Protection Pledge"**.

#2 - Use trade-ins to target people who have already purchased sunscreen

Tourists

Water recreation

Intervention idea:
Parks will need strategies to target visitors who have already purchased (ecologically harmful) sunscreen before arriving. One way to persuade visitors to give away their old sunscreen is to offer trade-ins where people can turn in non-mineral sunscreen and receive non-nano mineral sunscreen (perhaps along with some information on the effects of sunscreen chemicals).

Variations

1. **Host a series of "Clean out your cupboard" events** that are geared specifically towards the local population. These could be held during broader festivals or special events that are thematically related–for example, during National Ocean Month.

2. For a simpler version, combine this with **Idea #1 - Use individual park websites as a channel** to **provide guidance on local businesses and partners that have drop-off locations** for harmful sunscreens. This has already been done by some parks; an example is provided in the **Make it happen** section below.

3. **Offer on-board sunscreen trade-ins** for parks where visitors commonly arrive via cruise ship, ferry, or other boats. This may also be applicable to other mass transportation options (for example, airplanes). Work with private tourism companies to coordinate trade-ins.

Barrier to action:

- Many visitors plan their trips and purchase their sunscreen **long before they arrive at the park**. This makes the outreach efforts harder, and makes it likely that visitors will arrive at the park having purchased ecologically harmful sunscreen.
- The **default behavior** for most visitors may involve buying any regular sunscreen, rather than other preferred sunscreen options.
- Visitors may not be as likely to purchase ecologically friendly sunscreen if they feel like they have already invested money in purchasing sunscreen. This is known as **sunk cost**.

Behavioral solutions:

- People are less likely to change course when they have invested resources in their course of action—

sunk cost. Offering something in exchange, even if less valuable than the original item, can help make the transaction more palatable.

- Social events like sunscreen trade-ins send the signal that ecologically friendly sunscreen is the appropriate choice, helping create a **social norm around ecologically friendly sunscreen use**.

Make it happen:

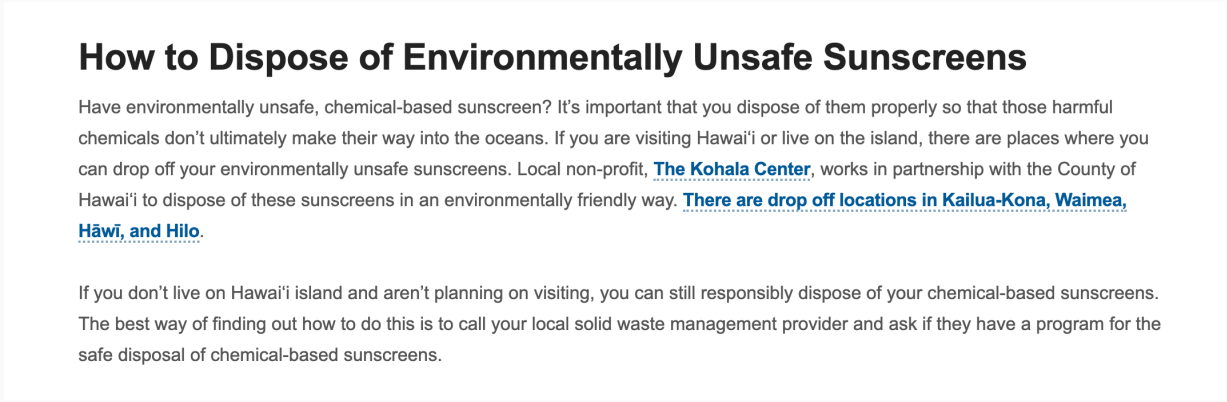
Who to contact

- The NPS WASO (Washington Office) often creates funding requests for initiatives like this, while regional offices can also support parks covered. If parks from more than one region are interested, a bi-regional funding request is also a possibility.

Tips and examples

- Consider reaching out to local partners who may be willing to donate the sunscreen or help organize the events. For example, the Kōkua Hawai'i Foundation in Hawaii partnered up with Little Hands, a local ecologically friendly sunscreen company, to organize a sunscreen trade-in and educational event at the beach. Attendants could learn more about preferred sun protection options and get free sunscreen samples.

- Another example is the *Plan your visit* section of the Kaloko-Honokōhau NHP, which includes guidance on how to dispose of harmful sunscreens, including links to local nonprofits that manage drop-off locations nearby.



