

WHAT MAKES FUR, FUR?



MATERIAL
INNOVATION
INITIATIVE

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Image Credit: Stella McCartney / Johnny Dufort
Stella McCartney 2019



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Image Credit: Inez & Vinoodh / Vogue France
Supermodel Gisele Bündchen graced the cover of Vogue France in 2017 wearing synthetic fur.





Image Credit: Gucci / Anthony Seklaoui
A synthetic fur coat from Gucci, 2023.

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Image Credit: Getty Images

Editor-in-Chief of Vogue, Anna Wintour, wears an Autumn 2020 Stella McCartney coat made from Ecopel's KOBA® faux fur.

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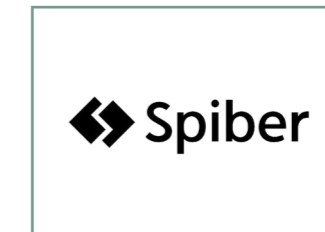
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INTRODUCTION

Fur is one of the earliest animal-based clothing materials used by humans, with evidence dating back over 40,000 years.¹ From apparel, to accessories, toys, homegoods, and more, fur has been a mainstay of the fashion industry ever since.

But with this rich history comes a price. Millions of animals are raised in poor conditions and slaughtered in the global fur trade every year to supply the world's fur demand. The environmental impact of animal fur is staggering: to make just 1 kg of mink fur, over 560 kg of animal feed is required, and over 110 kg of CO2 eq is emitted during manufacturing.²

With increasing awareness of animal welfare concerns, the public perception of animal fur has trended negative in recent years, and more and more fashion houses, publications, and jurisdictions are banning fur. But with the fur aesthetic remaining in vogue, there has been growing demand for an animal-free option.

Current-gen synthetic fur may be animal-free, and may have lower impacts in some categories compared to animal fur, but is still reliant on fossil fuel extraction and releases pervasive and polluting microfibers during its manufacture, use, and end-of-life. Fur is still a luxurious material prized for its lush textures, warmth, and visual appeal. Clearly there is a lucrative market for an animal-free, environmentally preferable, and high performing alternative, and the emergence of next-gen fur is here to fit the bill.

Note on shearing: For purposes of this report, we have included images of shearing, the hair of sheep still attached to the skin. The technology used to recreate fur can also be used to recreate shearing and, as the purpose of the report is to inspire the development of technology to replace fur, we thought it was useful to show shearing applications. We have not addressed the animal cruelty or environmental impact of shearing as it is normally treated as wool and we will address it in a future report on wool.



Image Credit: Saint Laurent
A synthetic fur coat from Saint Laurent's Winter 2022 collection.

WHAT IS FUR?

Over 99.99% of the fur currently sold on the market either comes from an animal or petrochemicals (synthetic or “faux” fur). In order to move beyond these lackluster inputs to create high-performing, environmentally preferable next-gen fur which mimics the incumbents, we need to understand more about the science behind animal fur and synthetic fur. What is its composition and structure, how is it manufactured, and what are some practical approaches that next-gen fur innovators can take to design their product? Let’s dive in below.

Animal Fur

Fur is one of the oldest animal materials used by mankind with the earliest fur clothing likely coming from fox, wildcat, and jackal pelts, providing early humans with protection and warmth in cold climates.^{1,2} Today, fur is a large international market with over 80% of imports coming from China.³ The most common animals used for fur are mink, foxes, rabbits, and raccoon dogs.⁴ Fur is a unique material in the next-gen space - containing both the skin (leather) and hair (fibers) in one continuous sheet-based material.

