A Surfer's Guide to Sustainability

By Nick Power

Abstract

This report assesses the sport of surfing for its environmental impact. Though the act of riding a wave is environmentally friendly, the industry and the lifestyle associated with surfing are unsustainable at present. And while steps have been taken to reduce the impact of surfing products, and the environmental consequences of the sport are beginning to be acknowledged by the its participants, as a whole the surf world does not seem to be moving towards sustainability at a quick rate. One obstacle to this goal is the dependence on petrol to create materials like foam for surfboards and neoprene for wetsuits. Another is the habit of travel involved in the surfing lifestyle. Though the exact environmental impact of the surf industry and surfing lifestyle are unknown, each part examined suggests that surfing does negatively impact the environment to a degree worth concern. Surfing depends on the health of the ocean, so it's necessary for surfers to aim for sustainability.

This study is a compilation of research on the surf industry: the process of surfboard manufacture, wetsuit manufacture, apparel manufacture, and the shipping of these goods. Surfers habits of travel are also addressed. In each case, the environmental consequences were summarized. For specifics about certain materials involved in wetsuits and surfboards, interviews by email were conducted.

The study concludes that the surf industry has the most responsibility to change in making the sport of surfing more sustainable. To do this, surf companies should localize production rather than keep factories overseas in order to reduce dependence on petroleum. Manufacturers must reduce the toxicity of surfboard and wetsuit manufacture by utilizing alternative materials. This includes researching new technology and using natural materials currently available. Surf businesses must also become more efficient in production, dealing with waste and using energy responsibly. To the point of the surfing lifestyle, surfers (especially professionals, who travel the most) must take less surf trips and drive less. And surfers, as a whole, need to become more environmentally conscious of the impact the sport has.

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Acknowledgements:

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List of Terms

Blank: unshaped surfboard foam

EPS: expanded polystyrene foam

Fiberglass: used to seal a shaped blank with a hard shell

Green Foam: recycled polyurethane foam blanks

PU: polyurethane foam

Resin: adhesive chemical that bonds fiberglass to surfboard foam

SIMA: Surf Industry Manufacturers Association

XPS: extruded polystyrene

1. INTRODUCTION

1.1 HOW SURFING AFFECTS THE ENVIRONMENT

The sport of surfing is idealized as a pure and respectful communion with nature. But the truth is, many of its elements are contributors to environmental problems. Surfboards and wetsuits are made from refined petrol, surf apparel is manufactured overseas with conventionally grown cotton, and surf trips use thousands of liters of petrol purely for a change of scenery and the possibility of a better wave. The lifestyle and products involved with surfing are responsible for Greenhouse-gas emissions, toxic chemicals that contribute to air and water pollution, and non-biodegradable materials that crowd landfills.

The proximity of peak oil and climate change will certainly impact surfers. The surf industry, relying greatly on petrol, will have to make fundamental changes in materials and methods of production. Oil is well known to be a non-renewable resource, and it's combustion releases CO2, a major Greenhouse gas. Studies suggest that increasing global temperatures will escalate the ocean's acidity, accounting for more dead-zones (oxygen-deprived sea water) (Science Daily, 2009), and coral bleaching (Pomerance, 1999). Because the sport depends on the health of the ocean and other aspects of the biosphere, it is logical and relevant for surfers to become educated about their impact on the environment and change to live in a more sustainable way. Alex Dick-Read (2007) of *The Surfer's Path* agrees: "Surfers tend to be the first to get sick if there's sewage in the water, to notice reefs dying, to be affected by oil spills, agricultural run-off and industrial pollutants. It's fair to say that we surfers should be natural environmentalists."

The concept of going "green" is gaining popularity in mainstream surfing, but there are remarkably few holistic efforts to link environmental problems with the lifestyle and products that surfing propagates. While interest in the environment appears to have started much earlier in magazines like *Tracks* and forward thinking individuals, the crux of environmental awareness for the global surfing community occurred in December 2005. Clark Foam, by far the largest industrial manufacturer of surfboard blanks, closed doors due to pressure from the Environmental Protection Agency. This event, which has been called "Black Monday", was the result of an ongoing dispute over the use of the chemical TDI, or Toluene Diisocyanate, and other waste management issues.

However, surfboards are not the only toxic expression of the surfing lifestyle. Swelling from a wave of popularity that has yet to recede, the surf clothing industry has

created a fashion that millions follow. Just like surfboards, these glitzy shirts and jeans are made in low-cost labor countries like Honduras from conventionally grown American cotton. At "12-18 cents an hour," these impoverished workers turn cotton, "one of the most water- and pesticide-dependent crops" into clothing (Claudio, 2007). Major surf brands appear to be negligibly different than any other member of the textile industry.

There have been grassroots efforts (like Surfers Environmental Alliance, Surfrider Foundation, etc.) that educate and stimulate surfers to become involved in environmental issues. These groups focus on issues like beach sewage and waste management, beach access, and offshore oil drilling to name a few (*Surfers Environmental Alliance*, 2010). Environmental action engages surfers to become aware of what's happening outside the conditions of the waves, as it affects the quality of the ocean. While it is important to focus on these specific issues, their purpose is not to look at the bigger picture and so they do not change the true nature of the sport or it's participants' attitudes. The truth is that the majority of what surfers ride, buy, wear, and do in the interest of surfing is supported by the petroleum industry (Davies, 2009), and that's a major concern. If surfers truly care about the ocean than it's necessary to make a more genuine commitment to reduce the impact of the surfing lifestyle.

Recently, surf conglomerates worldwide are starting to put out "green" shirts, trunks, and even surfboards. These products are labeled green due to the use of alternative materials (like hemp, recycled PET, and organic cotton). It would seem that the industry is coming around to the reality of the situation. But it may be difficult for consumers to distinguish any real environmental benefits. Companies that put out only a handful of green products are not addressing the root of the problem. This is commonly referred to as "greenwashing" and does far more harm than good (Nelson, 2010). By promoting consumerism this tactic is a false aid the environmental movement.

Still, market movers are a key step in transitioning surfing to a sustainable sport. Every year the industry offers more recycled/organic/hemp products, and writes more checks for non-profits that clean beaches and alert the public. Top professional surfers Chris, Keith, and Dan Malloy dropped a major corporate sponsorship contract with Hurley for a deal with eco-savvy Patagonia (Mauro, undated). And the media may be an important avenue for change. *The Surfers Path*, for example, is a magazine that prints on post-consumer recycled paper with non-GMO soy inks, and includes environmental crises in each issue (*The Surfer's*

Path, 2010). They have acknowledged the environmental concerns associated with producing surf gear, travel, etc. There is a trail emerging in the surf world that people will follow, but it has to lead in the right direction.

1.2 AIMS AND GOALS

The purpose of this project is to asses how surfing effects the environment, be it from the industry that produces surf gear or the consumer that buys it. Thus the aim of this guide is to affect companies and individuals involved by looking at both perspectives, and trying to pin down the most environmentally conscious move in either case.

The surf industry does more damage to the environment than the individual by far, so it would be senseless to ignore its place in the scheme of an environmental agenda. By industry, I'm referring to businesses including surfboard manufacturers, surf clothing and footwear companies, wetsuit brands, and surfing media companies. Marketing director Craig Metzger (in Lewis, 2010) of Ipath shoes agrees: "Corporations are the biggest polluters so it must be the corporations' responsibility to try and do the right thing for the environment and society". A goal is to suggest that business-as-usual is not holding up to social standards, especially considering that surfing depends on nature. Patagonia's Jen Rapp (in Lewis, 2010) adds, "the action sports industry has a vested interest in greening its business. We want to save the places we love and make products for". To remedy the business-as-usual approach, I hope to provide concrete, exemplary solutions by showing what some businesses are already doing, and supplying a few of my own ideas. All in all, the goal is to make surfing companies consider sustainability synonymous with quality. If there is no environmentally friendly alternative (as with the case of surfboards and wetsuits), businesses need to be efficient and focus on durability. This involves material changes but also energy efficiency in manufacturing, gas miles minimization, and effective marketing strategy.

For individuals, this guide contains an overview of relevant sustainability concepts that will create guidelines for understanding how choices affect the environment. The aim is to provide enough information to make environmentally conscious purchases for consumers. Next, the guide explains the environmental significance of travel. This will distinguish how the combustion of fossil fuels for the purpose of surfing impacts the environment. Overall, the goal of this project is to provide a balanced perspective that respects the demand for performance in surfing and the necessity for sustainable ways of living. To this end, I intend

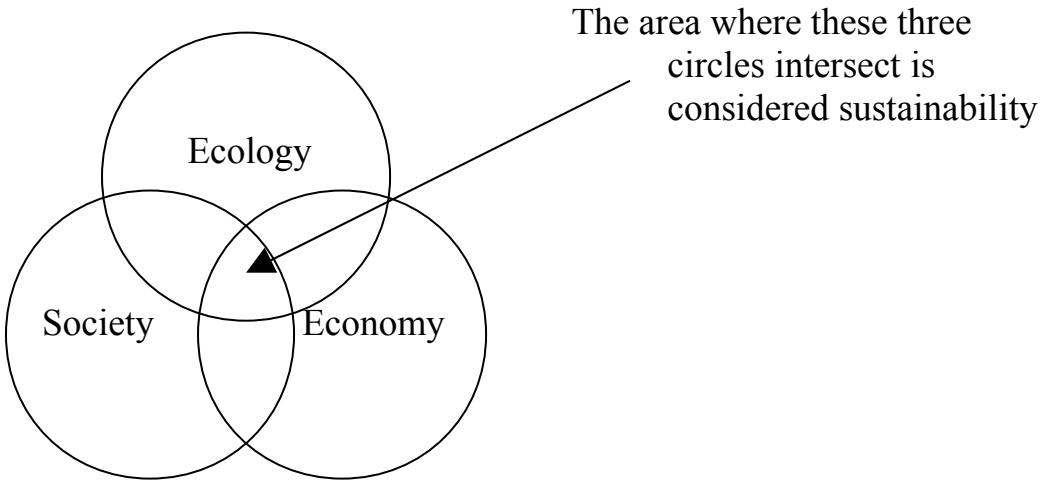
to educate those who do not know how to make their equipment last longer, their trips less destructive, and their lifestyles generally greener.

2. THE CONCEPT AND PRINCIPALS OF SUSTAINABILITY

Without defining this term explicitly, this project would be useless. Readers need to know a little about sustainability to understand what the aims are. A concise definition may be: a way of living that "meets the needs of the present without compromising the ability of future generations to meet their needs" (*Brundtland Commission*, in Barron & Gauntlet, 2002). In a very broad sense, the term refers to a culture that thinks and lives in balance with our care for the environment, society, and the economy.

Sustainable Futures Australia helps explain: "The way we presently live as a society, we do many things which damage basic life-sustaining processes. Without functioning ecosystems we cannot have, or maintain, quality of life" (Cuming, 1997). This does not just affect individuals. As the director of the Action Sports Retailer trade show Andy Tompkins points out, "The sustainability of the [surf] industry is ultimately dependent on a clean ocean," (Tompkins, in Wiedemann, 2007). In essence, we have ignored the fact that without clean air, water, and soil we cannot live (let alone surf or make money off of surfing). Our unsustainable lifestyle has created some serious environmental issues: climate change, the Great Pacific Garbage Patch, and peak oil to name a few. If we continue to be apathetic, either on an individual or industrial level, we are risking the quality of life for generations in the very near future.

The Triple Bottom Line



The triple bottom line is a balanced triangle of "economic prosperity, environmental quality and social well-being" (Suggett and Goodsir, 2002). It is a very common standard for good

business principles. The success of a company may increasingly depend on their ability to surpass the outdated expectation of making money, and be thus be critiqued for not having a grasp on these forward thinking principles. The triple bottom line offers a better quality of life by:

- Considering strong communities and positive social action ends of a successful business
- Establishing responsibility in the present to preserve the same opportunities we have today for people in the future. Also known as intergenerational equity
- Increasing biotic diversity, health, and maintaining ecological systems that all organisms (including humans) depend on to survive
- Providing deeper layers of the term success to customers, investors, and other businesses
- Strengthening relationships with customers by creating trust and interest

The main reason that businesses will have to meet increasingly higher standards is easily summarized:

"companies are now asked by many more stakeholders for information about their impacts on the environment, the economy and the society, and to attest to the ethical conduct and sound governance of their business. Companies are faced with deciding whether to resist these questions, or respond with available data, or whether to seize the opportunity to gain deeper insight into the impact of their own practices, as well as to become truly transparent and accountable" (Suggett and Goodsir, 2002).

Concepts

Economics and social action are fairly well known to most, but the environmental movement may not be. This section attempts to identify some important concepts for the reader, in the hopes of providing a general idea about sustainability past the specific targets of this paper. Because a general shortcoming of guides is that some topics will be missed, some general environmental concepts to remember are:

Interconnectedness of natural systems

Our natural environment is composed of countless self-regulating systems that depend on each other to maintain health of soil, air, water, and living organisms. Food chains are one example. The predators at the top of an ecosystem's food chain keep those lower in system from overpopulating, and those at the bottom feed the ones at the top. Each organism in this chain is important to maintaining biodiversity and preserving an important natural ratio. When something occurs to organisms at the bottom of the food chain, it has a domino effect to the organisms at the top.

Another example of interconnected systems is the movement of substances through water. Pesticides and fertilizers used on crops are spread by rain into waterways. These chemicals affect the surrounding environment, changing the landscape, and eventually end up in the oceans we surf in. We then have to deal with the impacts; dead zones, unhealthy marine life, and poisoned drinking water. The environment is impacted in a multiplicity of ways by a single event.

The Pre-cautionary principle

This concept is easily understood: where uncertainties exist about major "irreversible" environmental consequences, it is best not to make risky decisions (*New Zealand Treasury*, 2006). In other words, don't take chances that might have permanent consequences in the environment. There are always unintended consequences when a system is changed, or a landscape is altered. We can only strive to minimize lasting environmental consequences by treading lightly where we notice fragility. In fact, this should be used as an intergenerational concept; most environmental consequences will not manifest overnight. Included in this concept is an overall respect for limits—that nature does not have bottomless barrels of oil, inexhaustible amounts of trees, or limitless usable water—and so we must be careful about depending on them as though they are renewable.

Renewable and non-renewable

Limitations are a theme of life now. Wise use of water, gas efficiency, and over-population are common concerns of environmentalists. It is now known that we will run out of usable oil within the next few decades (*Oil Decline*, Undated; Campbell, 2008; Bartlett, in *University of Colorado*, Undated). If you are at all skeptical about this concept, I urge you to

watch Professor Al Barlett's talk called "Arithmetic, Population and Energy" available at: http://www.albartlett.org/index.html. The point here is that sustainability involves an effort to reduce or abandon dependence on limited resources, like oil and minerals. They will run out, so we cannot sustain a culture that depends on them to function. We have to learn that there are limits, and we are exceeding them by far.

Embodied energy

Embodied energy is the amount of resources and effort needed to produce a good in every step of its creation (Milne & Reardon, 2008). In the case of a surfboard, the energy embodied includes the extraction and refining of oil, the energy and chemicals used to create resin and fiberglass, the electricity used for shaping, and the gas used to transport the board to where it will be sold. The purpose for calculating embodied energy is to make products with a large amount function as long as possible. Otherwise, the effort put into its production is wasted if it is continually thrown away and replaced.

Life-Cycle Analysis: cradle-to-cradle vs. cradle-to-grave

A Life-Cycle Analysis is an important step in designing sustainable products. When considering the impact that a product will have on the environment, one must plan for all of the stages of its life. Where does it come from, how is it made, how much energy does it take to make it, how is it used, and how is it disposed of? These are questions that need to be asked before the production occurs, in the design phase. A Life-Cycle Analysis allows for the most complete understanding of a product's environmental impact. Something that is made, bought, and thrown away has a cradle-to-grave lifespan. As of now, the typical surfboard has a cradle-to-grave lifespan (although they *can* be recycled, most are not). This can be analyzed for its impact in a number of ways: the oil and chemicals used for materials, the non-renewable energy needed for manufacture, the gas used to transport it, and the threat it poses to the environment when thrown away. In the case of clothing, which is recyclable, a cradle-to-cradle assessment can be completed. That is, it's possible to plan out how a shirt is made to how it's re-made, or re-used in the most environmentally sensitive way.