How to Dispose of Environmentally Unsafe Sunscreens

Have environmentally unsafe, chemical-based sunscreen? It's important that you dispose of them properly so that those harmful chemicals don't ultimately make their way into the oceans. If you are visiting Hawai'i or live on the island, there are places where you can drop off your environmentally unsafe sunscreens. Local non-profit, **The Kohala Center**, works in partnership with the County of Hawai'i to dispose of these sunscreens in an environmentally friendly way. **There are drop off locations in Kailua-Kona, Waimea, Hāwī, and Hilo**.

If you don't live on Hawai'i island and aren't planning on visiting, you can still responsibly dispose of your chemical-based sunscreens. The best way of finding out how to do this is to call your local solid waste management provider and ask if they have a program for the safe disposal of chemical-based sunscreens.

#3 - Use art displays to make sunscreen effects salient and tangible

Kids and families

Water recreation

Intervention idea:
Install an eye-catching art display near beaches or visitor centers that shows the volume of sunscreen entering the ocean every year or the rate of coral bleaching to show the magnitude of the problem.

Variations

1. A possible variation is to work with local artists who may be involved in the community or even develop an artist-in-residence project.

2. Another possibility is reaching out to schools to get local students involved in creating the display. Consider combining this with other education-focused options such as **Idea #11 - Create activity kits around ecologically friendly sun protection**.

3. Another variation that would be quicker and easier to implement is working with existing spaces or locally relevant, available objects. For example, are there any walls available in interpretation centers that could be turned into a mural? Are there objects that make sense to use in the context, like an oil drum in a beach park or a pickup truck in a forest park? Some real-life examples are provided below.

Barrier to action:

- Visitors going on vacation are unlikely to have the negative effects of sunscreen as a top priority in their minds. In behavioral science, we say this issue is not **salient enough**, and as a result it gets deprioritized in favor of more typical vacation activities (for example, purchasing any sunscreen, planning daily activities, or going to see the main attractions).
- There's an added barrier here: the effects of sunscreen on aquatic life are not as tangible as, say, the effects of an oil spill. They seem **distant and abstract** in our minds, removed from everyday experience.

Behavioral solutions:

- Art displays attract people's attention. A display around sunscreen effects can both **signal** that the park prioritizes this issue and make it **more salient for visitors** who may have otherwise forgotten about it.
- Additionally, choosing an art display that shows something tangible, such as the total volume of sunscreen entering the ocean (or other bodies of water) makes it easier for visitors to visualize the effects. This can **help improve recall and increase availability in people's minds**.

Make it happen:

Who to contact

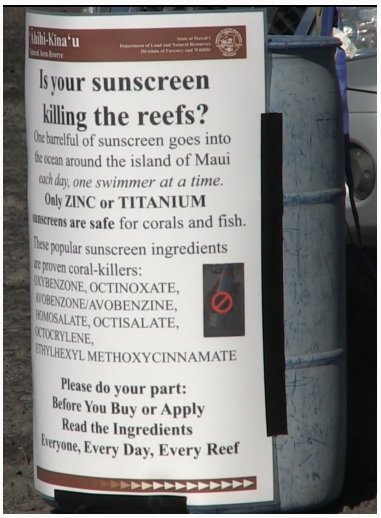
- NPS WASO has supported similar initiatives in the past. For example, NPS is currently involved in a partnership with NOAA to install marine debris displays in a number of parks. The first year will include Cape Lookout National Seashore, Perry's Victory and International Peace Memorial, and Bering Land Bridge National Preserve.

Tips and examples

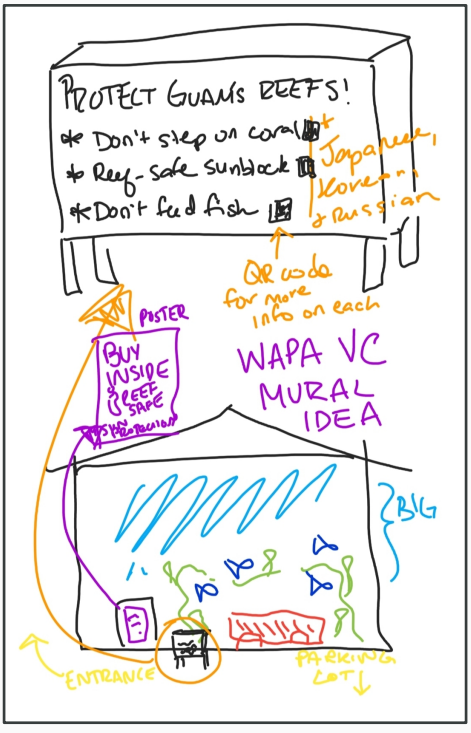
- Consider where the best place for a display is. What area has the highest foot traffic? Are there any transportation hubs nearby—like a bus station or a local airport—where the display could be shown? How could this fit into local interpretive programs?