At its core, fur consists of dense animal body hairs (also termed ‘pelage’) affixed to its skin. The raw material for animal fur are termed pelts, whose sizes and shapes are dependent upon the specific animal from which they were skinned. The hair itself is primarily composed of a protein called keratin - the same protein class that makes up human hair, wool, hooves, fingernails, bird feathers, and other semi-rigid biological structures.⁵

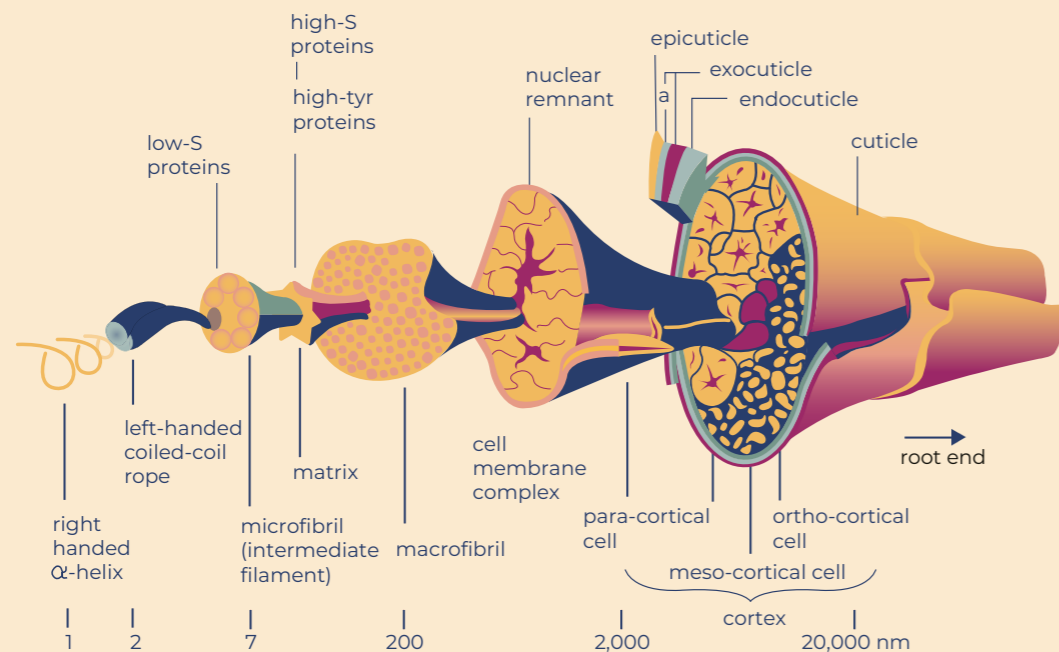


Fig. 1. The hierarchical structure of hair: beginning at the smallest protein building blocks to the cellular and cuticle layers which comprise the hair shaft.⁶



Image Credit: Richard Avedon
Model Dovima wearing a leopard fur coat from Bernham-Stein for Harper's Bazaar, 1950.



Image Credit: Andrew Skowron / We Animals Media

The keratin in hair has a unique sulfur-rich protein structure consisting of twisted helices which assemble into fibrils within the hair.⁷ The hierarchical structure of hair imparts much of its unique properties, in a similar fashion to silk. Across different animal species, different hair textures and properties are possible due to variations in the hair composition and structure, where the arrangement of scales and hollow structures are a core differentiating factor (see Fig. 2).