Less is more: deliberate simplicity

Consumerism is a huge problem in developed countries. While it may have benefits for the economy, persistent buying plagues the environment with pollution, outsourcing, and social disharmony. Aside from the energy and oil associated with creating and transporting items, excessive consumerism does very little for a person's well-being. Studies have shown that, though in the last 50 years the West has become richer, people have not gotten any happier (Dresner, 2002, p.73). Further, "when one-third of the world's population consumes two-thirds of the worlds resources" and expects developing nations to do the same, we are setting ourselves up for disaster (Norberg-Hedge, 2000, p.149).

It's important to ask the question: 'How much is enough?' At the rate we are headed, it seems as though nothing is. But it is possible to simplify life; buying less stuff will make less garbage, use less oil, and allow for appreciation of a few important possessions. Every time you exchange money, you make a decision on behalf of the environment. For more information on this concept, check out the Simplicity Collective, at http://simplicitycollective.com/.

Fix it don't replace it

This just goes along with living simply: try not to replace something you can fix. It's almost always better for the environment to keep an old car running, for example, than buying a new one. Repairs take fewer resources and create less waste. The same goes for surfboards, wetsuits, and clothing.

Local vs. global industry

Conducting and supporting business locally does two great things for the environment. First, you reduce gas consumption associated with shipping items that are not produced locally. Second, when you go to a local shaper (or source your product locally) instead of, say, buying a surfboard on the internet, you support the local community and the local economy (McKay & Bonnin, 2006, p.117). As corporations take over small businesses by the day, it's important that we try to retain the integrity of our communities by keeping the dollar close to home.

Re-use vs. recycle

Recycling is now a well-known environmental standard. It's a great way to reduce the need for making virgin plastic, paper, aluminum, and glass. But it does take energy to reclaim these materials. Recyclable items need to be transported to a facility to be heated at high temperatures and/or mixed with corrosive chemicals to be recycled into new products. Alternatively, re-using something, like a piece of clothing or a glass container, takes no extra energy. It is a more sustainable option to recycling, but both are very important.

Power of one

When looking at the environmental situation, it's easy to feel overwhelmed and helpless. We've made a mess of things, and it seems impossible to make a difference. But it's important to realize that everyone has a say in what happens. Opting to ignore your personal power to choose to avoid an environmentally unfriendly habit is one of the biggest barriers we face in trying to fix today's environmental challenges. Each individual matters, and each business sets a model. The best option is to become educated about the big issues and make the most informed decisions possible. One is enough to make a difference.

3. MARKETING SUSTAINABILITY IN THE SURF INDUSTRY

This guide depends on understanding marketing as much as it does conveying tips for sustainability. Surfers and businesses will want to know there are advantages to going green, and that their quality of life will not decrease. That is, we can still retain the essence of current surfing without the wastefulness of today's surf fashion, dispensable surfboards, and the single-serving lifestyle. Surfers will expect the same performance standards, cost, and availability of sustainable alternatives that they get from conventional ones. If a shift toward sustainability involves a step down in performance for a step up in price, it's not going to attract a lot of surfers. The reality is that sustainable alternatives do not presently exist in the majority of the surfing industry. However, that's not a reason to ignore the need for reducing the environmental impact of surfing. Rather, it's a challenge for the surf industry to invent new ways of accomplishing the same ends.

Companies will want to know that there is a consumer demand, a business advantage, or a necessity to become more sustainable. That is, they need reason to believe that they will continue to thrive as action sports brands, supplying consumers with a product that is up to par in quality while retaining a reasonable price. For this reason it's important to show that green has a substantially marketable value to the surfing industry. It's a task that necessitates some marketing skills on my part, for which I have consulted resources already involved in the surfing industry. For the purposes of my study, I'm equating consumerism of conventionally produced new surf products with an unsustainable lifestyle. The reason for this is that the purchase of new surf goods produced overseas, whether a surfboard or tee shirt, uses virgin resources to create, petrol to ship globally, and creates pollution—all on a very large scale.

3.1 THE SURFER IMAGE

The Surf Industry Manufacturers Association (SIMA) appears to be the number one resource for information on apparel, surfboard, and wetsuit manufacturers. They are an essential resource in discovering how companies market their image and make money. As a general fact, SIMA reports that the surf industry (all together) profits over seven billion dollars annually (SIMA, 2007). They express: "Passion and youth largely drive the surf industry. Surfers and skaters view the industry as a lifestyle, not a passing trend" (SIMA, 2009).

Apparently, surfers tend to associate their core enthusiasm for surfing with their loyalty to brands that sell the surfing image. I use the word image because it's not as though surfers can't get their clothing and shoes at K-Mart, for example. They go to surf shops, where they pay a premium price clothes that pros represent and magazines advertise. In the case of clothing, surfing brands sell a style, and that clearly matters to their customers. I gather that youth is a large factor in marketing: companies are aiming for a younger demographic and succeeding. At one recurring seminar hosted by SIMA called Boot Camp, Senior Vice President of TRU Micheal Wood presented a lecture called "Youth Truths: How to Connect with Today's Millenials." The lecture, according to a SIMA press release preceding the Boot Camp, aimed to "discern and explain the emerging attitudes, values, and preferences of young consumers. Drawing on experiences from global brand clients like Coke and Pepsi, Nike and Adidas, and MTV and MySpace, attendees will better understand young people today, where they're headed and how we can make a connection" (SIMA, 2009) To get a grasp of what young people want, the surfing industry is looking to bigger, more experienced and established brands for advice on what's hip.

3.2 A "GREEN" IMAGE

So where do the surfing image and the environmentally conscious consumer meet? It appears that distinctively "green" consumers are a selective, targeted market. SIMA also hosts a "Green" Boot Camp. It's a new informative meeting where industry executives and marketers gather to talk about ecological issues, brand initiatives into eco-products, and similar possibilities. I found some notes from Bill Byrne, head of an established marketing firm for action sports brands, which gave a run down of what occurred at Green Boot Camp in 2009. Granted this is essentially word of mouth (from the Bill Byrne Public Relations blog), and not a scholarly article. But scholarly articles about surfing tend to be in short supply. Byrne, the writer of this post explained that a discussion occurred called "The Future of Green Products", in which Derek Sabori (head of clothing brand Volcom's Environmental Affairs Division) commented [Byrne's words]:

"Volcom has produced eco-friendly boardshorts in the past, but due to manufacturing needs, these were typically brown or black in color… not super sexy to a lot of surfers. From working with both project BLUE and IPATH, I can tell you first hand that for a product that's eco to sell well in this industry, it has to perform and look like everything else. If it looks too crunchy, it's only going to appeal to the hippy set" (Byrne, 2009).

Continuing on this subject, Byrne includes that during the ending question and answer section:

"Lots of people accused the industry of blowing it, including someone…who stated basically that Patagonia was going to take over the surf industry. His rationale was that because of their advanced state of eco and team members that include the Malloy brothers, Patagonia is poised to take over surf. Offline, I spoke with some colleagues that thought he couldn't be more wrong. While Patagonia is a fantastic brand, they're far from poised to take massive bites out of Volcom, Quiksilver, etc.

Why? Marketing. Patagonia kills it from an eco and outdoor perspective, but the Malloy's don't appeal to everyone. Action sports is both a product and marketing driven world, probably more about image than performance in some instances. If Patagonia were to take over the surf industry, either there'd need to be a huge shift in consumer taste towards the Patagonia style or Patagonia would need to shift their style closer to what's selling in surf. Not to say it couldn't happen… I just think it's unlikely" (Byrne, 2009).

Coming from a marketing and public relations firm for action sports brands (such as Ipath shoes and Project BLUE), there are some key points to be taken here. For 'eco-products' to make a sizable difference in the surf industry, either a major shift in preference for the environment (and the image associated with protecting it) must occur, or eco-products will have to appear and work as good or better than conventionally made products. Additionally, it would help if the professional surfers representing these products were iconic to surfers in general, not just surfers already interested in the environment. No matter how positive or attractive the environmental "image" appears to some surfers, it might never be enough to rope in consumers more interested in the competitive, progressive, or fashionable aspects of surfing.

3.3 IMAGE BY BRAND

Surf brands establish a style, or image, by the way they market their products. Patagonia's image is that of the outdoorsman. On the Patagonia website, one finds

photographs of bearded rock climbers and soulful surfers. The Vice President of Marketing for Patagonia, Rob Bondurant, comments that the company markets to 25-40 year olds who identify with the craftsmanship of products and the company's environmental platform (Bondurant, in Stanger, 2009). Says Bondurant: "We're not about competition and we're not going to expect to pull that competition surfer into the brand's arm" (in Stanger, 2009). Contrast this with, for example, the Quiksilver website, which features athletes like Kelly Slater and Dane Reynolds in day-glow neon boardshorts boosting futuristic, complicated aerial maneuvers. The distinction is important to customers: Slater and Reynolds are continually recognized as premier progressive surfing icons, collecting professional contests results and appearing in progressive surf video sections.

These are deliberate differences in the personality of the brand. Dick Baker, the late President of SIMA, comments in the article "No slowing down for surf industry": "Virtually all brands in the surf industry have complete category representation in the surf lifestyle, with the larger brands representing full apparel collections in competition with other fashion brands" (in SIMA, 2009). By 'category representation', I presume that Baker is referring to the image or style associated with each brand by the customer. This explains why surfers who are interested in hyper-progressive surfing shop for brands like Quiksilver, and outdoorsy surfers go with Patagonia. Customer interests are satisfied by the aesthetic or values of the brand.

Even if customers are brand/image specific, the standards being set by the industry as a whole make any environmentalist optimistic. Environmentalism has reached all-time highs in demand, as reflected by the collective increase in use of alternative materials by surf brands. Says Dick-Read (2007), "all the biggest surf companies are wheeling out organic or recycled ranges and lavish charity donation schemes. More significantly, they claim to be cleaning up their production, processing, packaging and shipping. The time is right, as one company president says, "to do well by doing good". So green does sell, in some cases, as with Patagonia. On the other hand, the environmental impact doesn't have to be the selling point of a product: a business could market a sustainable product as a 'progressive' one and consider its environmental benefits a standard of quality manufacturing. In this way, brands maintain their specific image and aim for environmental balance.

3.4 GREENWASHING

The question remains: how does the consumer tell the difference between greenwashed marketing schemes and truly helpful steps towards sustainability? As popular as going green is, the incidence of greenwashing products or the company image is growing quickly. Green advertising has tripled since 2006 (*TerraChoice*, 2009, p.i), but that's not necessarily indicative of more sustainable products on the market. In one study (*TerraChoice*, 2009, p.i), only 25 of 2,219 products that claimed to be green actually were. Going green should not exclusively be a marketing strategy—it has to revolve around a genuine positive change. Companies that greenwash risk misleading consumers to waste effort on unhelpful purchases, take away from the marketability of truly environmentally conscious businesses, create consumer cynicism, and generally make progress towards sustainability slower (*Terra Choice*, 2009, p.2). For these reasons, it's unacceptable to make false or misleading claims about a product that has unreasonably few environmental benefits. There are at least seven 'deadly sins' of greenwashing (*Terra Choice*, 2009, p.3):

- **Hidden trade-offs**: Calling a product green based on one relatively small component, and ignoring the larger components of its manufacture or transportation (*Terra Choice*, 2009, p.3).
- **No proof**: Asserting a product is green without providing proof as to why or how it was labeled that way. Proof should be easily attainable to those who are looking for it (*Terra Choice*, 2009, p.3).
- **Vagueness**: The use of indirect or unclear terms that are associated with environmentally conscious production, but misconstrue themselves by doing so. An example is using the term 'All Natural', as "arsenic, uranium, mercury, formaldehyde are all naturally occurring and poisonous. 'All natural' isn't necessarily 'green" (*Terra Choice*, 2009, p.3).
- **Irrelevance**: Assertions that are honest but do not help the consumer to choose a product that is actually more environmentally friendly (*Terra Choice*, 2009, p.3).
- **Lesser of two evils**: Comparing one "greener" product against another when in reality they both have a large environmental impact (*Terra Choice*, 2009).
- **Fibbing**: Flat out making up an environmental advantage of a product (*Terra Choice*, 2009, p.3).

- **Worship of false labels**: Use of words or images that gives a consumer the impression the product has been approved by a third-party on the basis that it is environmentally friendly (*Terra Choice*, 2009, p.5).

In a perfect world, the consumer wouldn't have to worry about these pitfalls. Everything labeled green would be organic enough to compost, so to speak. But it's unlikely that such a change will occur overnight, and so for companies to separate their efforts as genuine, they have to be very "transparent" with every stage of the product, beginning to end (Kay, in Dick-Read, 2007). A truly environmental product can be put through a life-cycle analysis. That is, it's material extraction, material processing, manufacturing, use, and disposal are all aimed at minimal impact on the environment. As mentioned, it doesn't need to be the sole marketing strategy of every business. Some believe environmentalism is not a "marketable factor" to their customers (Wegener, in Sullivan, 2007, p.26). Rather, aiming for low impact production is an imperative that a company takes upon itself to do the right thing, as a parent of surfing culture.

Whether going the 'eco' route or not with adverts, the fact remains that it's possible for the industry, as a whole, to become more sustainable and retain sales. Frank Scura (in Lewis, 2010, p.16) of the Action Sports Environmental Coalition explains: "The brands' job is to leverage their buying power to influence the supply chain and to communicate to their consumers in ways that are relevant. We try to inspire them to think sustainably, once they do it translates creatively however the brand embraces it in their own voice". The progressive brands don't have to advertise their gear as green to actually be environmentally conscious. Being transparent simply means making the processes and materials open to the public, especially in the case of a product labeled 'eco'.

3.5 MEDIA SUPPORT

The last aspect of marketing environmentally conscious business involves the media reinforcement of sustainability as a principal part of surf mentality. This is an all-inclusive measure—the magazines and videos featuring professional surfers cannot be shallow and focus only on surfing. Sustainability needs to come up more frequently than once a year in magazines, for example, in the "green" issue. Surf media affects the youth: I know from experience that Taylor Steel videos and *Surfer* shaped the way I viewed surfing, if not life.

Thus, what surf-addicted kids need more of is not wasteful consumerism but substance pertaining to the condition of the environment and what they can do to help. Market habits are greatly influenced by the surfing media, after all (Sullivan, 2007, p.26).

An example of unproductive surf media is the film Young Guns by Quiksilver. However successful this hyper-progressive surf flick was for Quiksilver, the idea of taking a helicopter, giant motor yacht, and multiple jet skis to some beautiful tropical destination purely to document surfing is appalling from an environmental perspective. Furthermore, not for one moment is the local culture or ecology acknowledged. It's an absurd waste of resources for a way to glorify surf-stars and boost sales. Moreover, kids that idolize Kelly Slater and Julian Wilson get little more than inspiration to be single-minded about surfing from the movie. If aspects such as the local ecology or culture were included, it would shape a more thoughtful viewer, and thus a more considerate consumer. The benefit of this is stimulating the viewers' interest to preserve beautiful surfing destinations, not exploit them.

On the other end of the issue, it is the responsibility of more professionals to become role models of ecological action. Professional surfers have a huge influence on non-professional surfers, especially kids. The bigger name pros are celebrities to the world of surfing; they no longer need to be puppets of the contest circuit or company slogans to make a living. The personalities and values of professional surfers are of great interest to the surfing public, and as one source (Sullivan, 2007, p.27) comments "they have the ability to both drive and restrict research and development". There are only a handful of environmentally conscious pros in the spotlight; Dave Rastovich, Rob Machado, and the Malloy brothers to name a few. These surfers have branched off into the non-competitive, free-surfing arena of the media and have supported some environmental causes. But they represent an alternative perspective in surfing, which doesn't captivate every audience. What about the progressive and competitive surfers? If (for example) Dane Reynolds asked Quiksilver to make his signature boardshorts carbon zero, and wrote just one paragraph on his blog (found at marinelayerproductions.com) about the benefits of sustainability, thousands would be affected.