Example: Barrel display

- The Hawaii Department of Natural Resources has a 50-gallon barrel at a popular reef spot contact station on Maui with messaging around how much sunscreen enters the oceans over a given time period. It is accompanied with actionable steps visitors can take to mitigate the problem, and is a powerful visual awareness piece.



Retrieved from "DLNR & YOU-Reef Safe Sunscreens," https://vimeo.com/180382413.



Example: Mural

- One of the participants in our workshops designed a mural showcasing local aquatic life. The mural would be displayed on one of the facades of the Guam War in the Pacific NHP visitor center. This would be a low-cost option that uses existing Park spaces, and would rely on local artists to implement the design.
- The design would be combined with signage that i) highlights key, actionable tips (Don't step on coral, Use reef-friendly sunblock, Don't feed fish) in popular languages, and ii) indicates that reef-friendly sun protection can be purchased inside the visitors' center. See **Idea #5 - Use signage in high-visibility areas to highlight the issue** for more tips on designing effective signage and messaging.
- The display would also include a QR code that would take visitors to the Park website, making use of **Idea #1 - Use individual park websites as a channel**.

Sketch by Ashton Williams, War in the Pacific NHP

#4 - Set up a mix-your-own sunscreen bar

Kids and families

Water recreation

Intervention idea:
At concessions or visitor centers, local parks could set up a sunscreen bar where visitors can purchase a small container and fill it up with the ecologically friendly sunscreen of their choice and pay by weight. To make it more inclusive, consider making sure sensitive-skin, hypoallergenic, and tinted options are available.

Variations

1. Rather than have a permanent setup at the visitor center or concession, make this a temporary activity that is free of charge. This could be make-your-own-sunscreen workshops in popup tents during special days at the park, collaborations with local middle or high schools, face paint booths on the beach where the "paint" is sunscreen, or as a special Junior Ranger activity. As with **Idea #5 - Use signage in high-visibility areas to highlight the issue** or **Idea #6 - Install non-nano mineral sunscreen pump dispensers**, parks could take advantage of seasonal events such as National Ocean Month or locally relevant holidays and festivals.

2. To further add elements of customization, consider providing the option to add ingredients to change the sunscreen's color, smell, or SPF.

Barrier to action:

- Sunscreen is often perceived as a **hassle.** It can be sticky, hard to spread, and it often leaves a white tint behind. This is especially true for traditional non-nano zinc oxide-based sunscreens, which also are some of the least harmful options available.
- People may hear about the harm of sunscreens through word of mouth or on the internet, but it may not be **top of mind** when people are actually making decisions about sun protection.
- Since non-nano mineral sunscreens can be more expensive than conventional ones, people may be hesitant to invest in a full tube before being able to try it out.

Behavioral solutions:

- **Reframing** sunscreen choice and application as a fun activity can be a good opportunity to increase the usage of less harmful options. Reframe color or opacity in sunscreen as a benefit rather than a detriment.
- **The IKEA effect** describes how people value a product more if they were involved in creating or building it (like IKEA furniture).
- An on-site sunscreen bar would allow people to try out a new product **without the risk** of investing in an entire tube, and would be available at the moment when sun protection is most **salient**—when they are already in the park and are exposed to ecologically friendly sunscreen information.

Make it happen:

Who to contact

- This idea is likely to be park-driven, but WASO can support this by developing an SOP to provide a blueprint on how to do this in other parks.

Tips and examples

- Staff from the War in the Pacific National Historic Park in Guam organized a make-your-own sunscreen event for kids during a camp program. To minimize mess, the event was outdoors. Kids were able to design their own label, and customize their sunscreen with different colors and scents.

#5 - Use signage in high-visibility areas to highlight the issue

Simple | **Tourists** | **All parks**

Intervention idea:
Put up signage, posters, or other visuals about the negative effects of ecologically harmful sunscreens as well as the recommended types of sun protection in high-traffic and high-visibility areas. These areas could include:

- On informational bulletin boards.
- On yard signs in the area around the parking lot or along walkways from the parking lot to recreation areas.
- At eye level in toilet stalls and urinals. As with **Idea #6 - Install non-nano mineral sunscreen pump dispensers,** bathrooms can be a great place to install signage or use messaging, as there are likely fewer distractions competing for visitors' attention.

For parks where many visitors arrive via cruise ship, ferry, or other boat, work with the operators to install signage onboard and/or make an announcement to visitors prior to arrival.

Signage and other visuals are a critical and obvious intervention, and yet often they are less effective than they could be. A **quick checklist that can help you design effective messaging** is shown below, and remember that these principles can also be applied to other **Ideas** listed here.