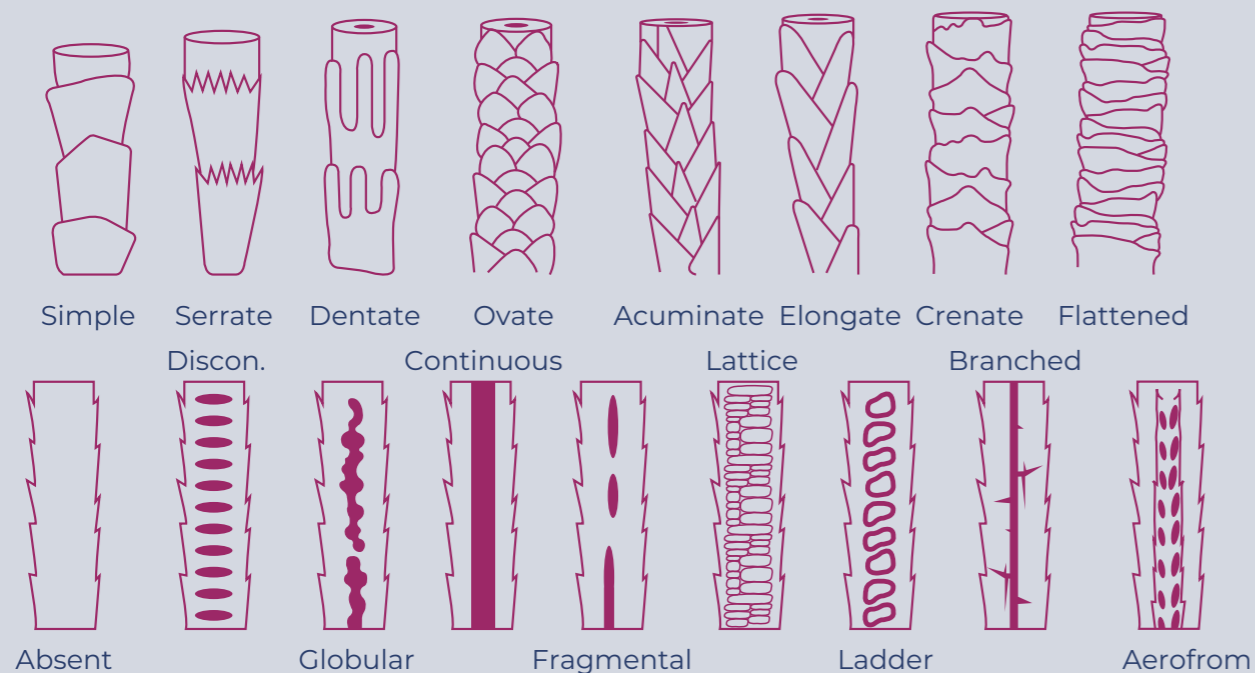


Fig. 2. Variation of scales and hollow structures observed in mammalian hairs.⁸

Overall, hair can be classified into seven different types of growth patterns: angora hairs are based on long shaft development (e.g. horse manes), definitive hairs maintain a fixed length before shedding and replacing (e.g. dog hair), vibrissae hairs are used as sensors (e.g. whiskers), spines (such as those found in porcupines), wool, velli (also known as down fur), and dense, short haired coats called pelage.⁹ Since fur production almost exclusively involves pelage, this report will focus on the properties of pelage hairs and their treatment. Pelage hair is implied whenever the term “hair” is used.



Fig. 3. Different animal hairs under an optical microscope.¹⁰



Image Credit: Alo Yoga
A synthetic fur coat from Alo Yoga.

Fur hairs are comprised of two layers: a soft, fine, and dense “underfur” covered by longer and coarser “guard hairs”. The underfur is largely responsible for heat retention and insulation, while the guard hairs protect the underfur from environmental factors such as moisture and sunlight.