3.6 MARKETING OVERVIEW

Sustainability is, in some cases, marketable for the surfing industry. But it depends on the dynamics of the company image, and the targeted consumers it appeals to. Therefore,

sustainable business practices are accessible to companies both willing and uninterested in marketing their products as such. For those that aim for environmentally conscious and mature customers, marketing sustainability may not be difficult. For brands that have a younger consumer demographic, sustainability may not easily be a selling point of products. But there are still incentives to aim for sustainability:

- Companies have a "vested interest" in the environment; surfing is an environmentally dependent sport
- Businesses would meet or exceed the rising demand for responsibility and accountability from shareholders
- Moves towards sustainability show forward thinking and generate heightened social status within current surf industry standards
- Efforts towards sustainability in surfing would set an example for other industries
- New initiatives, technologies, and ideas towards sustainability attract non-surfing media attention, bringing more interest and customers (based on the sheer volume of non-surfing news periodicals covering the surf industry's environmental impact at present)

The biggest incentive to change is that unsustainable business practices (as they are now) cannot last. They depend on non-renewable resources, underpaid labor that is unethical, and poor standards on waste management and pollution. To ignore that these loopholes have foreseeable ends is not only shortsighted, it's a poor business strategy. In the end, making the surf industry sustainable is inevitable because the alternative cannot be perpetuated unendingly.

Sustainability in the surf industry has the best shot at success if:

- The products appear and function as well or better than current progressive products
- The image is inclusive of all styles and aspects of surfing culture
- Transparency of manufacturing procedures is available to those who may be interested
- Life-cycle analysis is instilled as a standard measure of a quality product

- Businesses do not greenwash and instead take sustainability as a genuine goal
- It is media supported, in videos, magazine articles, advertisements, and surf-related websites
- Professional surfers of all styles are ambassadors for the movement, who comment explicitly about sustainability publicly

4. SUSTAINABLE INITIATIVES IN SURF INDUSTRY

It's unfair to point fingers at surf conglomerates without acknowledging the steps they have taken to lessen their impact on the environment. The point of this report is not to completely vilify the surfing industry. Rather, the aim of this project is to find ways to make surfing a more sustainable sport and lifestyle. I have included the environmental endeavors of some major surfing brands or typical materials they use. This gives the reader a general understanding of where the surf industry stands on environmental issues, and shows that some standards are being set. Brands that only carry one or two products marketed as "environmentally friendly" have been omitted. This is not a comprehensive list, but more a sampling of the larger companies and available technologies.

It's apt to have a look at what is meant by "sustainable" products. I cannot include every aspect of surf consumerism, but will attempt to address the major sects of the surf industry: surfboards, apparel, footwear, and wetsuits. Alternative materials along with manufacturing methods are major points of interest in more sustainable surfing gear. But as Joey Santley explains, "I don't know if we'll ever be able to achieve truly close-loop cycles of manufacturing in our current world of mass, global production, but I can tell you right now that increasing the life span of your products exponentially is hands down the greenest thing out there" (Santley, in *Surfing,* 2009, p.70). To provide the most holistic guide, I have attempted to include information on all three (manufacture methods, alternative materials, and care for increasing the longevity of the products).

4.1 SURFBOARDS

There are two important parts to finding a sustainable surfboard. The first is that it's sustainable. This means the construction, use, and disposal minimizes or avoids pollution, use of non-renewable resources, and serves a long functional life. In researching all kinds of different boards, I found that a completely sustainable surfboard is not an option. Everything surfers ride demands resources from the environment. But there are ways to do much less damage, and make boards last much longer. There are three aspects to surfboards when assessing their sustainability (or lack of):

1. Locality: Where do the materials to shape the surfboard come from? Where is it shaped, and to where is it shipped? Gas miles play a pivotal factor in the surfing industry's footprint, so a board that is locally crafted is best.
2. Materials: What is the environmental impact of the materials each board is made of? Is it durable? Does it biodegrade?
3. Process: Are the boards shaped in a way that minimizes waste and energy use? Is it mass-produced or shaped by hand? Do any materials get recycled or reused?

The second part, being much more important to surfers, is the board's ability to perform. Apart from the shape and craftsmanship, the materials that go into a surfboard influence the speed, weight, and flexibility, which are only detectable by the experienced surfer. Shaper of …Lost surfboards Matt Biolos offers: "Surfers are not going to sacrifice the performance of a light board for being green," (Biolos, in Woody, 2009). Consumers will not be interested in buying a board that's sustainable if it rides like it's made of lead; it's a lower standard of surfing. Sean Sullivan, who completed an analysis of sustainable surfboard options in 2007, agrees: "the larger market is demanding a board that looks and performs in a similar way to the modern surfboard" (p.29). So as a set of guidelines, I tried to find feedback on these necessary qualities observed from shaper and surfer viewpoints:

- Strength, durability, or longevity of the board
- Flex, as it relates to responsiveness underneath the surfer's feet. Boards with good flex feel snappy, tend to generate more speed out of turns, and do not become warped after long periods of use.
- Buoyancy, which relates to how well a board paddles and sits atop the water. A board with good buoyancy floats well, paddles fast, but tends to grip the wave rather than slip or lose traction over the surface of the water
- Weight, as generally the ideal surfboard is light and easy to turn
- Cost, because if the average surfer can't afford it, then it's not going to make a serious difference to the environment in the surfboard market

4.1.1 A VERY BRIEF HISTORY OF SURFBOARDS

In an article entitled 'Time Machines' published by *Surfing* (1989, p.68), a timeline showing the evolution of what surfers ride is laid out. According to this article, surfboards were first recorded around the turn to the 19th century, with the Polynesians in Hawaii (*Surfing*, 1989, p.68; Sullivan, 2007, p.5). The boards they rode were structural dinosaurs compared to those of today. They were huge, heavy slabs of local breadfruit and wiliwili trees shaped into tall tombstones (Sullivan, 2007, p.5; *Surfing,* 1989, p.68-9). 'Time Machines' shows that materials changed by 1910 due to a dearth of the native trees, and that surfing legend Duke Kahanamoku made do with redwood imported from the contiguous states. But within another decade, the solid and impossibly heavy logs were giving way to a new design: the paddleboard (*Surfing*, 1989, p.69). *Surfing* claims that it was Tom Blake who made waves in developing a hollow-body design to facilitate control and improve the buoyancy of surfboards. He is also responsible for the creation of the fin, originally just a sloped blade of wood to ease steering (*Surfing,* 1989, p.69). These wood-composite boards utilized water-resistant adhesives, which allowed for surfers to make boards significantly lighter and offered the ability to carve down the face of the wave deliberately (*Surfing*, 1989, p.70).

Surfing's 'Time Machines' details that a giant leap from wood to foam occurred just after Word War II, when fiberglass, resin, and polystyrene foam became available (1989, p.70-1). Initially, the resin and foam didn't mesh; polystyrene foam disintegrates upon contact with the available polyester resin (*Surfing*, 1989, p.70). Innovator Bob Simmons navigated around this dilemma by sandwiching the foam between sheets of thin plywood and applying layers of fiberglass (*Surfing*, 1989, p.70). Hence, as 'Time Machines' explains, surfing entered the foam era in 1949, and in less than ten years polyurethane foam became available. The advantage of this substance was invaluable; it bonded with the polyester resin without problems (*Surfing*, 1989, p.79).

Boards continued to evolve faster and faster. The 60's and 70's saw surfboards shrink from nine to six feet, inspired by increasingly radical-maneuvered performances of surfers like Nat Young, Bob McTavish, and kneeboarder George Greenough (*Surfing*, 1989, p.73). It was at this time that surfboard shapers began sprouting up everywhere, especially in backyards. The surfboard became a vehicle of experimentation and a manifestation of personal style (*Surfing,* 1989, p.74-75). The next decade saw shapes, fin set-ups, and designs

of all imaginations. But it was in 1981 that Simon Anderson set the standard with the three-finned shortboard, coined the "thruster" (*Surfing*, 1989, p.76) Along with fin setups, different core materials were considered, but none replaced the polyurethane (PU) thruster standard (*Surfing*, 1989, p.77). To date, PU is the most popular core material for a surfboard (Sullivan, 2007, p.10), and probably the most environmentally damaging.

Why is this history lesson important? Surfboards have changed many times, and so will likely continue to change as alternatives become available. They began as organic conduits to wave riding, made of biodegradable wood and oils. Today, surfers ride toxic chunks of foam. Because surfers have become attached to the polyurethane feel, most seem to be skeptical about any purchasing anything different in the sense of alternative material boards (Hunter, 2008, p.4). But as explained in the *Drift* article called 'A greener wave,' shaper Rob Lion (of Royal surfboards) explains "We have a very romantic notion of what surfboards are, and forget that molecularly they are just lumps of plastic." He continues: "Surfboards have been evolving since the first trees were cut down; why should we stop and stay stuck forever in the same tar pit" (Lion, in Sankey, 2010)? Let's take a look at what these lumps of plastic are.

4.1.2 RECIPE FOR A SURFBOARD

The majority of surfboard construction typically entails three key ingredients: a raw blank, fiberglass cloth, and resin hardener (Sullivan, 2007). The blank is the foam core; the fiberglass and resin make the protective, watertight shell of the board. Common surfers know the steps of the shaping process: a shaper gets a truckload of blanks, rolls of fiberglass, and drums of resin. Then each board is shaped, painted, glassed, and sanded according to the design goals. But what are these materials made of, how do they interact with the people that come in contact with them, and the environment they are released into?

The materials that form PU blanks are essentially refined petroleum (Carroll, 1989, p.82; Sankey, 2010, p.1). Oil is mined from the ground in crude form and refined into substances that are corrosive at best, and poisonous at worst. Nick Carroll (1989, p.82) has described PU surfboards in the *Tracks* article 'How surfing pollutes' as "a cocktail of potentially lethal chemicals". In the article, Carroll explains that PU blanks start as liquid chemicals in a manufacturing plant. They begin as three substances: polyether polyol,

polyester polyol, and **Toluene Diisocyanate (TDI)** (Carrol, 1989, p.82). These comprise the pre-polymer; then a separate polyether-polyester mix is created and combined with tin catalyst and water (Carrol, 1989, p.82). Carroll continues that before the two chemical brews meet each other, silicone cell formers and a few other chemicals are added. These are what create the air cells in the foam that make the board buoyant (Carrol, 1989, p.82). The article illustrates that the master polyurethane amalgam is then poured into blank molds. The entire process must be temperature controlled very strictly; an uncontrolled temperature will result in a poorly made blank with inconsistent or unfavorable cell size (Farrelly, 1973, p.59).

Finished blanks are shaped, either by hand or machine. Then they are covered with **fiberglass**. In the same *Tracks* article, Carroll writes that fiberglass cloth begins its life in a factory, as molten glass (1989, p.82). The glass is pressed through a "platinum bush" and threaded into the fabric we recognize in shaping rooms (Carroll, 1989, p.82). This fabric is oven dried, cleaned, and sized before being divided into grades (Carroll, 1989, p. 82).

Polyester resin is the last ingredient. It is composed of three chemicals: **maelic anhydride**, **phthalic anhydride**, and ethylene glycol (Carroll, 1989, p.82). These substances must be cooked together for up to eight hours with machinery at temperatures as high as 300 degrees Celsius (Carroll, 1989, p.82). These chemicals bond to form the base of the resin, called **styrene monomer** (Carroll, 1989, p.82). Once the styrene monomer is rendered, the next step is to add promoters like cobalts and amines (Carroll, 1989, p.82). These substances react with **methyl ethyl ketone peroxide** and inhibitors (Carroll, 1989, p.82). The purpose of these substances is to control the gelling, or firming, time of the resin (Carroll, 1989, p.82).

4.1.3 ENVIRONMENTAL DAMAGE FROM SURFBOARD CONSTRUCTION

Blanks

The blowing, or creation, of blanks is associated with a number of health and environmental concerns. This industry is a player in climate change by releasing CO2, a known greenhouse gas, and hyrdo-flurocarbons, which weaken the ozone layer (Sullivan, 2007, p.10). In addition, blanks use harsh chemicals as ingredients. These chemicals enter our environment by vaporizing or being thrown in to landfills and leaching into water and soil.

A major toxin used to blow PU blanks is ***Toluene Diisocyanate* or *TDI***. This is a very harmful chemical. It irritates the skin, eyes and lungs (Carroll, 1989, p.82). TDI causes jaundice, and may induce those around it to vomit as it corrodes liver and lungs (Carroll,

1989, p.82). It's associated with difficulty in breathing, increased mucous production, and even cancer in laboratory animals (Carroll, 1989, p.82-3; *California Department of Health Services*, 1989, p.4).

The California Department of Health Services estimates that one in twenty, or 5% of people with exposure to TDI develops asthmatic sensitivity to the substance, sometimes permanently (1989, p.3). For these individuals, any exposure to TDI, even in minimal amounts, can cause an asthma attack (*California Department of Health Services*, 1989, p.3). Fumes are released when new blanks are cut into, but the bulk of TDI exposure occurs during the manufacture of PU blanks (Carroll, 1989, p.82). In the aforementioned *Tracks* article 'How surfing pollutes', Nick Carroll (1989, p.82) explains: "Authorities in the USA wanted to ban it but couldn't because there are industrial processes, including paint manufacturing, which require it and nothing else."

In the 1970's when PU was relatively new and the health effects were yet to be discovered, employees of the blank-blowing industry suffered immediately. Mark Pinnington, of Surfblanks Australia, expressed; "On a couple of really hot days I went outside for some air and just collapsed. Sometimes in there it used to spin me out" (Pinnington, in Jarratt, P. & Leggat, C. 1976). Even now, almost 40 years after these symptoms were observed, TDI is still a regularly used ingredient in PU surfboard blanks.

TDI was the main reason for the Clark Foam shutdown in December 2005, almost ending the production of raw surfboard blanks globally (Bell, 2005). Owner Gordon Clark was responsible for producing as much as 90% of the industry's PU blanks before the shut down (Bell, 2005). Sending out up to a thousand blanks per day worldwide, Clark Foam monopolized the global blank manufacturing industry (Bell, 2005). As it turned out, they were also responsible for pouring "over 4,000 pounds of styrene fumes per year" (Bell, 2005) into the air as well as failing to manage "polyester resin, dust, [and] trash" (Sanders, 2005). When Clark Foam shut down, it sent a red flag out to the industry that was clearly ignored. Instead of a fundamental change in the materials and methods, what occurred afterwards is essentially the same as with all consumer goods in mass production. According to 'A greener wave', surfboard manufacture moved overseas to countries with cheap labor and relaxed environmental standards like China, meaning even more shipping miles and more TDI (Sankey, 2010). A survey in the April 2010 edition of *Transworld Business* revealed that 90% of the leading 75 surfboard retailers in America sell Asian-made surfboards (Hunter,

2010, p.11).

As a response to the issues associated with TDI, some surfboard manufacturers are using alternative chemicals. One that has surfaced and is considered an 'environmentally friendly' alternative is **MDI**, or **methylene di-phenyl di-isocyanate** (*Surfrider*, Undated). MDI is less volatile, which means it vaporizes into the air slower and thus reaches harmful concentrations slower (*California Department of Health Services*, 1989). Blanks that use MDI also absorb significantly less water when dinged, and so last longer (McMahon, 2008). It is regarded as a safer alternative to TDI, although it is still an isocyanate (by nature a corrosive chemical), and thus is essentially the lesser of two evils (Davies, 2006; Sankey, 2010, p.5).

Fiberglass

Fiberglass forms the hard, waterproof shell over the foam. Glassing a surfboard entails applying fiberglass fabric to a shaped blank with liquid resin and sanding once dried to make the board smooth. Sanding creates ***fiberglass dust***. Workers who have repeated exposure to this waste frequently develop emphysema and other fatal respiratory illnesses (Carroll, 1989, p.83). Images of glassers and sanders with no respirator on in the 1960's and 1970's serve as painful time capsules. As seasoned shaper Dick Van Straalen recounted in late 1980's, "glassers all turn into junkies. The toxins they breathe in make them get into it" (Van Straalen, in Carroll, 1989, p.83). He recalled two specific glassers; one who overdosed on the chemicals, and another that lost teeth from becoming hooked on the toxins (Carroll, 1989, p.83).

Fiberglass is very energy intensive to make (Carroll, 1989, p.82). Surfboards require A-grade fiberglass, which means a chemical plant must produce massive amounts (many thousands of meters) to choose the necessary top quality material (Carroll, 1989, p. 82). In addition to all the energy needed to mass-produce it, when fiberglass is applied to PU boards, it may be treated with toxic metals like chromium (Sullivan, 2007, p.10).

Resin

Polyester resin is applied to the fiberglass to make it harden. It is based of ***Styrene Monomer***. As stated by Carroll, styrene causes drowsiness, liver damage, and dizziness (1989, p.83). One source (Sullivan, 2007, p.10) asserted that styrene has been established as a carcinogen. In addition, it releases Volatile Organic Compounds, which meet with Nitrogen Oxides in the air and contribute to the formation of smog (Sullivan, 2007, p.10).