Barrier to action:

- People have a **limited ability to pay attention** to cues. When going on vacation, visitors likely have many things to worry about—all of which will compete for their bandwidth.
- **Uncertainty and ambiguity** around a particular issue renders people less able to form intentions and take action. Visitors may have heard public health messaging encouraging them to use sunscreen and, therefore, they may not be sure of what they are supposed to do.

Behavioral solutions:

- Conflicting messaging makes it harder for visitors to know what to do. **Consistent, standardized messaging** helps reinforce the expected behavior (using ecologically friendly sun protection options) and the reason behind it (the damage to aquatic life).
- Making signage eye-catching, easy and quick to read, and placed apart from other signage captures people's attention among other cues.

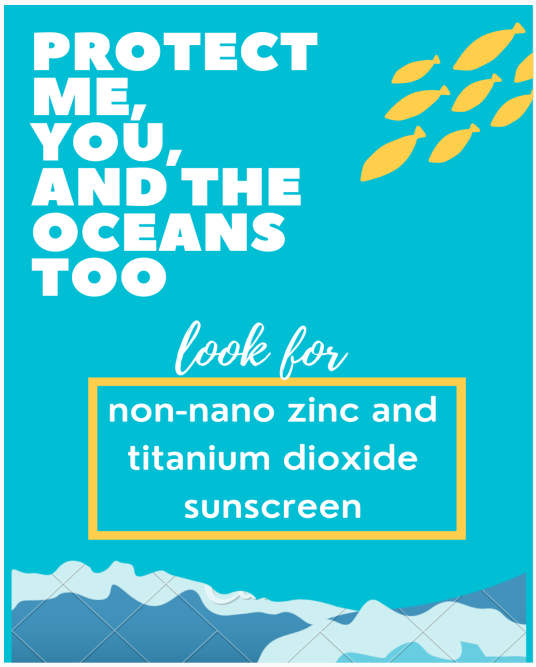
Make it happen:

Who to contact

NPS has developed standardized messaging around reef-friendly sun protection methods. Some of the language is available here.

Tips and examples

Sample poster



Checklist for Effective Communication

Grab attention:

- **Use strategic formatting:** Consider using formatting (for example, bold lettering and color) to highlight your key points and make them more salient.
- **Make your message relevant:** Make sure the information is relevant and valuable to the reader.
- **Timing:** Timing is everything. Reminders and calls to action are more effective if the information is available at the time of the decision. For example, a reminder to wash your hands will likely be much more effective if placed above the sink faucet than if it is placed in an office.

Know your audience:

- **Trust:** Make sure the messaging is coming from a source that visitors trust. Note that this is context dependent (for example., locals may trust different sources of information in comparison to tourists).
- **Use social identities**: Highlight positive social identities that may inspire people to act. For example, locals may feel a sense of attachment to the region that tourists do not share.

Make it easy:

- **Reduce hassles:** Make sure what you are asking your visitors to do is easy to accomplish. If the action has several steps, make sure you lay them out and make them easy to understand.
- **Make it jargon free:** We tend to overestimate the ability of the reader to understand technical wording and jargon because we may be more used to it. Make sure signs are jargon-free and use simple wording that is easy to understand and unambiguous.
- **Provide guidance and help**: Make sure that a visitor reading your sign knows what they are expected to do, and make sure they have a place to go to if they have questions.

Inspire action:

- **Make key points salient:** Highlight the benefits of carrying out the action provided and the costs of not doing so.
- **Use deadlines:** Deadlines make it easier for people to carry out their intended behavior.
- **Social norms**: People look for cues on what is appropriate behavior around them. Is there a social norm visitors could potentially follow? Reinforce adherence to a norm, not lack of adherence (for example, saying “10% of visitors use ecologically friendly sunscreen” may convey that this is acceptable).

#6 - Install non-nano mineral sunscreen pump dispensers

Tourists

All parks

Intervention idea:
Install pump dispensers of non-nano mineral sunscreen outside high-traffic areas, such as bathrooms, beach entrances, or along the beach. Bathrooms are areas of high traffic where your audience may be more likely to pay attention to signs and other salient items (partly because there are fewer attractions to compete for their attention!).

Consider combining this with some of the suggestions laid out in **Idea #5 - Use signage in high-visibility areas to highlight the issue**. Signage on or next to the dispenser can show visitors what an appropriate amount is, include more information on which sunscreens are good and which are bad, and reinforce any other messaging the park feels should be salient.

Variations

1. Are visitors required to board any public vehicles to reach their destination, such as boats, ferries, or buses? Do people engage in other water recreation activities nearby, such as snorkeling or paddleboarding? Consider placing the dispensers in these traffic bottlenecks to make sure they are visible.