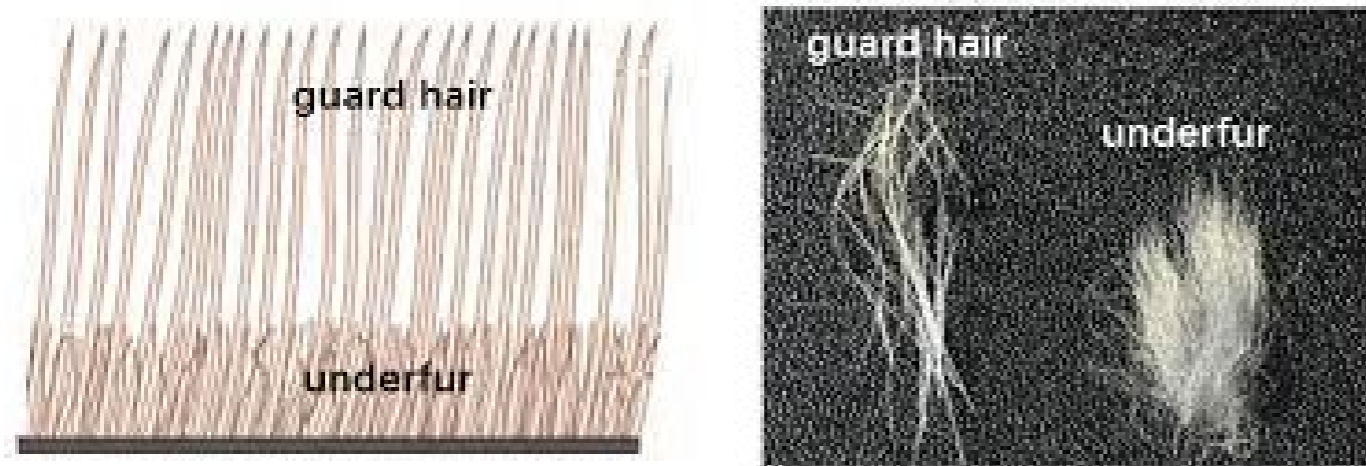


Fig. 4. Guard hairs and underfur combine to give fur its unique appearance and properties.¹¹

Fur hairs can vary between species, and may even offer benefits depending on their design. For instance, sea otter guard hairs have incredibly fine scales, allowing their hairs to interlock and form waterproof seals (Fig. 5).

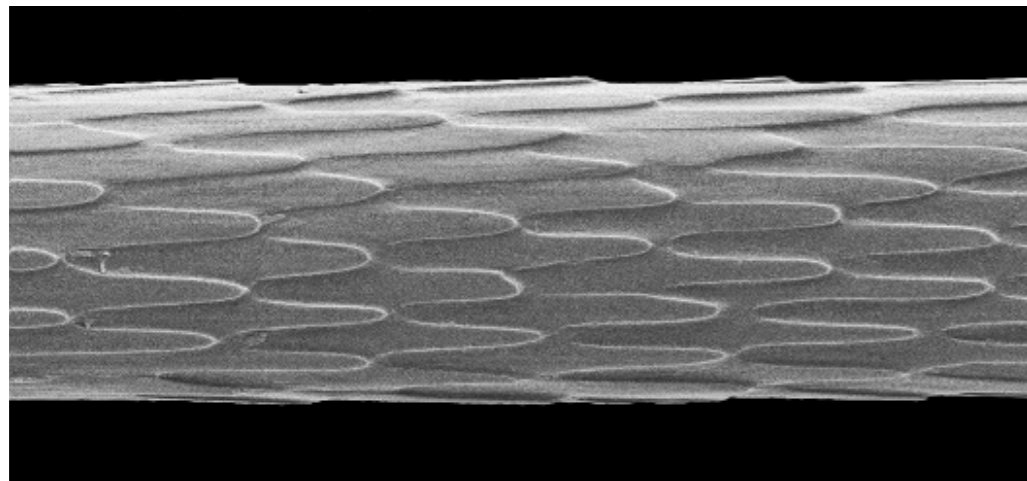


Fig. 5. Scanning electron microscope image of sea otter guard hair.¹²

The qualities and properties of animal furs are diverse. The composition and structure of fur can vary significantly between different animals based on their evolutionary adaptations and habitat requirements. Even within a single species, there can be different types of fur with specific adaptive functions. Although variations in fur make its properties difficult to analyze, its diversity also provides many opportunities for potential innovation and development of next-gen materials and clothing.

Fur clothing requires that the hair remains attached to the animal’s hide. Hair length and width are therefore important for reasons ranging from consumer comfort to the fur’s performance. In most cases, longer hairs grant greater insulation compared to shorter hairs. This is because insulation relies primarily on trapping air between hairs and underneath the pelage. Longer hairs can extend over a larger area, trapping more air, and improving heat retention and the wearer’s comfort. Most furry animals carry hair lengths greater than 40 mm, with the exception of mustelids (minks), otters, and seals; minks are generally bred for their short hair length and dense pelage, while otters and seals take advantage of their hair’s diameter and circularity.^{13,14}

Once the fur is extracted from the animal, it is preserved and finished in a similar way to animal leather - via tanning processes. While leather tanning takes many steps to remove the hair from the skin, fur tanning instead focuses on preserving and enhancing the appearance and structure of both the skin and the hair. Animal furs are often dyed during or after tanning to improve their appearance and apparent quality. Natural fur hair colors do not necessarily develop evenly, and consequently, manufacturers use dyes to supplement the natural appearance of furs.