Styrene Monomer is composed of *Maelic anhydride* and *Phthalic anhydride* (Carroll, 1989, p.82). Maelic anhydride is more toxic, but Carroll asserts that they are both used in food preservatives and pesticides (1989, p.82). They have been linked to respiratory damage and bronchitis (Carroll, 1989, p. 82-3). In addition, ***Methyl Ethyl Ketone peroxide*** is a chemical used that is intensely corrosive to epidermis, respiratory tract, eyes, and liver (Carroll, 1989, p.82). It's also important to note that resin is made in a very energy intensive way: at a very high temperature for a very long time.

Not much information exists about the effects of these materials on soil, water, and air quality after long-term exposure. But the immediate health effects it poses for humans suggest reason enough to be worried about their release into the environment. Suffice it to say that a sensible person would be cautious to ignore or write-off toxic substances whether scientific research has or has not been done on this matter.

For the record, one source (Schultz, Undated, p.4) estimates the creation of one six-foot locally hand shaped PU surfboard to release 380 pounds, or 172 kilograms, of carbon dioxide. This number is based on a Life-Cycle Assessment, which includes the material extraction, material processing, manufacturing, use, and disposal of the board. The carbon footprint of a PU board gives some understanding of the environmental impact apart from the chemical pollutants detailed above. The typical life expectancy of a PU surfboard, according to *Surfing*, is one year (Walker, 2009, p.72).

4.1.4 DEMYSTIFYING ALTERNATIVE SURFBOARDS

There are some alternative materials to typical PU surfboards that have been developed in recent years. It seems when Clark Foam shut down, a market for new materials opened up. I will try to talk about the benefits and drawbacks of some major available materials as they relate to environmental impact and performance. Unfortunately, most of

these materials are not clearly more or less environmentally friendly than their competitors; there are many shades of gray.

EPS and Epoxy Includes: Firewire, TufLight, and SurfTech

One option is expanded polystyrene foam, also known as EPS. An article in *Drift* Magazine called 'Coffee Cups and Surfboards' acknowledges that this is the same foam Bob Simmons used before polyurethane took over, but instead of using polyester resin it is now paired with epoxy resin (Sankey, 2010, p.1). Epoxy resin is about two times less likely to fracture, which should not be confused with being double the strength of polyester resin (Pirsh, 2010). It can be understood as much harder, but only a little stronger.

The EPS/epoxy combination has a great strength-to-weight ratio, but the flexibility is not exactly the same as the standard PU board (Carroll, 2006, p.2). The Surf Industry Manufacturers Association released a newsletter for shapers, in which Nick Carroll (2006, p.3) explains that the difference between PU and EPS is like "apples to oranges." Compared with PU foam, EPS has a softer core (Carroll, 2006, p.3). The flex, in Carroll's words, is "more lively" and "stiffer". Essentially this is because PU boards have a dense foam core with a thin coat of glass, and EPS boards have soft porous foam with thick, hard glass (Carroll, 2006, p.3). EPS blanks are more buoyant (the cells are expanded, meaning they have more air in the center) (Carroll, 2006, p.2). The final product is a board that floats better, is easier and quicker to paddle, and is much lighter (Carroll, 2006, p.3).

As written in "Coffee cups and surfboards," an environmental advantage of epoxy resin is that it releases only about 50% of the volatile organic compounds (VOCs) that are associated with typical polyester resin (Sankey, 2010, p.2). Other sources (Chouinard, in Sullivan, 2007, p.11; *Secret Spot Surf Shop*, Undated) claim that epoxy releases up to two-thirds less VOCs then does polyester resin. EPS foam is recyclable, but only pure off-cuts from shaping bays could be easily reclaimed for new blanks (Sullivan, 2007, p.11). That means finished surfboards, in composite form, are not recyclable. Also, the Product Development Director of SurfTech offers that a major environmental benefit of EPS foam is that they are TDI free (*Secret Spot Surf Shop*, Undated). So they last longer, ride the same or better, have a slightly lower impact, and are partially recyclable.

This kind of foam is the base for SurfTech (Carroll, 2006, p.2), Firewire (Sullivan, 2007, p.13), as well as EPS custom shaped surfboards. Firewire boards use EPS cores with

"parabolic balsa rails" instead of the typical central wood stringer (Sullivan, 2007, p.13). TufLight and SurfTech boards are mass-produced with EPS foam and epoxy resin (*Secret Spot Surf Shop*, Undated). The major difference between brands like Firewire, SurfTech, TufLight, and boards crafted by local shapers is that they are shaped and glassed by machines, in an assembly line (*Secret Spot Surf Shop*, Undated; Stolz, 2008). They are molded into models as opposed to being crafted to custom orders individually (*XPS Surfboards*, Undated). This process lacks the unique quality and personal attention that is typically idealized in a surfboard, but it does tend to reduce waste (*Secret Spot Surf Shop*, Undated). The process utilizes technology to calculate exact amounts of polystyrene to be molded, eliminating wasteful off-cuts and recycling any excess glassing materials (*Secret Spot Surf Shop*, Undated). Also, a molded EPS/epoxy board tends to last longer (5+ years) than a custom EPS board does (2 years) (Walker, 2009, p.72). However, most EPS surfboard factories operate overseas, so the boards travel quite a bit to get to surf shops in America and Australia (Stolz, 2008). Obviously, the machines also use electricity.

Some cheaper EPS blanks are very water absorbent (Carroll, 2006, p.4). If the board is dinged (cracked), it's important to get it out of the water immediately, because they basically sponge in water due to the beaded foam (Carroll, 2006, p.4). If the ding is ignored, the board will de-laminate (a separation of foam from fiberglass), which involves a lot more repair or the board becomes useless (Carroll, 2006, p.4). Most importantly, 'Coffee cups and surfboards' distinguishes that EPS blanks are still made out of petrol, so they are not sustainable (Sankey, 2010, p.2).

Performance Overview:

- Stiffer flex than PU due to harder glassing
- More buoyant than PU due to beaded foam
- Lively, fast
- Very lightweight

Environmental Overview:

The good

- No TDI in blanks

- Up to 2/3 less VOCs released
- Tend to be more durable than PU boards
- Pure off-cuts are recyclable
- Little waste from high efficiency technology in factory molded boards (like SurfTech, Firewire, etc.)

The Bad

- Made from petrol
- Factories overseas mean more gas miles, more electricity, and more air pollution
- Cheap EPS is water absorbent (shorter life)

XPS Mainly found in XTR and Chouinard Surfboards

XPS stands for extruded polystyrene. Ventura shaper Fletcher Chouinard explains that polystyrene foam is "forced through a small opening, like toothpaste is extruded from a tube" (*Fletcher Chouinard Design*, Undated). XPS blanks are considered by many to be the superior brother of EPS foam, partly because they have very consistent density (*Fletcher Chouinard Designs*, Undated). Chouinard claims they are 73% less water absorbent than PU foam and compare equally to PU in flexibility and density. So they yield a similar feeling board that, if dinged, will absorb practically no water compared to the average PU or EPS blank (*XTR Surfboards*, Undated). This is because XPS blanks utilize closed cell technology instead of expanded, beaded foam like EPS (*XTR Surfboards*, Undated).

XPS boards emit no volatile organic compounds into the air as an added benefit of their composition (*Fletcher Chouinard Designs*, Undated). They take epoxy resin, so again they are less likely to crack (*Fletcher Chouinard Designs*, Undated). Still, we haven't moved out of the realm of petrol-based foam, and so if the aim is to find a sustainable surfboard, XPS is not the answer. This form of polystyrene is only more efficient than EPS.

Performance overview

- Ride as good or better than EPS and PU boards
- Have great buoyancy
- Generally last longer

- Great flex if glassed correctly
- Lightweight

Environmental Overview

The Good

- Absorbs exponentially less water than PU or EPS when dinged
- Very durable
- Epoxy resin releases less VOCs and air pollutants

The Bad

- Made from petrol

Homeblown's BioFoam

Homeblown's BioFoam is composed of 50% renewable plant materials (McLaren, 2007; Sankey, 2010, p.2). The boards are glassed with hemp cloth and "bio-based resins" (McLaren, 2007). Because these blanks use MDI and agricultural oils as the basis for their construction, they are more energy efficient, require fewer non-renewable resources, and release fewer of the harsh air pollutants that contribute to climate change and adverse health (Sullivan, 2007, p.12).

One of Homeblown's claimed environmental benefits is that it has factories in areas of high demand, including Cornwall and Jeffery's Bay (Sullivan, 2007, p.25). Essentially they believe it reduces their impact to ship the ingredients for blanks to other companies who can assemble them for their local market (Sullivan, 2007, p.25). This slightly reduces the carbon footprint, as blanks are very large in comparison with their low weight, and thus take larger shipping containers when sent in finished form (Sullivan, 2007, p.25).

But these boards are far from the answer to a sustainable surfboard. In the article 'A greener wave', Homeblown's director Tris Cokes describes the shortcomings of BioFoam: "The best gloss I can put on Bio Foam is that it educates people. It makes the industry aware that there could be a better way. It is made with GM soya from one of the world's largest producers, who farms in the Amazon. The soya is shipped to the US for processing before the finished blank is shipped to the UK. I am probably shooting myself in the foot by saying this:

the foam itself is good, but it's a piece of greenwash. If you did an environmental audit on Bio Foam, you would find it is not that environmentally friendly at all" (Cokes, in Sankey, 2010, p.4).

Because these boards appear to be about the same as a typical PU board (both in performance and as a measure of environmental impact), I will skip the overview. Simply put, they are not a sustainable material for surfboards.

Wood

There are a number of different materials used in wooden boards. Some shapers use bamboo, alaia, balsa, and others use a composite of wood and foam. The benefits of wood are: it's light, it's very strong, and it's biodegradable. Wood can be a sustainable material to build boards with when faster growing trees are utilized.

An ideal wood board balances these characteristics: light, strong, and low-impact. And while this combination is available in some wood boards on the market, their presence in the surfing world is still minimal at this point. Most of the board-makers I researched (Gary Young, Riley Surfboards, Grain Surfboards, Tom Wegener, and the Eden Project) were specialty labels that cater to a certain style, with less demand than the general surfing public would require. As such, I think wood surfboards are only an option for a target market, not capable of supplementing a fundamental shift in surfboard manufacturing. Based on observations from a number of wood shaper's websites, I doubt wood can replace foam because:

1. Hundreds of thousands of foam surfboards are made each year, which would demand massive amounts of timber. Unless bamboo farming becomes a reality in major surfing areas, that kind of demand is not sustainable. The only debate then is whether less surfboards would have to be made, because wood surfboard shapers claim they last much longer.
2. Wood rides much differently than foam, tends to be heavier, and thus may not satisfy the standard of surfing that customers expect from a high-performance surfboard.
3. Wood boards require more skill to shape, and are much more expensive. They are art as much as surfboards, and so are priced as such.

At this point, riding a wooden board is like eating a vegan diet for most surfers; it's just too extreme of a commitment. One surf journalist (Martin, 2009, p.67) described the wood

surfboard company Grain as “the Paul Fucking Bunyon of the surf industry.” Most other wood shapers occupy a bracket of high-end boards as an art form. Still, wood is an option on the market, and as one of the more organic methods of surfboard building, wood shapers could certainly thrive in a sustainable surfing industry.

Gary Young, who received the 2008 Green Wave Award for his work with bamboo in surfboards, is one exemplary shaper (Gray, 2009, p.66). Bamboo is a great material for sustainable surfboards because it grows extremely fast and is very strong. Young achieved an advanced use of this wood by “developing a method that created triaxial blending of the bamboo grain, first by layering it at two different angles, then by creating his own weave to achieve the same effect. As he progressed, he discovered that he needed less and less epoxy resin (a third less, in fact), as he perfected his vacuum bagging technique. And he needed no fiberglass at all. Bamboo’s amazing properties negate the need. And, on the inside, the extruded polystyrene foam cores were inexpensive, readily available, recyclable, and best of all, closed-cell. They don’t absorb water” (Gray, 2009, p.72).

This method of surfboard construction should be taken seriously—it’s one of the most durable and efficient surfboard designs from what I can tell. The distinction between rotary-cut bamboo (what Young uses) and bamboo cloth or bamboo laminate rolls, which are actually made of synthetics like rayon and other heavy chemicals, is key. The latter materials are far from environmentally friendly (Gray, 2009, p.72). Like most wood boards, however, very few high-performance shapes are currently made, and even fewer big name surfers are endorsing them. Former World Champion Sunny Garcia and Flyn Novak are two professionals who have put them to the test, but at this point bamboo shortboards don’t appear to be highly available to the surfing public (Gray, 2009, p.72-4). Young is not the only board builder who uses a composite of wood and foam recipe. Mark Roberts of Glass Tiger uses practically the same materials: EPS core with structural veneer and no outer glassing. He says the result is a stronger board with similar weight to a PU surfboard (Roberts, 2010, p.32). To keep the boards in shape, Glass Tiger surfboards must be resealed with waxes and oils twice a year. Says Roberts (2010, p. 32): “I much prefer the idea of being able to maintain something yourself rather than buying a product new and watching it break down”.

The Eco Board is another concept project rather than a mass-produced high performance surfboard (Dunn, 2005). Still, knowing how they are built is an important step towards creating the most sustainable surfboard. Eco Boards have balsa cores, which are

considered to have a soft impact on the environment considering the tree's quick rate of regeneration (Sullivan, 2007, p.12). Like BioFoam boards, they are glassed with hemp and linseed oil (*247*, 2009). Since all three parts of the board are sourced from plants, this is the closest recipe to the ancient Hawaiian boards there is (Colin, 2005).

It seems these boards are one answer to the sustainable surfboard. The materials are low-impact and biodegradable, leaving only the performance to be inspected. Eco Boards are custom shaped according to templates available online, meaning a customer can get the particular details they want in each board. As for how they ride, Eco Boards were test driven by British professional surfer Mark "Egor" Harris and junior champion Tassy Swallow (*247*, 2009). Both surfers were enthusiastic about the boards buoyancy, and called it "as good as a regular board" (*247*, 2009).

The drawback to these boards is that there is only one manufacturer, and they are located in the UK (*Eden Project*, Undated). So for British surfers, the Eden Project's Eco Board is one of the best, if not the premier small-market sustainable option for a new surfboard. Otherwise, the petrol used in shipping them may offset the environmental benefits of the board.

Wood shapers tend not to be globally available in surf shops the way foam surfboard shapers are. As such, wood presents the possibility of solely local based surfboard market. Board makers like Grain, Chris Garrett, Tom Wegener, and Gary Young are examples of successful small local business that resonate globally.

Performance Overview

- Compares to a PU board according to experienced British surfers
- Wood boards are heavier than foam, not necessarily a bad thing
- Some shapers believe wood has irregular flex
- Tend to last longer/more durable
- More expensive

Environmental Overview

The Good

- As sustainable as surfboards get

- Made from fast-growing balsa, bamboo, hemp, and linseed oil
- Wood shapers exist in lots of surfing areas (UK, Hawaii, U.S. East Coast, New South Whales) locally

The Bad

- Not globally mass-produced, so not available to the majority of surfers

Green Foam distributed by USBlanks

Green Foam is new to the surf industry, now based in Gardena, California (*Surfline*, 2010). Conceptualized by Joey Santley of the ReSurf foundation, this foam makes completely recycled blanks by pulverizing entire old PU surfboards and re-blowing the blanks with the scrap material (Woody, 2009). Green Foam also uses off-cuts from the shaping room, so as to eliminate the typical waste associated with shaping surfboards (Woody 2009; Surfline 2010). Shaper of …Lost surfboards, Matt Biolos vouches for them: "they are priced competitively, perform like new polyurethane boards and do not require shapers to change the way they make boards" (Woody, 2009). According to Santley, professional surfers like Cory Lopez, Chris Ward, Kolohe Andino, and Donavon Frankenreiter have all given Green Foam the thumbs up (Santley, in *Surfing*, 2009, p.70). Because of the quality of surfing these athletes do, I assume the boards have the potential to perform at least as good as typical PU boards.

However, there are some issues with Green Foam at this point. First, they are still very low in production. In 2009, they sold only a thousand or so blanks (Woody, 2009). At this time they were not really an option, when considering that as many as 316,000 surfboards were sold in the US alone in 2008 (Woody, 2009). But this problem may already be remedied. Green Foam very recently signed an exclusive contract with USBlanks (*Surfline*, 2010). USBlanks, according to a press release, is the premier producer of blanks in the world (*Surfline*, 2010).