2. For a lower cost variation, consider setting up a few dispensers for a special event, such as Earth Day. This may not necessarily create a habit, but it may still signal the importance of ecologically friendly sunscreen and introduce visitors to other sunscreen options. For example, visitors may realize that the ecologically friendly sunscreen provided is much nicer to apply than they had initially anticipated, and they may decide to switch next time they purchase sunscreen.

Barrier to action:

- Researching, finding, and buying ecologically friendly sunscreens can be a **hassle-filled** process: people have to figure out what the "good" and "bad" ingredients are, and then go to (potentially) several stores to search.
- Even when we form an intention to do something—such as bringing ecologically friendly sunscreen to the beach—we may fail to carry out the behavior, especially if there are several steps involved. Perhaps we forgot to buy the sunscreen, or we did buy it but we forgot to put it in our bag.

Behavioral solutions:

- Evidence suggests that **reminders** are particularly effective when provided close to the intended action. A dispenser at the beach entrance may prompt people who have not yet put sunscreen on to do so using the preferred option provided.
- Installing pump dispensers at key locations is possibly the **lowest-hassle** sunscreen solution: people don't need to research and purchase their own, can take what they need, and can apply immediately. Furthermore, it reduces the hesitancy around investing in a whole tube of sunscreen that they may not have tried before.

Make it happen:

Who to contact

- To implement this idea at scale, talk to central NPS offices to develop a standard operating procedure (SOP) for how to put this in practice. This would address the sunscreens that would work in the pump, type of pump to use, how to refill, proper storage, and could be circulated with all parks that are interested.
- A group focusing on melanoma awareness (or similar) might be a useful partner for this idea. A popular success story highlighted by the CDC is that of El Paso (also known as "The Sun City"). The Rio Grande Cancer Foundation has partnered up with local businesses and agencies to install sunscreen dispensers and raise awareness around skin cancer.

Tips and examples

- During the summer of 2020, the state of Rhode Island installed dispenser stations loaded with non-nano zinc sunscreen in popular beaches throughout the state. For the first time, the dispensers were touch-free to minimize contact and comply with COVID 19 safety measures.

#7 - Design a Junior Ranger "Sun Protection" badge

Kids and families

Water recreation

Intervention idea:
Design a new Junior Ranger Sun Protection Badge that rangers earn by completing some number of activities, perhaps tailored to different age groups. Depending on the age range, activities could include:

- Make your own mineral sunscreen
- A scavenger hunt at a grocery store to find and take a picture of harmful sunscreen chemicals and ecologically friendly sunscreen ingredients
- A coloring book featuring people wearing sun protective gear or prompting kids to draw sun protective gear on beachgoers
- Simple number puzzles to calculate the amount of sunscreen that enters the ocean every day at beaches in a given state (for example, "Each person puts on 0.5 oz of sunscreen. If there are 100 visitors to each beach in Hawaii every day, and there are 40 beaches, how much sunscreen is entering the water?"). Consider combining this with **Idea #3 - Use art displays to make sunscreen effects salient and tangible.**

Barrier to action:

- Visitors and their families may **perceive** the negative effects of sunscreen as a second-order problem when compared to other, more salient issues (like plastic pollution, for example).

Behavioral solutions:

- Junior Ranger programs contribute to forming an **identity** as an individual that cares for and protects the park's natural resources. Including ecologically friendly sun protection as part of the program signals that it is just as important as other program components.

Make it happen:

Who to contact

- WASO can support parks in the creation of materials for a Junior Ranger book and accompanying activities.

Tips and examples

- There are a plethora of examples of existing Junior Ranger badges. The NPS Junior Ranger badge page can be found here.

- To the left is an example of what a Sun Protection Badge might look like.

#8 - Create pop-up interpretation stations

Kids and families

All parks

Intervention idea:
Pop-up interpretation stations can create accessible and highly visible opportunities for the public to engage with themed activities around environmentally friendly sun protection. They can either be standalone or manned by roving rangers. Activities at the station could include:

- Taking a "Protect Yourself, Protect the Reef" pledge at the station as suggested in **Idea #10 - Encourage visitors to take a "Friendly Sun Protection Pledge."**
- Getting information on where to find sun protection options.
- Contribute to a collective art piece, perhaps combined with **Idea #3 - Use art displays to make sunscreen effects salient and tangible**.
- Getting your photo taken at a face-in-hole photo board of a ranger pledging to protect the parks, or a park visitor wearing appropriate sun protection.
- Run a scavenger hunt on the beach for kids to find and check off specific types of items (for example, "a rock that looks like an animal," or "purple seaweed"). Upon completion, explain how chemical sunscreens affect all these different types of aquatic life.