Image Credit: Balvik C. / We Animals Media

Current-Gen Synthetic Fur

In the modern era, current-gen synthetic fur, or “faux fur”, made from synthetic plastics is a form of pile fabric, where tufts or loops of fibers protrude vertically from a fabric base layer. Here, long fiber “hairs” are interlaced in a fabric backer via techniques like specialized knitting or tufting to produce a fuzzy sheet of material.¹⁵ Post-processing via thermal, mechanical, or chemical treatments allows synthetic fur to take on specific textures and attributes. Synthetic fur is just one type of pile fabric - carpets, terry cloth towels, velvets, and other fabrics are also produced via similar methods.

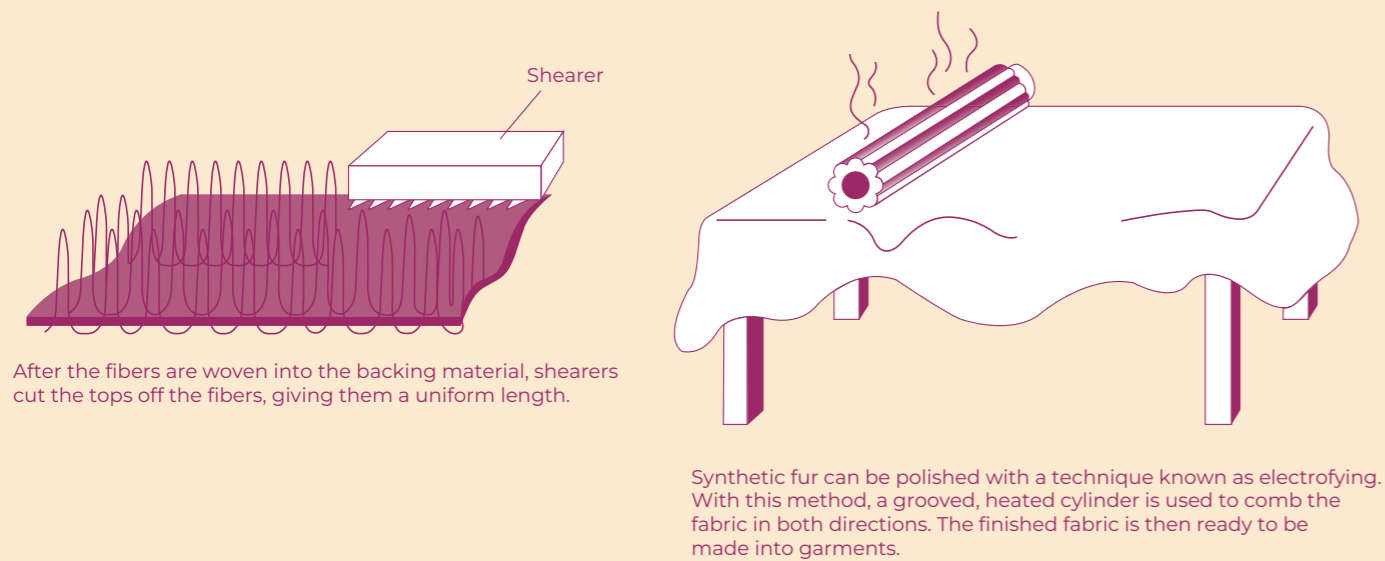


Fig. 6. An example of a common technique to manufacture current-gen synthetic fur.¹⁶

When innovators are considering a venture into next-gen fur, it is generally more practical to design their material as an improvement to the performance and sustainability of current-gen synthetic fur, rather than directly mimicking animal fur. This is because the leather component of animal fur is less necessary in the majority of applications (and can even weigh down or decrease the breathability of the fabric), and it is instead the “hair” component that supplies most of the desired esthetics and performance for fur articles. It is also because it is more practical to create a pile fabric from sustainable fibers using standardized, scaled pile fabric machinery (as described above), than it is to cultivate animal skin in the laboratory, with dense functional follicles that can create hair. Fur pelts can have hair densities as high as 24,000 hairs per cm².¹⁷ That means an average sized mink coat contains over 600 million individual hairs!¹⁸ That’s a lot of hair follicles to engineer and grow for only one product.