So the market for Green Foam may open up quickly in the next few years, but because the agreement is exclusive, Green Foam is only made in California. Unless USBlanks decides to share the technology, or establish factories in other countries, this is not ideal for surfers in places like Australia. Chris Hines, Sustainability Director for the Eden Project, agrees: "Worst thing is to move boards half way around the world" (Hines, in Sullivan, 2007, p.28). Another main issue is that the technology is new, which tends to result

in some defective blanks (Woody, 2009), which may curse their popularity.

Performance Overview

- Perform equally to PU boards according to pro-surfers and shaper Matt Biolos
- Priced competitively

Environmental Overview

The Good

- Made completely from recycled off-cuts and old surfboards, no new foam needed
- Eliminates dust waste from shaping bay, keeps old boards out of landfills

The Bad

- Blanks still made out of PU, even if recycled
- Possibility of defective blanks
- Exclusively made in California

Hollow-core composites (i.e. Aviso, Saloman S-core, and Hydro Epic)

Hollow-core composite surfboards are a step forward into progressive surfboards, where surfing is clearly influenced by technological advantages. Developed using futuristic materials like carbon fiber, polypropylene (Kealoha, 2006), aluminum honeycomb, and Kevlar (*Hyrdo Epic*, Undated), there are some major technological steps in these boards. They toss out the usual solid foam core wrapped in fiberglass combination, and mimic the structure of hollow paddleboards a la Tom Blake. The resulting boards are a fraction of the weight of typical finished PU surfboards, a lifespan up to twice as long, and a price tag twice as expensive (Callaway, 2006). It is intensely difficult to understand the chemistry behind composite technology, so I employed MIT graduate and composites expert Gerry Flanagan to help me understand them.

First, carbon reinforced plastic (carbon fiber and resin, the common key ingredient on these surfboards), has an incredible strength-to-weight ratio (Flanagan, pers. comm. 11/4/2010; Callaway, 2006). It is used on Boeing 787 planes and Formula One cars because it's very stiff and lightweight (Flanagan, pers. comm. 11/4/2010). What this means for a

surfboard is: they're really tough, and really light. In fact, some complain that they are too light and don't keep momentum when surfing (Callaway, 2006). However, it all depends on what the surfer wants, and the manufactures tend to sell these boards as nearly indestructible. The boards also appear to have an inexhaustible flex characteristic, which means they feel snappy and lively for the duration of their functional life (Callaway, 2006).

Hollow-core composites utilize synthetic technologies that are born in labs, under intensive energy inputs. Says Flanagan, strong carbon fiber begins as a liquid polymer like polyacrylonitrile, which is extruded through a small opening to create a filament (pers. comm. 11/4/2010). A filament is elongated, then heated under tension to 2,000-3,000 degrees Celsius (Flanagan, pers. comm. 11/4/2010). This changes the polymer filament into an "arrangement of graphene crystals" (Flanagan, pers. comm. 11/4/2010). That's the process for one fiber to be created. For use on a surfboard, a bundle of 20-50 thousand fibers must be manufactured together (Flanagan, pers. comm. 11/4/2010).

The fibers are woven into a fabric that can be handled, and then applied to the surfboard (Flanagan, pers. comm. 11/4/2010). Companies use their own design for each surfboard, but it appears that most have a hollow core supported by an internal skeleton (*Hydro Epic*, Undated; Kealoha, 2006). Typically, there is some sort of high-density foam around this frame, and then a carbon reinforced plastic layer (*Hydro Epic*, Undated; Kealoha, 2006).

This all may seem very complex, and that's because it is. The drawbacks of these materials are pretty large. The first is that they are priced well above the spending limit of what most consumers walk in the door with. Often they sell for over $1,000. Also, custom surfboards are not an option. These boards come in models, and cannot be shaped to customer specifics (Callaway, 2006). Shapers can use carbon fiber cloth, but hand shaping usually entails a solid foam core. Poor use of the carbon fiber fabric can result in de-lamination, just like with a fiberglass board (Flanagan, pers. comm. 11/4/2010).

To the point of sustainability, carbon fiber (and most composite materials, for that matter) requires huge energy inputs, which "is partially reflected in the high cost of the fibers" (Flanagan, pers. comm. 11/4/2010). This is probably the most environmentally corrosive aspect of these boards. Furthermore, the finished composite surfboard is non-recyclable and non-biodegradable at present (Flanagan, pers. comm. 11/4/2010). So while they last a very long time, are very strong, and probably not bad boards to ride, they are not

yet the perfect answer to the sustainable surfboard question.

Performance overview

- Very light-weight (some complain too lightweight, doesn't hold momentum)
- Very strong, durable
- Inexhaustible flex pattern
- Very expensive
- No option for custom orders

Environmental overview

The good

- Last a very long time
- Difficult to ding

The bad

- Huge energy drain
- Don't biodegrade, are not recyclable

4.2 WETSUITS

4.2.1 ENVIRONMENTAL IMPACT OF WETSUITS

Few surfers enjoy the luxury of surfing in warm water year-round, and so most must purchase wetsuits to surf comfortably in the colder seasons. I know from personal experience that these winter sessions can be the best; they are uncrowded, peaceful, and sometimes soulful. But the manufacture of these second skins, as research shows, is harmful just as surfboard production is.

Scientists call the synthetic rubber used in wetsuits polychloroprene (Carroll, 1989, p.82). Surfers call the finished product neoprene, which is actually "a trade name of DuPont, a huge US-based multinational industrial chemical corporation" (Carroll, 1989, p.82). There are two ways of creating polychloroprene (Copeland, 2008).

The first method, used in the majority of wetsuits, is based from crude oil by utilizing

a substance called **butadiene** (Copeland, 2008). The butadiene petrol-product is used to create polychloroprene beads of resin by a series of reacting chloroprene monomers in a petrochemical plant (Copeland, 2008). The "resiny platelets" of polychloroprene are melted and added to **carbon black** and a metal salt like **magnesium oxide** (Carroll, 1989, p.82). **Carbon Black** is essentially pure carbon that has been combusted under very specific, controlled process of heating (*International Carbon Black Association*, 2006). As described by the International Carbon Black Association (2006), both methods for creating it appear to be extremely resource intensive, requiring a massive manufacturing plant to control temperature and pressure very deliberately. This production must create extensive carbon emissions and is undoubtedly dependent on non-renewable fossil fuels. The **Magnesium oxide** is mined from the ground or from ocean brine in the raw and heated at temperatures up to a thousand degrees Celsius (*Martin Marietta Magnesia Specialties*, Undated). The process creates magnesium oxide and a carbon dioxide by-product (*Martin Marietta Magnesia Specialties*, Undated), resulting in significant amounts of Greenhouse gas.

The other method of creating polychloroprene involves mining limestone, also called calcium carbonate (Copeland, 2008). The resulting material is called geoprene. Limestone, which is non-renewable just like petroleum, is mined from mountains with heavy machinery (Copeland, 2008). The limestone is crushed and heated in a furnace at temperatures up to 3,600º F (Copeland, 2008). The resulting material is introduced to more chemicals to result in acetylene, which is the base of limestone-derived polychlorene (Copeland, 2008). As Copeland (2008) of Patagonia wetsuits explains, "Polychloroprene from any raw-material source creates the greater part of a wetsuit's environmental impact; the other components such as nylon or polyester fabric play a much smaller role".

Zinc oxide accelerators, plasticizers, and stabilizers are the next chemical additions (Carroll, 1989, p.82) to polychloroprene. What results is a "rubber hydrocarbon" that is joined with a blowing agent, which is how the closed-cell bubble technology that insulates surfers is made (Carroll, 1989, p.82). Blowing agents use AZO compounds that emit nitrogen gas and other spin-off fumes (Carroll, 1989, p.82). Then the spongy neoprene goes to a mould where it is baked (Carroll, 1989, p.82). The material is then cut, sewn, and glued at the seams to create the finished wetsuit. This last step includes "a heavy use of toxic adhesives for lamination. These solvents evaporate during manufacturing, both polluting the environment and creating a health and safety risk to workers (Hillary, 2010). The last

measure of environmental impact would be where each suit is made, as shipping them clearly demands more petrol and creates more CO2 emissions. Most wetsuit brands use overseas factories in Asia.

4.2.2 MOVES TOWARDS AN ENVIRONMENTALLY CONSCIOUS WETSUIT

Though a few companies produce wetsuits with limestone-based polychloroprene (Body Glove, Matuse, West), Patagonia's geoprene suits appear to be the most environmentally conscious in design. First, the design reduces the need for rubber resources by lining the suit with recycled polyester and chlorine free wool (Hillary, 2010). Apparently this allows them to make suits with a thinner layer of geoprene while still keeping the surfer as warm as a typical thick suit does. As added benefits, professional surfer Keith Malloy (in *Patagonia*, 2009) boasts they take only about a third of the time to dry that a regular neoprene suit does, while Mary Osborne claims the materials last much longer (in *Patagonia*, 2009). A major drawback to the suits is that the rubber comes from Asia (*Patagonia*, 2009), meaning gas miles play a role in the suit's carbon footprint. They are also not widely available and are fairly expensive.

Body Glove sells the "Eco" as their environmentally conscious suit. They claim the two main materials, Bio-Stretch material and Eco-Flex exterior are "non-petroleum based and 100% environmentally friendly" (*Body Glove*, Undated; Christensen, pers. comm. 20/4/2010). The geoprene for the suit is (like Patagonia's) limestone based, the production of which "consumes one tenth the amount of energy normally used in the manufacturing of standard petroleum based wetsuits" (*Body Glove*, Undated). The smaller zippers are recycled and the printing on the suit is done with water-based inks (*Body Glove*, Undated). The "Eco 2", the most current model, has laminates that are made of corn (Christensen, pers. comm. 20/4/2010). The suit is also, according to a Body Glove employee, recyclable (Christensen, pers. comm. 20/4/2010).

While this all seems like a pretty solid foundation for a greener wetsuit, there are a few things I would like to point out. The main issue is that the geoprene is manufactured in Asia (Underwood, 2009). In the beginning, both Patagonia and Body Glove got this material from the same company: the Yamamoto Corporation (Bergman, 2007; Underwood, 2009). The new "Eco 2" is now manufactured in Thailand, by Sheico (Christensen, pers. comm. 20/4/2010). Moreover, the limestone for the polychloroprene requires petrol to mine out of

the Earth, and energy to heat into a rubbery state. Thus, calling the suit's Bio-Stretch material 100% petrol free, even if it's not contained in the rubber, is misleading to consumers. Labeling it as such doesn't account for resource extraction, manufacture, and travel miles. Body Glove also admits about the Eco suit that the liquid tape and stretch material are both the same as a typical suit (Underwood, 2009). Lastly, Body Glove does not have a wetsuit recycling program, so I assume they are referring to utilizing an outside source in claiming that they are recyclable. In this case, all wetsuits are considered recyclable into mouse pads, beer cozies, and yoga mats by organizations like ReSurf and Rip Curl. So my assessment is that Body Glove paints the Eco greener than it really is. That said, it is a hugely progressive move towards lowering the impact of wetsuits, and Body Glove deserves credit in the respect of creating a better-than-generic-neoprene suit.

Billabong offers an environmentally marketed neoprene wetsuit as well. The B9 Eco Suit allegedly "consumes 80% less energy and produces 80% less carbon dioxide emissions than a regular suit" (Hillary, 2010). The wetsuit also includes the use of water-based inks and the internal lining, which is 90% recycled polyester (*Billabong*, 2010). But an efficient neoprene wetsuit is still oil derived, and thus isn't particularly ecologically sensitive.

Wetsuit recycling is in early stages, but there are some organizations that make effort to re-purpose neoprene. For example, the ReSurf foundation is working neoprene scraps into sandals, traction pads for surfboards, and even reusing them in new suits (Swegles, 2010). Some Rip Curl outlets accept old wetsuits (and use cut-offs from manufacturing processes) to create a 30% neoprene/rubber combination for the sole of a "Resurection Rubber" shoe or travel bag (*Rip Curl Planet Foundation*, 2009; Hillary, 2010). One source (Hillary, 2010) asserts that Rip Curl has made this approach more holistic by "using non-solvent glues in the lamination process, resulting in a major reduction of chemicals polluting the air." It appears that, while small, steps are being made to make the embodied energy of neoprene last.

4.3 SURFING APPAREL

Surfing, at the roots, is a celebration of individuality and style. It's an expressive art as much as it is a sport. Be it on the face of the wave or in the parking lot, surfers tend to look and act in ways that dignify their unique perspective. They think, speak, and dress differently. But the industry that once simply supplied surfers with surf trunks and tee shirts are now multi-million dollar conglomerates, which are "only narrowly behind oil and mining as one

of the most polluting industries on the planet" (*Australian Surf Business,* in Elliot, 2007). In fact, Surfrider Foundation's creator Glenn Hening (in Dick-Read, 2007) points out that there is little difference between clothes found in surf shops and those found in malls: "As it turns out, the surf industry is not the surf industry – it's clothing companies with a very good hook."

The executive director of SIMA Sean Smith summarizes "Surfing is not just a sport; it's a fashion trend" (Smith, in Wiedemann, 2007). Surf clothing is no longer only a matter of function, but a question of what style can be marketed as hip. SIMA stated that in 2009, during a period of economic stress, the surfing apparel industry alone still profited $1.7 billion. Commenting on this robust figure, the SIMA report exclaimed "Passion and youth largely drive the surf industry. Surfers and skaters view the industry as a lifestyle, not a passing trend" (*SIMA*, 2009). So what results from a loyal, passionate addiction to surf threads? The answer comes right from the garment itself.

4.3.1 ENVIRONMENTAL IMPACT OF THE APPAREL INDUSTRY

A look at the "Made in" tag on surf clothing shows most garments have been manufactured in Asia or a developing nation elsewhere. Typically, these items begin as cotton fields in the United States (Claudio, 2007). Conventionally grown cotton is one of, if not *the* most, water and pesticide dependent crop in the world (Claudio, 2007). In buying a surf shirt, surfers propagate pesticides washing into waterways and eventually into the ocean.

The water and chemical intensive cotton is shipped to a processing factory in China, or a number of other developing countries, where workers are absurdly underpaid (12-18 cents per hour) and overworked (Claudio, 2007). The clothes are then exported to the States, Australia, Japan, and anywhere else there are surf shops. There they are bought to create the surfing "look". According to the book *True Green*, "apart from food, clothes shopping has the highest environmental impact of all consumer activities, with about 150,000 liters of water used in the production and transport of the new clothes bought by the average Australian household each year" (McKay & Bonnin, 84). Thus the footprint of this clothing, including gas, water, and labor is enormous. If it's still unclear, surf apparel companies are probably the biggest contributors to environmental problems involved in the surfing industry, aside from the habit of travel.

4.3.2 SUSTAINABLE INITIATIVES BY BRAND

To be fair, the industry should be examined for any progress being made towards sustainability. Especially since going green has become so popular, it's important to get the specifics of how some of the bigger companies define their stance on environmental approaches to production. An overview of the industry allows for an assessment of the direction the surf market is headed in. This analysis of the industry looks at eight major clothing labels and three footwear brands that have a declared environmental platform. I included two environmental organizations that are associated with surf apparel: Project BLUE and the Action Sports Environmental Coalition.

Project BLUE

Project Blue is an organization of major surf brands, including Billabong, O'neill, Electric, Nixon, and DAKINE. These brands offer a line of products, of which a portion of the profits are donated to the Surfrider Foundation (*Project Blue*, 2010). As a result of these efforts, Project Blue has helped to donate over $140,000 to the Surfrider Foundation (*Surf Expo*, 2010). The Project Blue website (2010) claims: "To make a big change, there first needs to be a million little changes". The website advocates responsible purchasing and the adage "reduce, reuse, recycle".