Variations

1. If the park is strapped for staff or resources, consider organizing the popup as part of a larger event (an example is Hawaiian Cultural Festival, shown below in the **Make it happen** section) and calling for volunteers to run the stations.

2. Another option is to focus on educational events and get local schools involved. For more information on how to do this, see **Idea #11 - Collaborate with local schools for hands-on science workshops**.

Barrier to action:

- For parents and other caregivers, getting kids to put on sunscreen or sun protective clothing can be a total **hassle.** By having fun, kid-friendly, engaging activities that center healthy sun protection, those barriers can be lessened.

Behavioral solutions:

- Seeing other people engage with activity stations can send a **social cue** that engaging in environmentally friendly sun protection is common and accepted.

Make it happen:

Who to contact

- If you want to set up a pop-up station, WASO can help, but keep the timing in mind! In the spring, parks can submit funding requests to WASO for materials for these stations. They would be disbursed and used in the following fiscal year.

Tips and examples

- Individual parks can identify what types of stations would work best in their context. Some questions to consider are:
    - What areas have the highest foot traffic?
    - Where do people purchase or apply sunscreen?
    - Where might people already be thinking about environmental stewardship?

- Every year, every Hawaii national park hosts an annual festival featuring cultural demonstrations, crafts, games, food tastings, and other educational events. These parks are working on hosting reef friendly sun protection education opportunities at the festivals.

#9 - Work with concessionaires to stock non-nano mineral sunscreen, Ultraviolet Protection Factor (UPF) clothing, and other reef-friendly sun protection options

Kids and families

Tourists

All parks

Intervention idea:
Work with local concessionaires to see if non-nano mineral sunscreens and UPF clothing can be included in contracts. The clothing items can be light, airy, and attractive—flowy poncho-style cover-ups, sun hats, or sarong-style beach wraps. Provide suggestions for how they can set up sunscreen displays to clearly demarcate the environmentally friendly ones. Encourage them to stock sun-protective clothing that is appealing to kids such as themed hats and shirts with different animals.

Variations:

1. In stores, to reduce ambiguity and confusion, make sure ecologically friendly sunscreens look very different from less preferred options (for example, different placement or signage) so that the choice visitors are making is highly visible.

2. The National Park Foundation could create a label for non-nano mineral sunscreens to display.

Barrier to action:

- When people think of sun-protective clothing, what comes to mind as **readily available** may only be uncomfortable-looking, unattractive rash guards.

Behavioral solutions:

- People tend to develop a preference for objects or people that are more familiar to them through **mere exposure** to them. The more commonplace sun-protective clothing becomes, the more normalized and even preferred it may become.
- **Choice architecture**—how options are presented—have an impact on people's behavior. Setting up non-nano mineral sunscreens on shelves such that they are at eye level and are clearly differentiated from chemical sunscreens can encourage people to choose them.

Make it happen:

Who to contact
This idea will depend heavily on individual parks' contracts and relationships with local concessionaires. Talk to your park's superintendent, or connect with regional park associations (such as the Hawaii Pacific Parks Association) to discuss how to go about bringing up this idea with concessionaires.

For parks where visitors regularly arrive via cruise ship, work with private cruise lines to ensure that they are stocking and selling non-nano mineral sunscreen and UPF clothing onboard.

#10 - Encourage visitors to take a "Friendly Sun Protection Pledge"

Simple

Kids and families

All parks

Intervention idea

Have visitors sign a pledge before arrival at the park. This could be upon registering for a pass on the park website or upon making cruise or ferry reservations. The exact pledge can vary depending on the priorities and audience of the park, or visitors can choose among a set of pledges (or write their own):

- Properly dispose of non-mineral sunscreens when they get home.
- Only use non-nanotized mineral sunscreens.
- Tell one other friend about the danger of non-mineral sunscreen.

Variations:

1. Depending on the pledge, visitors can also fill out planning prompts that ask them to make a plan about exactly when and with whom they will take the action.
2. If they consent, visitors can get their picture taken at the moment of signing and the park could post it to their social media. Pictures could also be taken on a Polaroid, and visitors could get to keep their picture along with a magnet to put on their fridge as a reminder and display of their commitment.

Barrier to action:

- Sunscreen use is a fairly **invisible** behavior; there are few opportunities to display one's sunscreen use or to see others' behavior.
- Even if people know the dangers of sunscreen chemicals, they may **procrastinate** disposing of them and acquiring other methods.