“When innovators are considering a venture into next-gen fur, it is generally more practical to design their material as an improvement to the performance and sustainability of current-gen synthetic fur, rather than directly mimicking animal fur.”



Dr. Sydney Gladman, MII Advisor



Image Credit: Emma Brewin
Shown here is a dyed synthetic fox fur hat.

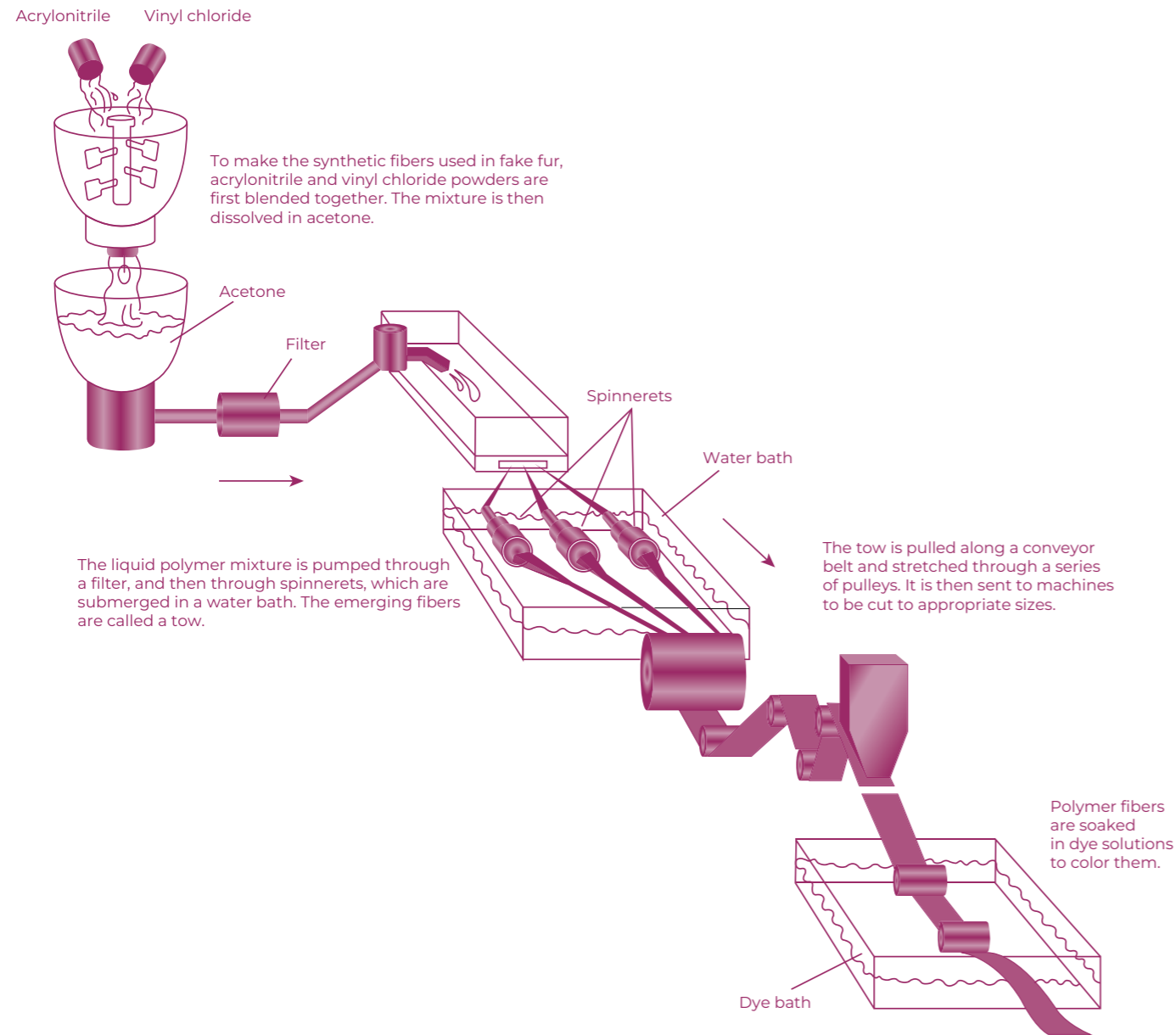


Fig. 7. A common manufacturing process for creating synthetic fur fibers.¹⁹



Image Credit: Sydney Blackburn / Flickr
A synthetic fur blanket.

Existing synthetic fur fibers are typically made of fossil-fuel derived polymers like polyester, acrylic, and modacrylic, which are melt-spun into continuous filaments producing uniform strands of hair. Although synthetic fur fibers can appear similar to animal-based fur hairs, their texture can be improved by varying the lengths and widths of fibers used. Combining coarser and wider fibers with finer strands can produce a more complex and varied texture that better mimics animal-based fur. The finer “underfur” strands could be stitched in greater density, lending a more realistic and softer design as well.

During the extrusion process, cuticle patterns could also be created along the fiber exteriors. Depending on the product, fibers can be made more or less likely to interlock with each other by either extruding smooth or rough fibers. In products where exposure to moisture may occur (such as clothing or fur-lined products), allowing hairs to interlock with each other may be advantageous in preventing water absorption and saturation (mimicking the waterproofing properties of sea otters). In cases where looser fibers are preferable (such as blankets), smoother fibers could create a softer and more delicate feel. Varying the exterior design and texture of synthetic fur fibers can allow designers and manufacturers to tailor the material to best suit their products. Post-processing of synthetic fur fabrics can also alter the luster, texture, and handfeel of the pile fabric. Synthetic fur is dyed to either match incumbent animal fur patterns, or dyed to unique colors and lusters not native to animals. Additives and treatments also offer performance enhancements such as increased softness or reduced flammability.