Project Blue just recently partnered with the SIMA Environmental Fund, which hosts an additional 19 non-profit organizations aimed at saving the coasts (*Surf Expo*, 2010). According to the SIMA Environmental Fund Board President Paul Naude, the surf industry has donated over $5 million to these grass-roots organizations (*Surf Expo*, 2010). *Surf Expo* (2010) reports that Project Blue now donates to the following additional organizations:

- Alaska Wilderness League
- Algalita Marine Research Foundation
- Assateague Coastal Trust
- Heal the Bay
- KAHEA: Hawaiian-Environmental Alliance
- North Shore Community Land Trust
- Ocean Institute

- Ocean Defenders Alliance
- Orange County CoastKeeper
- Paso Pacifico
- Reef Check
- Santa Barbara Channelkeeper
- Santa Monica Baykeeper
- Save the Waves Coalition
- Seymour Marine Discovery Center
- SINADES
- Surfing Education Association
- Surfrider Foundation
- WiLDCOAST

Action Sports Environmental Coalition

The Action Sports Environmental Coalition (ASEC) is a third party catalyst in encouraging action sports companies and athletes to be role models of environmental action. Created by Frank Scura, the organization aims to educate and perpetuate sustainable initiatives from retailers to professionals to manufacturers (*Action Sports Environmental Coalition*, Undated). They have worked with brands like Quiksilver and Volcom as well as surfers like Rob Machado (*Action Sports Environmental Coalition*, Undated). The ASEC has created a number of active participation events, including Roll Anything Day, which promotes skateboarding and biking instead of driving (*Action Sports Environmental Coalition*, Undated). Scura and the ASEC are credited for starting the Green Room concept, a marketing scheme that involves devoting floor space in surf shops only to environmentally friendly products (*Action Sports Environmental Coalition*, Undated). The ASEC is also involved in a youth education outreach project: the Water Innovation Now contest (aimed at rewarding kids for coming up with water conservation strategies and effective communication of them) (*Action Sports Environmental Coalition*, Undated).

Patagonia

Since their involvement with surfing, California based Patagonia has been the most publicly recognized environmental surf brand. And they certainly deserve credit; Patagonia makes a genuine effort to do much more than sell organic tee shirts. In fact, it's pretty difficult to summarize all their support for the environment. They have an extensive track

record that grows each year. The company's charity is notable: "at least 1% of sales or 10% of pre-tax profits – whichever is more" plus donations, resulting in over $34 million dollars to environmental groups and causes (*Patagonia*, Undated). Owner Yvon Chouinard and Blue Ribbon Flies owner Craig Mathews created the 1% For the Planet Foundation, which any business can join to donate profits towards environmental charities (*Patagonia*, Undated). They offer a grant opportunity for grassroots environmental organizations, which has supported over 1,000 groups to date (*Patagonia*, Undated). Patagonia has a recycling program for it's clothing, and have recently embarked on a new environmental crusade called "Freedom to Roam", which is designed to protect habitats of animals like wolverines, salmon, and pintail ducks (*Patagonia*, Undated).

Not only does Patagonia support heaps of non-profits, their Reno office building deserves mention too. The building is a LEED certified mix of recycled and repurposed materials, and even includes a storm-water runoff system: "pervious pavers that allow water to percolate back into the ground" (*Patagonia*, Undated). Similarly, their Ventura office has it's own solar power plant in the parking lot, which generates 12% of their power, and will save an estimated 5,669 barrels of oil and 4 million pounds of Greenhouse Gas emissions over it's 30 year lifespan (*Patagonia*, Undated).

The last horn I'll toot for the company is Patagonia's Environmental Internship Program. As the company explains "Through the program, employees can leave their jobs to work for the environmental group of their choice. Patagonia continues to pay their salaries and benefits while they're gone, and environmental groups worldwide get them for free. To date, more than 750 employees have taken part in the program" (*Patagonia*, Undated). As far as social action goes, I think this is unheard of in most businesses. Patagonia is very transparent about their environmental action, with a section on their website (the Footprint Chronicles) dedicated to showing their products ecological footprint.

Volcom

Volcom has a line called the V.Co-Logical Series, which is an attempt to make an environmentally responsible division of the company. To this end, they produce clothing made of "100% certified organic cotton, hemp, vegetable dyes, organic stains and other low impact production methods" (*Volcom*, 2007). V.Co-Logical also uses "recycled PET,… no-chemical washes, and…re-usables (limited edition water canteens)" (Sabori, in Fitzpatrick,

2009). This line does not represent their entire clothing selection, but V.Co-Logical is also paired with the 1% For the Planet organization. As part of the V.Co-Logical effort, Volcom releases adverts that encourage consumers to skateboard instead of drive. The Volcom headquarters recycles, has a ban on single use water bottles, and has a company bike for employees to ride short distances (Sabori, in Fitzpatrick, 2009). Volcom also "recently collected 5,000 pairs of jeans for the homeless" (Montgomery, 2010).

Billabong

Apart from being a member of Project Blue, Billabong makes a small effort to release some "eco" products. These products include a material called Eco Supreme Suede, which is made from recycled PET bottles (about 10 bottles a pair) (Billabong, 2010). According to Billabong's website, over five million bottles have been recycled thus far (*Billabong*, 2010). This is perhaps their largest effort towards reducing their impact. Worth mentioning is team rider and unofficial environmental embassador of Billabong, Dave Rastovich. Rastovich spearheads most of Billabong's environmental ad campaigns and is also responsible for the organization Surfers for Cetaceans, which lobbies to protect dolphins and whales from unethical culling.

Rip Curl

Rip Curl partnered with the World Wide Fund for Nature (France) to create the Rip Curl Planet organization in 2006 (*Rip Curl Planet Foundation*, 2009). In addition to offering grants to environmental action groups, 'Rip Curl Planet' products accounted for over 10% of their total sales in the 2008 spring-summer season (*Rip Curl Planet Foundation*, 2009). As part of their efforts to reduce the environmental impact of their clothing and wetsuits, they have put some research into recycling material like neoprene and using "bio cotton" (*Rip Curl Planet Foundation*, 2009). It appears they use the recycled materials for a few of their other products, like boardshorts, as well.

Rip Curl sponsors some major professional surfing events, including the Rip Curl Pro at Bells Beach, Australia. To reduce the impact of these events, Rip Curl has set some standards, including: "constant on site cleaning", recycling, "eco-responsible purchasing", "local or bio food", "non-use of disposable plastics", "dry toilets", and "restriction and partial compensation of CO2 emissions produced from transporting the Rip Curl riders and the

teams of judges and organizers" (*Rip Curl Planet Foundation*, 2009). In 2008, the Rip Curl Pro at Bells Beach worked with CO2 Australia to make the first carbon off-set pro surfing event (*Rip Curl*, 2009). They compensated the travel, set up, and running of the program by taking the aforementioned efforts, but also by "planting native mallee eucalypt trees to counterbalance these emissions" (*Rip Curl*, 2009).

Quiksilver

Quiksilver may be the largest and most established surfing brand there currently is. They sponsor nine-time world champion surfer Kelly Slater, probably the Micheal Jordan of contemporary surfing. Quiksilver has it's own Foundation for supporting local and global action groups: the Quik Foundation. Though they do support organizations like the Surfrider Foundation, Alaskan Wilderness League, and Reef Check, the Quiksilver Foundation seems to be aimed mostly at socially responsible humanitarian movements (*Quiksilver Foundation*, 2008). By this I mean they support education, health, and equity in groups like the Joyful Heart (supports victims of sexual assault), CHOC (children's hospitals of Orange County), the Eddie Nash Foundation (supports victims of child abuse), and Keep a Breast (fund raising for breast cancer) (*Quiksilver Foundation*, 2008). Organizations affiliated with the Quiksilver foundation also include educational programs like Quik Science and indigenous aid groups such as the Sumba Foundation (*Quiksilver Foundation*, 2008).

Quiksilver offers a few 'eco-friendly' products. These clothes include 100% organic cotton shirts, "repurposed polyester" and "recycled supersuede" boardshorts, plus caps made from 100% recycled plastic bottles (rPET) (*Quiksilver*, 2010). It should be noted, though, that most of Quiksilver's clothing is not aimed at sustainable manufacture.

Body Glove

According to the Body Glove website's "Eco" page, their mission statement says the company "will strive to follow the lead of our environmentally conscious founders and continue to support local and international environmental organizations while also leading the way in product development and corporate responsibility. [Body Glove's] mission is to be smarter, greener, cleaner" (*Body Glove*, 2010). In line with this, they have created an "Eco line" which includes wetsuit gear, rashgaurds, and personal flotation devices made from alternative materials. Body Glove supports organizations like Heal the Bay, the Surfrider

Foundation, and Reef Check (*Body Glove*, 2010). They have an "action" page coming soon to their website, which is aimed at showcasing their own environmental efforts as well as encouraging customers to become socially active (*Body Glove*, 2010).

Hurley

Hurley, like many surf brands, offers a pair of recycled PET boardshorts. What sets Hurley apart from other companies is their stance on the issue of water access. According to an article by the industry news group *Shop-Eat-Surf*, Hurley has joined with the non-profit organizations Waves for Water and the Ecology Center in San Juan Capistrano, California to do it's part on the issue of resource use and availability (Montgomery, 2010). Their mission is to provide water filters to those in need and educate people on sustainable living (Montgomery, 2010). It may be a technique for marketing the company's "eco" factor, but Evan Marks, executive director of the Ecology Center, vouches for their determination in calling Hurley's pledge "exponentially higher" than most others involved with the organization (Marks, in Montgomery, 2010). Hurley CEO Roger Wyett commented; "This is our effort to get behind something that matters as part of the fabric of our company" (Wyett, in Montgomery, 2010). Besides that, Hurley has taken some direct initiatives, such as "eliminating 90% of plastic bottles at the Hurley Pro at Trestles by having water dispensers and steel bottles available on the beach" (Montgomery, 2010).

O'neill

This company is a member of Project Blue, meaning they donate a percentage of their profits to environmental organizations. O'neill will join many in the surf industry with the ECO'neill line of clothing, which will include t-shirts, singlets, and caps made from 100% organic cotton and recycled plastic boardshorts (*Surfer*, 2010). More notable is the O'neill Sea Odyssey program. Created by Jack O'neill in 1996, the program takes place on land and at sea (in a 65ft catamaran), "where 4th - 6th grade students from schools throughout Central California receive hands-on lessons about the marine habitat and the importance of the relationship between the living sea and the environment" (*O'neill Sea Odyssey*, 2005). The program boasts educating over 50,000 students about the Monterey Bay National Marine Sanctuary since it started (*O'neill Sea Odyssey*, 2005).

Footwear

According to SIMA, footwear showed a jump in retail sales greater than any other clothing or accessory item between 2006 and 2008—an increase of 15.6% or a gain of $1.5 billion (*Surf Industry Manufacturers Association*, 2009). Because of the growth noted in this portion of apparel, it's appropriate to include shoe and sandal companies in an industry overview.

Ocean Minded

Ocean Minded is a brand that publicly embraces environmentally conscious actions. First, they repeatedly hold local (California) beach clean-ups (*Ocean Minded*, 2010). Second, the brand utilizes alternative materials including water based glues, hemp, recycled car tires, organic cotton, recycled wool, recycled PET (plastic bottles), vegan materials, suede without chromium sulfate, and recycled ethylene vinyl acetate (*Ocean Minded*, 2010). Recently, Ocean Minded partnered with GAP clothing stores because of their strong environmental platform (Montgomery, 2010). I'm not optimistic about what effect this move to inland stores will have on their carbon footprint, though it can't be any worse than the typical larger sandal brands that have already done so.

Reef

Reef sandals (and more recently, clothing) created Redemption, which strives to reduce their product impact, increase the charity and volunteerism from within the organization, and create more efficient ways of operating the business (Gass, in *The Greener Grass*, 2007). Reef has done more than just the typical organic cotton and recycled materials bit—they call one aspect of the three-part initiative the "culture of giving" (Gass, in *The Greener Grass*, 2007). General Manager Mike Gass comments in an interview "With our culture of giving we have a financial contribution piece with the reef Redemption Fund and a volunteer piece through the Reef Redemption Committee…More than half of the employees are regularly volunteering to participate in beach clean ups and are looking for ways to give back to the community" (Gass, in *The Greener Grass*, 2007). Reef, as part of their "in-house efforts", has aimed to get the office building LEED certified, eliminated superfluous waste like paper cups, and even recycling irrigation water (Gass, in *The Greener Grass*, 2007).

Sole Technology

Sole Technology is the parent company of Etnies and Emerica shoes, among others. Etnies has entered the surfing world and gathered an amazingly talented team, including Jamie O'brien, Eric Geiselman, the Malloys, and Brett Simpson. But what separates Sole Technology from normal footwear brands is quite amazing. Their goal, according to CEO and founder Pierre Andre Senizegues, is to become a carbon neutral company by 2020 (*Sole Technology*, Undated).

An "eco-audit" is a regular business practice for Sole Technology. Eco-audits focus on "carbon emissions, waste and consumption and water usage" (*Sole Technology*, Undated). Sole Technology deserve credit; not many companies take such a holistic and dedicated approach to sustainability. Etnies, as part of their green plan, has made such additions: "616 solar panels, the conversion to water-based cement manufacturing, corporate wide-recycling efforts, and the creation of a seasonal sustainable footwear and apparel collection" (*Sole Technology*, Undated). By this year (2010), they anticipated to recycle 70% of their internal waste (*Sole Technology*, Undated). The Sole Technology buildings use waterless urinals and dual flush toilets to compensate for some of the water used in cotton apparel production (*Sole Technology*, Undated). Without a doubt, this is the most sustainable-minded footwear brand in action sports today. This is an example of a company that's transparent about it's impact; take a look at the Sole Technology website. It includes the amount of their raw carbon dioxide emissions (broken down by the source) and waste by the pound. Creator of Sole Technology Pierre Andre Senizegues was an executive producer of the motivational film *The 11th Hour*, which educates viewers about climate change (*Sole Technology*, Undated).

5. TRAVEL

5.1 SURFERS HABIT OF TRAVEL

Travel is by and large the most environmentally unfriendly part of surfing culture (McKay & Bonnin, 2006, p.111; Burwell, 2010). Studies (Burwell, 2010) show that travel is the main contributor to global warming. The only reason surf travel has a smaller impact than the manufacture of surfing equipment/clothing is because surfers don't travel as often as surfing products are shipped globally. But either driving everyday to check the surf or flying to Indonesia for a surf trip, the Greenhouse gasses, ozone depletion, and resources it takes to build and operate vehicles are environmentally overwhelming. Still, expecting surfers not to travel is futile. In the words of Dick-Read (2007):

"Surfers will think nothing of driving for hours to check every spot looking for the best wave for the wind, swell and tide conditions. Flying to the far side of the world for high-quality waves is simply seen as essential to the authentic lifestyle. Every surfer wants to go to Hawaii, Indonesia, Australia, South Africa, Chile, France, California at least once in their life; the "luckiest", the top 44 professional surfers on the Fosters ASP Dream Tour, do so several times a year."

In fact, the amount of damage that professional surfers do is the only accountable evidence of travel emissions created by the sport (since recreational surfers do no keep log of miles traveled). *Surfing* reports the Association of Surfing Professionals (ASP) annual contest tour accounts for "more than 24 tons of CO2 over the course of a season" per surfer (Cornuelle, 2009, p.74). In the same article, the author claims that each ASP competitor would need to offset their emissions by planting 575 evergreen trees a year, which would only begin to offset the carbon after ten years of growth (Cornuelle, 2009, p.74).

5.2 ENVIRONMENTAL IMPACT OF AIRPLANES

Riding on an airplane is arguably the worst thing a single person can do for the environment (McKay & Bonnin, 2006, p.111). The book *True Green* reports: "air travel produces as much CO2 as each passenger driving their own car the same distance" (McKay & Bonnin, 2006, p.111), but the pollutants are released directly into the atmosphere. Airplanes emit VOCs, nitrous oxide, and dump millions of gallons of toxic de-icing chemicals into waterways (Holzman, 1997). Nitrous Oxide is 300 times more powerful as a

Greenhouse gas than CO2 (Vincent, 2007)

5.3 ENVIRONMENTAL IMPACT OF CARS

Cars are one the biggest drains of fossil fuels in our current society. Even worse are the huge emissions of hydrocarbons, nitrogen oxides, and carbon monoxide that result from driving (Elkington & Hailes, 1989, p. 243). These gases are linked to acid rain, smog, and global warming (Elkington & Hailes, 1989, p. 243). Every time surfers check the waves by car, drive to a nearby friend's house, or leave the car running idle for a period of time, they needlessly increase the concentration of these harmful gases.