Behavioral solutions:

- Taking a pledge is a form of a **commitment device** to take a specific action; having a physical reminder, like a Polaroid and a magnet, is another form of a commitment device.
- **Planning prompts** help people visualize themselves taking the desired behavior and increase the chances that they'll actually follow through on taking the actions.

Make it happen

Tips and examples

Honu sea turtle pledge:

Kaloko-Honokōhau National Park in Hawai'i has developed the following pledge to encourage a culture of stewardship among visitors.

Gateway community variation:
Provide gateway communities with materials to promote ecologically friendly sun protection. One version of this could be providing NPS logo signs to providers of sun protection gear in gateway communities that can be placed on or near shelves with NPS sunscreen messaging.

As a real-world example, in Key West, FL, the non-profit organization Reef Relief encourages businesses to make the Responsible Sunscreen Pledge if they provide or sell sunscreen that does not contain oxybenzone or octinoxate. These pledges are displayed as window decals, and a list of participating businesses is available on Reef Relief's website.

#11 - Create activity kits around ecologically friendly sun protection

Kids and families

All parks

Intervention idea:
Develop activities, lesson plans, and/or educational kits around ecologically friendly sun protection or the effect of harmful chemicals on marine life. These materials can either be used on-site (for borrowing or for interpretation use), or can be ordered by teachers for use in schools.

Some activity ideas could include:

- Put sunscreen on beads that are responsive to UV light to show that mineral sunscreen is effective in blocking UV radiation.
- Guide students in taking water quality samples and interpreting water quality results.
- Measure the effectiveness of different types of sunscreen and clothing on photo paper that is responsive to light.

Barrier to action:

- Discussions of sun protection focus on conventional sunscreen products, not other methods like clothing, hats, or staying in the shade—**non-mineral sunscreen is the norm.**

Behavioral solutions:

- Tangibly demonstrate how mineral sunscreen and different types of clothing are just as effective at providing sun protection.

Make it happen:

Tips and examples
Several parks have previously worked with the central NPS offices and universities to develop activity kits. Check out the Electrical Conductivity STEM Backpack (a kit that guides the user in testing the electrical conductivity measurements of various types of water encountered along Kaloko-Honokōhau's hiking trails to quantify their salinity).

Ideas: Regional and National Level

#A1 - Standardize language around sun protection that is inclusive of all types of parks

Intervention idea:
Current NPS-wide communications on sunscreen use center on coral reef parks. The language, graphics, and recommendations can be expanded to be inclusive of all parks. They can additionally include standardized talking points for rangers and park staff on how to describe environmentally friendly sun protection methods. In advance of the summer season, NPS can put out press releases to different media outlets to communicate clear guidance to visitors and get the word out.

Barrier to action:

- There is high **ambiguity** around what to look for and what to avoid. The desired type of sunscreen can be referred to under many names: "reef-friendly," "reef-safe," "non-nano," "mineral," "zinc," and "titanium" or "titanium dioxide." Moreover, the names of chemicals to avoid are long and complicated, making it confusing for people to know what to seek out and what to avoid.
- Messaging centered on coral reefs can create a strong and clear link between wearing chemical sunscreen and swimming, so people don't understand **the relevance in non-coral reef parks**. A more accurate framing would explain how sunscreen ends up in oceans, harming marine life, whether through the wastewater system or from directly swimming in bodies of water.
- If visitors believe ecologically friendly sun protection is only important in a small fraction of locations, which they consider **"vacation" locations** or places where their normal routines are suspended, they may reason that it's okay to keep and continue using more harmful sunscreen in other, "normal" locations, even if those locations contain other types of sensitive natural resources.

Behavioral solutions:

- **Consistent, standardized messaging** helps reinforce the expected behavior (using ecologically friendly sun protection options) and the reasoning behind it (the damage to marine and other aquatic life).
- Using **heuristics**, or rules of thumb, creates easy-to-remember guidance for what sunscreen to buy and which to avoid.
- Establishing a new **mental model** around how conventional sunscreens cause harm to aquatic life broadly, not just to coral reefs, can shift the narrow association with coral reef parks.

Make it happen:

Tips and examples
Some parks already use helpful heuristics to ensure that visitors do not harm aquatic life. These are a couple of examples from the Kaloko-Honokōhau National Historical Park **honu protection heuristics**. These are heuristics that help visitors keep an appropriate distance when diving and looking at honu in the water or on the beach:

- "If you stretch out your arm, the honu shouldn't be bigger than the size of your thumb"
- Make the shape of a heart with your hands, and have someone take a picture of the honu inside of the

heart. (This ensures that visitors are keeping a safe distance from the turtles, while promoting a fun way to document pictures of the turtles.)

Ideas for heuristic taglines:

- "-Enzone? Heck no!"
- "Look for the oxides: zinc oxide and titanium dioxide."

Ideas for alternative taglines:

- "From ridge to reef"
- "Protect me, protect you, and protect the oceans, too"
- "Healthy sunscreen, from land to sea"

#A2 - Facilitate communication and shared learning across parks

Intervention idea:
The workshops we ran in August of 2020 proved to be an excellent way for staff at parks to inspire one another, share examples of ideas that already had been tested out, and form connections to pursue ideas in collaboration. NPS can continue to host similar spaces to share learnings.

As more parks implement ideas, a searchable database with descriptions, pictures, links, and contact information would serve as a centralized resource for parks looking for ideas and guidance. Yearly awards could also be given for the most creative and effective ideas.

Barrier to action:

- Implementation is **invisible**. Since parks operate fairly independently of each one another, it can be hard to know who is implementing what idea, or even that this is an issue that others are thinking about and addressing at all.
- Many dissemination and knowledge management options can feel like a **cost without reward**, as they incur steep time and attention costs without necessarily receiving recognition or gratitude from others.

Behavioral solutions:

- **A centralized repository** of information would not only provide actionable guidance for parks wanting to implement ideas, but would also set the **norm** that this is an issue that parks across the country are addressing.
- **Communities of practice** with regular opportunities to exchange ideas in presentations and conversations, as well as explicit recognitions and awards, create **social rewards** for trying new ideas and sharing what they learn.

Make it happen:
For inspiration for what a virtual convening could look like, see slides from the workshops we ran here.

Conclusion

Behavioral science asks what factors affect and condition human behavior—in other words, why people do what they do. At ideas42, we use that knowledge in ways that help improve lives and tackle tough social challenges.

Using sun protection methods that reduce harm to aquatic life is one of these challenges. As long as there is no comprehensive nationwide ban on the chemicals in question, behavioral factors will influence people's choices, and should be carefully considered; whenever a process depends on people's decisions and actions, there is room for behavioral design to add value.

We approached this issue by first generating a set of hypotheses that answer the question, "Why aren't people already using non-nano mineral sunscreen, UPF clothing, and other ecologically friendly alternatives?" Through a series of workshops with staff from parks, NPS offices, and local non-profit organizations, we narrowed in on which of these factors and forces were, in fact, shaping people's real life behavior. In tandem with participants, we then generated design ideas that directly addressed the identified barriers. The result is the **playbook of ideas**—a set of 13 tangible interventions that can be implemented at the park, regional, and national level.

Along the way, we uncovered additional barriers that may be hampering current efforts. We noticed that park staff are not always aware of what other parks are doing, or of the existing efforts by NPS to promote ecologically friendly sun protection. The workshops provided a space and a platform for cross-park exchange of ideas, and we were surprised to learn that a number of the ideas we had come up with had already been tested and implemented by parks around the country. In continuing this spirit, we additionally included ideas that **facilitate communication and learning across parks.** We hope this will help empower NPS staff and friends to iterate on these ideas, tailor them to their own context, and ultimately bring about change.

The pressure on our natural ecosystems is one of the greatest challenges we face. Behavioral science is one tool in our toolkit that we can use to address it. While there is no silver bullet, we hope that the research and ideas contained here will contribute to making widespread ecologically friendly sun protection a reality.

References

Akerlof, K., & Belman, D. (2020). National Park visitor sun protection behaviors & ecological effects: A literature review. *Unpublished manuscript*.

Coups, E. J., Manne, S. L., & Heckman, C. J. (2008). Multiple skin cancer risk behaviors in the US population. American Journal of Preventive Medicine, 34(2), 87-93.

Levine, A. (2020). Sunscreen use and awareness of chemical toxicity among beach goers in Hawaii prior to a ban on the sale of sunscreens containing ingredients found to be toxic to coral reef ecosystems. *Marine Policy*, 103875.

NPS (2020). Protect Yourself and Protect the Reef (U.S. National Park Service). (2020, June 3). Retrieved October 21, 2020, from https://www.nps.gov/articles/protect-yourself-and-protect-the-reef.htm

Raffa, R. B., Pergolizzi Jr, J. V., Taylor Jr, R., Kitzen, J. M., & NEMA Research Group. (2019). Sunscreen bans: Coral reefs and skin cancer. *Journal of Clinical Pharmacy and Therapeutics*, *44*(1), 134-139.

Schuldt, J. P., McComas, K. A., & Byrne, S. E. (2016). Communicating about ocean health: theoretical and practical considerations. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *371*(1689), 20150214.