6. DISCUSSION

Possibly the most difficult obstacle to achieving sustainability in the surf industry is that there is practically no such thing as sustainable surf product design at this point. The materials, technology, and momentum towards that goal are still very limited. Metzger (in Lewis, 2010) points out "no product, that I know of, goes cradle-to-cradle but that doesn't mean we can't take steps in achieving a balance between commerce and environment. It's all about commitment and seeing past the numbers and realizing the big picture." On the same note, Rapp (in Lewis, 2010) choruses "there is no such thing as sustainable business or sustainable products. Every product we [Patagonia] make has a negative environmental impact. Simply by being in business, we are polluters. However, our task (and our challenge) is to create the best products we can while causing the least amount of harm to the planet… you can make environmentally-minded products for a youthful audience - while being profitable." The sustainable movement in surfing is still in the early stages: the major energy source for almost every manufacturing plant is non-renewable, the labor and environmental standards where products are manufactured are low, and design does not emphasize durability over performance or image. Overseas production is still unquestioningly supported. But these factors can change, if the effort is collective, cooperative, and genuine.

6.1 OPTIONS FOR A MORE SUSTAINABLE SURFBOARD

There is currently no sustainable high performance surfboard globally available to surfers. And because surfers are particular about the way a board rides, a "greener" surfboard will have to perform as good or better than a standard PU board. The *most* sustainable option that is available to the majority of surfers is a used surfboard (Schulz, Undated, p.8; Sankey, 2010, p.8). Choosing a used board in good condition means no extra energy or materials to shape and a less expensive surfboard. There are significantly less gas miles put into buying a used board as well; it doesn't come from an overseas factory. Even if a board was originally produced in Asia, increasing the longevity (by buying it used instead of new) is the best way to make use of all the embodied energy put into producing and transporting it. More to the point, most local surf shops don't carry an alternative surfboards section, but they do have a used board rack. Having a good used board section in surf shops is unbelievably important. We need to make use of every foam board that is shaped. The more new foam boards are

produced, the more the ozone is depleted, toxins are released, and junk ends up in landfills. Focusing quality used surfboards as the bulk of a shop's selection would have little affect on business: new surfboards are hardly where profits are made by surf shops (Hunter, 2008, p.5). Surfboards simply draw people into doors, and stand as a 'core' factor for shops (Hunter, 2008, p.6). It takes a bit more observation on the part of the consumer, because there is a higher chance of getting a board with de-lamination, hidden weak spots, or dings. But a surfer can choose almost any quality, size, or shape in the case of most surf shops.

Above all, the object is to increase the lifespan of each surfboard, and decrease the need for more. This can be done in a few ways:

1. Moving the board away from the sun when not surfing. UV rays degrade the quality of the materials, turn the board yellow, and decrease its lifespan (Sullivan, 2007, p.31). Put it in a case or in the shade.
2. Getting any dings (fractures in the fiberglass) fixed professionally, as soon as possible. Unless it's really small and simple to fix, ding repair is better left to professionals. They will do a better job and are much better suited to deal with the aforementioned chemicals. Dings let water into the board, which can waterlog, de-laminate, and corrode the inside. Riding with un-repaired cracks will further shorten the lifespan of your surfboard (Sullivan, 2007, p.31).
3. Purchasing a board with a thick coat of glass.
4. Choosing a surfboard that can accommodate the range of conditions for your break. For example, if a surfer lives somewhere with small waves, riding a longboard or fish would suffice most days. No surfer should realistically need more than 2-3 surfboards to comfortably surf any wave at his/her break.
5. Selling or donating old boards to be re-used by another surfer.

If the board gets to the point of being unusable (broken in half, very de-laminated, etc.) than surfers should try to donate it to ReSurf (www.resurf.org). Alternatively, they could use it as a canvas for an art project, make a chair or mailbox out of it, or hang it on the wall. The best thing to do is to try and keep them out of landfills. Creativity will need to fill this gap.

It is unreasonable to believe that all surfers, surfboard manufacturers, and surfboard retailers will be satisfied with only buying and selling used surfboards (and they will all eventually break), the next best option for consumers is to buy a locally made board, with

materials as low impact, locally sourced, and as durable as possible. The availability of these boards is in the hands of retailers, because surf shops are the middlemen between customers and shapers. *Transworld Business* (Hunter, 2010, p.11) reported this year survey results that only 50% of the leading American surfboard shops stock locally shaped surfboards. Shops should aim to buy the majority (if not all) boards from local shapers. Having boards shipped from Asia or any far off destination contributes to CO2 emissions and the use of petrol, not to mention the small shapers that go out of business. Further, if shops have locally available Eden Project eco-boards (i.e. a UK surf shop) or Green Foam boards (a California shop), than offering these is a good step. To start closing the loop, shops should strive to offer a surfboard recycling program, such as the one supported by the ReSurf foundation.

Shapers can aim to make more durable, low impact boards. The most durable and widely available materials appear to be EPS, XPS, and wood. The most durable resin is epoxy. The lowest impact materials seem to be Green Foam, bamboo, and epoxy resin. Shaper Dick Van Straalen endorses carbon fiber and EPS foam, for the strongest combination (Van Straalen, pers. comm. 20 May 2010). His boards are glassed with taped rails, which means they are glassed to maximize strength and flex (Van Straalen, pers. comm. 20 May 2010). This is the same idea behind the Firewire parabolic balsa stringers—putting the strength of the board in the rails.

All available foam is oil derived or oil dependent for transport, and thus not particularly sustainable. However, shapers could minimize their impact by maximizing the use of local materials. Blanks and glassing materials should be produced on the same coast that the boards are shaped on. Consider making boards with a slightly thicker coat of glass, and "taping the rails" when glassing the board.

Developing more durable, high performance boards for a sustainable future may include a combination of different materials, like foam and bamboo a la Gary Young. Surfboards need a durable shell and closed cell core to stay strong and dry. But they also need to be performance and cost effective. Because materials like carbon fiber are very resource intensive and expensive, fast growing wood like bamboo may be the better option. I admit it's a science that is better left to shapers to figure out the correct materials for flex, weight, cost, and buoyancy. Shapers and manufacturers should consider the incentives of designing greener materials and methods—the surf world is without an environmental alternative.

6.2 OPTIONS FOR A MORE SUSTAINABLE WETSUIT

Wetsuits are also difficult in that they need a specific amount of stretch and insulation to serve their purpose, which cuts out a good deal of green alternatives. For example, recycled neoprene is available, but as Rip Curl explains: *"*There is no recycled neoprene to date that has the stretch that we see in wetsuits today" (*Rip Curl*, in Hillary, 2010). Similarly, natural rubber was considered for the Body Glove Eco suit, but it did not hold up to tests for "durability and weight" (Underwood, 2009). What is available today in wetsuits is oil-based neoprene and limestone-based geoprene, and both have an environmental impact. Still, limestone suits may very well be the most environmental alternative, as they appear to produce a better suit for less oil.

Manufacturers of wetsuits should aim to minimize waste and increase energy efficiency. They can consider recycling scraps as filler for furniture, reclaiming the rubber for footwear, or donating it to a recycling program like that of Colorado's Ecological Designs (*Ecological Designs*, 2009), Rip Curl, or ReSurf. Companies can invest in renewable energy —just because neoprene is based from non-renewable resources doesn't mean the electricity used in producing wetsuits also has to be. And manufacturers should keep options open for alternatives to traditional polychloroprene. The best way to do this is try out different materials and get feedback from team riders about how to make the wetsuit better. Above all, wetsuit manufacturers should consider localizing production to reduce gas miles.

Owners or managers of surf shops should try to get suits made near where the shop is located. Selling more environmentally designed suits is great, because it supports the "green" market. But voicing a concern to manufacturers about the footprint of shipping products across the globe is important. Surf shops can do some research on what suits last the longest and endorse those suits over short-lived ones. Selling quality items instead of short-lived ones will increase the credibility of the shop while reducing its environmental impact. Shops should repair wetsuits (re-taping seams, re-stitching, and patching) for customers and collect old suits to reuse the rubber for repairing a damaged suit.

The best thing for surfers to do is to make a wetsuit last as long as possible. There are a few ways to take care of a suit so as make it last longer than one season. The first is to rinse the suit out after every session with cool, fresh water. This is the most important part of wetsuit care, as salt will corrode the suit and make it increasingly more inefficient at doing its job: insulating while allowing flexibility for movement (*Express Wetsuit Repair*, 2007). Hot

water is not good for a suit, but taking it in the shower can work if cool or tepid shower water is used, which can feel piping hot on skin after cold-water surfing. The other option is to fill a bucket with water and plunge the suit into it.

Although it may be tempting, drying a wetsuit in the sun degrades the rubber and breaks it down (*Express Wetsuit Repair*, 2007). After rinsing with fresh water, wetsuits should be dried in the shade. The best way for a suit to dry is turned inside out, laid flat, or hang by the middle (not on a hanger by the shoulders, as stretching will occur)(*Express Wetsuit Repair*, 2007). Wetsuits should never be folded up for storage, as creases and stretching decrease the quality of the neoprene and don't keep you as warm (*Express Wetsuit Repair*, 2007). They also make rips more likely, as wetsuits loose their stretch component with age. For this reason, surfers should try to stretch before getting into their wetsuit. Stretching will stress the neoprene more than it's normal range of flexibility (*Express Wetsuit Repair*, 2007).

When a wetsuit becomes old and outdated, surfers can try to recycle or reuse it. XCEL offers some alternatives: "make mouse pads, stubby coolers, donate [old wetsuits] to your local repair shop if it still has usable rubber so they can use your suit to repair others" (*XCEL*, in Hillary, 2010). Says Rip Curl: "We strongly encourage old suits be recycled and donated to surfing organizations or even family friends that are just starting to surf" (*Rip Curl*, in Hillary, 2010).

6.3 SUSTAINABLE APPAREL

Most brand initiatives into environmental causes are marginal at this point. While companies like Patagonia and Sole Technology set standards, there are clearly others that lag behind, waiting for profit-proof that the environmental labels are an avenue for good business. The major companies tend to do the least about their unsustainable production habits. As Dick-Read (2007) points out, "Although the big companies do have good track records when it comes to charity and support for environmental initiatives, their phenomenal growth came with a distinctly head-in-the-sand approach to the damage caused by bleached cotton, toxic dyes, petroleum-based fabrics and plastic packaging." Considering the use of overseas, cheap labor that returns multi-million dollar profits, big apparel companies like Quiksilver, Billabong, and Hurley are in a position to clean up their act. But for most major companies, that's not going to happen overnight. Vipe Desai of Project BLUE points out

"People have to realize that most major companies are big ships and can't change direction easily. We'll get there, but it's going to have to come incrementally and in steps sometimes smaller than many people would like them to be" (Desai, in Lewis, 2010).

Greenwashing is not an acceptable marketing strategy for any apparel business. For example, many of the bigger surf brands have released boardshorts made out of recycled PET plastic bottles (Billabong "Stand" and Rusty "Eco stretch"). Supposedly, each pair of trunks is made out of about ten plastic bottles that have been pulverized and reclaimed through a process of polymerization (Freeman, 2008). But the environmental benefits are vague; aside from recycling a few million water bottles, the remaining and overwhelming majority of their product line is produced conventionally, overseas, and (most importantly) unsustainably. Companies, like Billabong, also market recycled boardshorts as if they pulled those bottles out of the ocean or from a beach cleanup, when in actuality they have not. Ian Cohen, of the Clean Seas Coalition, explains that the surf industry gets into the green labels "because, like other industries, it's profit-driven" (Elliot, 2007).

If the bottom line is money, the surf industry is not going to take steps towards sustainability unless consumers support it. And the reality is, not all surfers are going to buy into the grassy eco image. But consumers will buy products that are ecologically conscious if they appear and function up to standards with other products. So business may not need a green marketing strategy. The options are quickly expanding in price and availability of alternative materials. Reef's Mike Gass offers: "Now that there is a proliferation of ecologically minded product offerings we have seen the supply side really expand. I think the relationships should get easier to create as the competition spurs the market" (Mike Gass in *The Greener Grass*, 2007).

In the case of marketing a brand or product as green, transparency is key. To claim a product is green, it's going to take more than labeling it 'eco' and spending a few extra dollars on organic or recycled materials. Businesses need to be up front with customers about their impact and what is being done to minimize it (see Patagonia's Footprint Chronicles or Sole Technology's environmental audit report for examples). Manufacturing needs to be localized and energy efficient, right down to the bulbs (or passive solar) that light the building. The information, technology, and methods for operating energy efficiently and responsibly dealing with waste are available. The most important perspective for a company going green is to view every aspect of its operations as an opportunity for improvement, and

take advantage of the growing public support.

Possible steps towards sustainability:

Short Term

- 1% For the Planet on all profits, not just an 'eco' line
- Offer an environmental grant program
- Start a community garden
- Start an organic lunch program for employees
- Start a compost program in the office
- Have a green-employee seminar
- Go for paperless, or use recycled paper only
- Have company bikes for getting around
- Skype a business meeting instead of traveling, if possible
- Use waterless urinals and double-flush toilets in buildings
- Have a regular tree planting event

Long Term

- Make every item have a smaller impact: switch all production to use local organic cotton, organic wool, hemp (if it doesn't have to be imported) or another low-impact material
- Sponsor or create an environmental education plan for youths
- Perform waste-management assessments and environmental audits yearly
- Invest in renewable energy
- Become LEED certified
- Have water catchment systems for the building
- Localize business production in areas with high sales
- Set a goal for carbon neutral

Surf shops that want to support sustainable clothing initiatives can consider adding an Action Sports Environmental Coalition approved "Green Room." That is, converting an area in the store to only advertise and sell 'green' products. This strategy has worked well for

shops in California like Hobie and Pacific Beach Surf Shop (Stanger, 2010). But for shops that take this step, it's important to insist that the products on display are actually taking steps towards sustainability. Organic cotton or recycled PET isn't sustainable unless it is sourced and made locally.

One sustainable fabric source is clothing that ends up in thrift stores or op shops. Second-hand clothing requires no resources or energy to create. It's already made and there's more than enough to go around. In the US alone, only about a fifth of the clothes donated to second-hand stores are resold, because the amount of clothing donated dwarfs the consumer demand (Claudio, 2007). The rest is recycled into padding for furniture, rags for industrial use, or exported to different countries for dispense (Claudio, 2007).

The advantages of second-hand clothing are:

- Just as good as new clothes
- Already "broken-in"
- Create a unique style
- Can have retro appeal
- Exponentially less expensive
- Already produced, no energy inputs or materials needed

The converse of buying second-hand clothing is to donate unwanted old clothes to Goodwill or the Salvation Army, which would partially close the loop for clothing.

6.4 REDUCING THE IMPACT OF TRAVEL

While airplanes may be extremely degrading to the environment, travel is invaluable. It provides access to great waves, new people, different cultures, and consequently provides unequalled educating experiences. There's no way around it, but there are ways to travel more efficiently and less harmfully.

First, surfers can travel less often by making one long trip instead of multiple short ones. Fewer plane rides means less CO2, VOCs, and toxic chemicals. This will reduce the environmental impact, allow the traveler to get the same amount or more surfing in, and get comfortable with the surroundings. Travelers will also have the opportunity to learn more

about the culture and ecology because they wont be cramming as much surfing in as possible; it makes for a much more relaxing trip. They can learn where the local markets are instead of buying food from conglomerate super-markets. Locally markets will usually have fresher food, support the local economy, and typically be better for the environment.

Second, surfers can stay close to home when traveling. Though the far away destinations are tempting, there are great waves everywhere, and many of them are right around the corner. Taking a train, for example, is much less demanding on the environment, and they work when traveling domestically. Trains have a significantly lighter footprint than airplanes when people actually use them (Vincent, 2007). They also offer more flexibility: on most trains you can stand up, move around, and even sleep in a bed.

In the case of car pollution and gas miles, the best thing to do is drive less. Every litre of petrol a person can avoid using saves roughly 2.3 kg in greenhouse gases (McKay & Bonnin, 2006, p.102-3). Walk to nearby locations, bike to places slightly further, and enjoy the extra time well spent. Surfers can ride a skateboard—it will help their surfing ability.

If it's an unreasonable distance to walk, bike, or ride a skateboard, surfers should drive as fuel efficiently as possible. Accelerating slowly, driving the speed limit, and avoiding sudden breaking are all ways to do this (McKay & Bonnin, 2006, 108). Driving faster takes more fuel to get to a destination. Putting surfboards inside the car (instead of on top) reduces drag and increases the fuel efficiency of a vehicle. Driving alone is hugely wasteful, so bringing friends to go surfing spreads the petrol more evenly. Above all, the best thing to do is ride on public transportation. In considering buying a car, surfers should get a used one in good condition with the highest fuel efficiency available. New cars mean more resources, more industrial emissions, and more money spent.

7. CONCLUSION

The simple act of riding waves is very environmentally friendly. Surfers have a respect for nature and awe for environmental beauty when it comes to perfect point break line-ups, sheet glass beach break barrels, or exotic coral reefs. But they are two-faced about their dedication to protecting them. In order to ride waves, they contribute tons of CO2 into the air, depend heavily on oil, and take part in the same consumerism as most typical Westerners. Businesses are even worse: the manufacture of wetsuits, surfboards, and apparel all play a role in the sport's destructive nature. It's a very shallow appreciation for the ocean, and if surfers really care about reducing their impact on the environment—which they depend on- they will all have to make an effort to use less resources and create more alternatives.

Surfers are involved with direct action environmental causes: the Surfrider Foundation, Surfers Environmental Alliance, Surfers Without Borders. And surf companies, as research shows, tend to donate substantial amounts of money to protect nature reserves and surf breaks. Going green is gaining popularity in surf industry as well: recycled materials and green labels are much more salient today then they were five years ago.

However, these initiatives are fairly thin at present; much of them are market oriented instead of effective solutions. The industry that builds surfing equipment, the media that sells it, and the surfers that buy it still all face a dilemma. The sport is largely dependent on petroleum, cheap labor, and toxic materials. Surfing is no purist pursuit, and now it's time to face the challenge to make it one for the sake of surfing, if not for the bigger environmental picture. Otherwise surfers play a hand in destroying the quality of the ocean.

7.1 RECOMMENDATIONS

Making surfing more sustainable is a realistic goal. There is enough interest, support, and knowledge within the surf industry to make serious changes in the next ten years, enough to significantly reduce the sport's impact. Volcom's Jeff Baillargeon (in Lewis, 2010) agrees: "When you think of all the "firsts" that have gone down in history, this one [making truly sustainable products] seems somewhat manageable". The question is whether changes can be made as quickly as possible, because the reality is that environmental consequences are decades away. To make this change, it would take a majority volunteer effort on the part of

some big companies in the competitive market, as well as effective promotion from media and support from professionals in all brackets of surfing style. Most of the power in that sense lies with the industry; companies have team riders, media attention, and control over the production of equipment under the corporate umbrella. Brands like Patagonia and Sole Technology have set the bar, now Quiksilver, Billabong, Hurley—all the giants need to participate to catch up and set it higher. The big businesses create the most products, reach the most destinations and therefore do the most damage. They also have the most money to invest in research, product development, and redesign their facilities. Even if sustainability doesn't boost sales, what it comes down to, says Baillargeon, is "stewardship" (in Lewis, 2010). Companies are expected to be responsible and conscious of their business practices.

To become sustainable, the first important step is that surf businesses need to manufacture locally. Gas miles play a major hand in the ecological footprint of the industry. Apparel companies need to stop supporting cheap labor overseas and move factories into areas close to demand (i.e. major surfing areas). Surf shops with all local and used boards, locally grown organic cotton shirts, and locally manufactured wetsuits should be the norm. The least a surf company can possibly do is shipping efficiently. That means using trains and boats instead of airplanes, with recycled packaging materials.

The second major change involves materials. Surfboard and wetsuit manufacturers should keep searching for alternatives to being petrol dependent—both technology and basic natural fibers are considerable paths to explore. The use of bamboo on surfboards, for example, may make a strong board more energy efficiently than carbon reinforced plastic does. But the technology of recycling surfboards is invaluable because it eliminates toxic surfboard waste. Green Foam's recipe should be available on every coast. Marketing alternative products to consumers will not be difficult with the help of professional surfers, media, and the availability of demonstrations. If the pros can rip the equipment, the media sells the advantages, and consumers can try out alternatives, I believe that businesses will see a more responsive reaction to green initiatives.

The third important step to becoming sustainable is increasing efficiency in production. For any surf businesses, buildings need to be more efficient in use of light, water, air conditioning, and waste management. Joey Santley explains: "I gaurentee you every single manufacturer in the surf industry could be saving money and energy in some way" (Santley, in *Surfing*, 2009, p.70). LEED certification, renewable energy, and passive solar

lighting are possible avenues for greening. In general, efficiency needs to be a requirement in quality surfing businesses. Senizergues (in Lewis, 2010, p.16) of Sole Technology admitted to "six-figure savings" in becoming more energy efficient and effective. To aid this change, Transworld Business, Shop-Eat-Surf, SIMA and other industry media reporters could feature a green business section, in which companies that are pushing the sustainable envelope are interviewed. If the media covers these brands, they set an example and draw attention to make a universal shift more attractive.

A fourth major step involved in making surfing greener is travel. Of all the lifestyle habits surfers own up to that are destructive, travel is probably the worst, albeit the least frequent for average surfers. Surf trips, taken as often as possible by surfers, are extremely environmentally draining. A look at a modern professional surfer's itinerary is an environmental nightmare. Between contests, photo trips, and promotional events, pro surfers travel more than a fair amount. The only suggestion I have for this issue is to fly less. Carbon offsets will not balance the footprint of the ASP world tour. Surfers need to take as close to zero flights as possible. Surf travel, by train, bicycle, or bus are the alternatives. All of them have recently been featured in surfing media, which is exciting. Even better, surfers can rediscover their local spots. Companies and magazines should do more features about local lineups, focusing on community and not territory.

The last large change is the abandonment of a selectively "green" image in the surfing culture. Green marketing can be useful for educating surfers and supporting environmental initiatives. But, ultimately, sustainability should be a lifestyle inclusive of all surfers, not just those that buy into the outdoorsy looking tee shirts. The surf industry and surfing media need to move unanimously towards carbon zero, non-toxic, and sustainable production regardless of the marketing scheme. Businesses need only be transparent, they do not need to lose brand diversity to become better as a whole. If the surf industry doesn't get cleaner and greener, surfers who support it have no voice about offshore oil drilling, no say about the use of pesticides on cotton, and no compassion to speak out about cheap labor in third world countries.

7.2 AREAS FOR FUTURE RESEARCH

One of the biggest weaknesses of this study was the lack of personal communication with more of the surfing community and industry. However, my study provides the basis for that communication. Future studies would involve interviews with shapers, industry players, and professional surfers. There is plenty of research worth being done towards sustainable rubber development, environmental alternatives to conventional plastics involved in surfboards, and sustainable fibers. Additionally, company interviews would help to create a more specific picture of what goals and obstacles to sustainability are.

Sustainable shipping, energy, and no-waste strategies—these are all worth studying in real world situations, in shaping rooms or wetsuit/clothing factories. Standards need to be set as to what green manufacture is and isn't, and that can only happen given looking at specific situations, and not in the abstract. If I could continue this study, I would aim to end up in these places, interviewing people who have a hand in the making of surf products.

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Appendix:

Informed Consent:
This interview forms part of an Independent Study Project for the SIT Study Abroad program: "Australia: Sustainability and Environmental Action". The purpose of this study is to determine the environmental impact of surfboard construction and the materials involved. It is also to determine which materials are the best choice for surfboards based on durability, weight, and expense. The end result will be a body of research that supplements a guide for surfers to make sustainable purchases, and create a smaller ecological footprint.
For this portion, I am attempting to obtain professional insight as to the environmental impact, longevity, and efficiency of the composite material carbon fiber.
Participation in this study is voluntary. It will involve an interview of approximately 30 minutes in length to take place. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher.
You have the right to decide whether you wish to be identified as the source of information you provide or to remain anonymous. If you prefer to remain anonymous, your name will not appear in the report resulting from this study. With your permission, the interview may be quoted directly. All information you provide is considered completely confidential. Your name will not appear in any thesis or report resulting from this study unless you give permission to do so. If you wish to remain anonymous, data collected during this study will be kept confidential. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.
If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me by email at powernc@guilford.edu. You can also contact my Academic Director, Peter Brennan by email at peter.brennan@sit.edu.
I would like to remain anonymous OR I allow the use of my name
Signature:Gerry Flanagan Date: April 10, 2010

Thanks again for your help,
Nick Power
SIT Student

For specific examples of the composites I am looking at, feel free to visit these websites:
Aviso Surfboards: http://www.avisosurf.com/TechAdvantage.html
Hydro Epic Surfboards: http://www.hydroepic.com/technology.php
Name: (if you want to remain anonymous, just leave this blank)
What is your experience working with carbon fiber (CF)? (How long and in what job or research position?)

I have been in the field of composite materials for 33 years, starting with undergraduate research at MIT, followed by work at the Air Force Materials Laboratory. I was a lead research engineer at Grumman Aerospace, and then became Technical Director and Vice President of Materials Sciences Corporation, a leading research company in the field composite structural design and analysis.

How is CF made? In the simplest possible terms, what are the key ingredients and under what conditions are they combined to yield the final product?

To start, I think your questions are a little wrong. You need to distinguish carbon fibers from completed composite components. Carbon fibers are very difficult to manufacture, and are only available from a small number of companies in the world. However, once you buy the fibers, the remaining steps to produce a composite part are amenable to small scale fabrication. The final product is likely to contain about 40% fiber (by volume), and 60% a binder, sometimes called the matrix, or simply "resin". I'll try to break this down some. The fibers start from a couple of possible feed-stocks. The best (strongest) fibers are start with polyacrylonitrile (PAN). This is a liquid polymer. The liquid is forced through a tiny hole to make a filament, and a reaction starts to solidify the polymer. The filament is stretched many times it's original length to reduce the diameter. One secret to the strength of carbon fibers is to reduce the diameter to the order of 5 micrometers. The fiber is then heated to 2000-3000C while under tension to convert the polymer to an arrangement of graphene crystals. All of these steps require a lot of precision and process control. The production lines that create the fibers represent huge investments and proprietary knowledge. I've described a single fiber, but a usable bundle of fibers (called a tow, or yarn) contains 20-50 thousand fibers that are processed together.

The next step is to convert the fibers into a reinforcement form that can be handled. There are two major possibilities. One is called prepreg, in which the fibers are embedded into an uncured polymer sheet. This is used by aerospace products, but probably isn't of interest for surfboards. The other method is to weave the yarns using some textile process. You then get a fabric that you can pick up without getting a giant ball of lose fiber. A small company could chose to get into the weaving process, but again, most product manufacturers simply buy the woven fibers.

Now comes the interesting step. The fabric has to be solidified to be turned into a surfboard. Basically, the fabric is somehow placed where it needs to go, and a polymer resin is added (usually under pressure) that hardens to make a part. Adding the resin is where there is much innovation and variety. For lost-cost parts, vacuum assisted resin transfer molding (VARTM) is popular. A plastic vacuum bag is wrapped around the part. The bag is connected to a bucket of resin. A vacuum is drawn on the bag, which sucks in the resin. The vacuum keeps the part under pressure while the resin hardens through a catalytic reaction. Remove the bag, and you have a nearly finished part.

How much time and energy does this process take? (does not have to be quantitative)

Making fibers is energy intensive, although I could not quantify (I'm a designer, not a materials person). The energy input is partially reflected in the high cost of the fibers. The resins used to solidify the part usually start from petrochemical stocks. Again, I couldn't quantify. The final step of making a part, and performing the VARTM process is relatively low energy and cost.

Where is CF usually used? On what consumer products?

Many aerospace products, including major wing structures and fuselage of the Boeing 787. I worked on ship structures, including the entire deckhouse of a Navy ship. The masts of high-end sail boats are frequently CRP (carbon reinforced plastic. I'll start using that instead of CF, since it implies the final product, not just the fiber reinforcement). Slowly being introduced into cars parts. The hulls of racing sail boats and Formula One cars are carbon. For consumers, there are sports products; baseball/softball bats, tennis rackets, and now skis.

What are the benefits of using CF?

We talk about the strength-to-weight ratio, and stiffness-to-weight ratio. Both can be several times better than the best metals. If only strength is needed, glass fibers may be a cheaper choice. However, if stiffness is also needed, the carbon fibers are much better than class.

Are there downsides? Does CF have any major weaknesses?

Biggest downside is raw material cost. Design is also harder. The material is strong in the direction of the fiber. That means you have to figure out where to place the fibers.

Does CF fracture under any certain circumstances?

All materials can be overloaded to failure. If you have layers of cloth, the part may be prone to delamination. Think of wood that can split along the grain. There has to be special consideration of joints and fasteners.

How does CF break down (or how long does it typically last)?

One of strong motivations to use CRP is long life. It will not corrode, which is great for anything marine. Also, the fatigue life (failure due to cyclic loading) is much better than for metalic structure.

Does CF biodegrade? Can it be recycled?

Unfortunately, no. The parts would have to cut up or ground, which breaks the fibers and renders the material unusable for any application I can think of, except some sort of filler. The same characteristics that give the material long live make it not degradable.
Are there any known environmental issues/health risks associated with the production or use of CF? (includes those who make it, come in contact with it, or dispose of it)

The hazards are related to working with the chemically reactive resins, but these involve fairly standard industrial processes to protect workers. The fibers appear to be biologically benign. They seem to be the wrong size to cause lung damage in small doses (remember that I'm not a primary source on biological matters). There are some problems handling the raw fibers associated with the fibers getting into machinery and computers and shorting out the electronics.

Biggest issue is related to volatile chemicals released during the resin infusion step. Many of

the high-strength polymers used release styrene. Some of the old processes (particularly in the boat building industry) could release large quantities of styrene into the atmosphere. A big advantage of the VARTM process I mentioned above is that the volatiles are controlled and can be condensed out before release into the atmosphere. These days, composite part have to meet pretty strict standards on volatile release.
The final products are not chemically reactive, and are therefore I believe pretty benign in the environment.

Is CF sensitive to sunlight, salt, water, or sand?

Any polymer material (in this case the resin binder) will break down under ultraviolet light. This simply requires some coating or paint to protect the part from sunlight. The resins are strongly resistant to any chemical attack, including salt. The materials typically have a reduced strength after long exposure to moisture, but this is a stable value and can be handled by using reduced strength values in the original design.

Aloha,
My name is Nick Power. I'm a student currently enrolled in the program SIT: Sustainability and Environmental Action, located in Byron Bay, NSW, Australia. I'm currently compiling a guide called "A Surfer's Guide to Sustainability", which will focus on products and lifestyle decisions that have a lower impact. I'd like to feature the Eco-suit and talk about it's environmental advantages, but I'm having trouble finding information about it on the web. I was wondering if I could talk to someone in your organization who could answer some questions. I'd just like to know a little about how it's made, and what it's made of (in more detail than is available on your website). Any help would be greatly appreciated. I have included the questions below to save time and avoid playing e-mail tag.

1. On the Body Glove website it explains that the Eco suit is made from 100% petroleum free rubber, completely non-toxic rubber. The technology, I have gathered, is called eco-flex and bio-stretch. Could you explain what these materials are made of, if not from petrol? What are the raw ingredients?

2. I have read that these suits use as little as 10% of the energy that typical neoprene suits use. Could you explain how this suit takes significantly less energy?

3. Please comment on the Eco suit's durability. How long can the average (surfs a few times a week) customer expect a new one to last? Can it be recycled or is it biodegradable?

4. Where are these suits made (i.e. where is the Body Glove manufacturing facility)?

For the record, I plan to appreciate the Eco suit as a concept and viable option for the environmentally aware surfer in the guide. Thanks again!
Nick

Hello Nick,

Thank you for your inquiry!

Here are the Eco 2 Wetsuit Material Specs:
The premise behind the Body Glove Eco 2 was to make a wetsuit using as few petroleum products as possible for the everyday surfer. We strived very hard to make the Eco affordable.

A normal wetsuit is made from materials derived from 100% petroleum and is environmentally friendly.

The Eco was one of the first ever wetsuits made from non petroleum materials and maintains maximum elasticity without sacrificing the natural resources of our Earth.

The interior foam rubber on the Eco 2 is made from limestone.

The exterior and interior laminates are made from corn.
The inks are water based.

The Eco has been very helpful for people with neoprene allergies and is made of the purest form of non-toxic stretch on the planet.

Eco 2 is manufactured by Sheico (in Thailand) and is far more flexible than the original Eco wetsuit.

The average wetsuit should last between 1-2 years – normal wear and tear.

The Eco suit is not biodegradable – but can be recycled.

Thank you for contacting us. We appreciate your support and business.

Best regards,

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