WHY NEXT-GEN FUR?

When we think of sustainability at MII, we think of creating a system in which humans live in symbiotic relationship with nature. We also imagine a world in which all of the planet's inhabitants can live their lives engaging in their natural behaviors in their natural habitat. Our current system is broken, with our manufacturing taking too many natural resources, emitting numerous hazardous chemicals into the environment, and confining trillions of animals away from their natural habitats, social interactions, and innate behaviors. The solution is on the horizon: next-gen materials.

Animal Cruelty

One of the most important reasons to move away from animal-based and synthetic fur is the materials' impact on animals. Around 100 million animals are bred and killed on factory farms each year globally with around 5 million additional animals caught and trapped in the wild.^{1,2} In addition, synthetic fur releases microplastics into the environment, causing pain, suffering, and death to trillions of wild animals.³



"PETA entities' investigations into the fur trade have revealed that chinchillas scream in pain while they're electrocuted, terrified minks cry out and struggle as workers cram them into metal drums that are then pumped full of gas, and rabbits are bludgeoned and decapitated while they're still alive, among other horrors.



The fur industry is the antithesis of creativity, innovation, and ethics, and if companies want to appeal to increasingly socially conscious consumers, they need to commit to using luxurious vegan materials, which don't involve the violent deaths of animals."

Tracy Reiman, Executive Vice President of PETA



Fur production harms animals, people, and the planet. For companies it is high time to ditch animal fur with so many innovative new materials available today and ethical consumers demanding sustainable alternatives."



Thomas Pietsch, Head of Wild Animals in Textiles and Entertainment, FOUR PAWS International



Image Credit: Jo-Anne McArthur / We Animals Media
A fox in a fur farm, who has chewed off her tail and a leg. Quebec, Canada, 2014.

Animals Farmed for Fur⁴

95% of fur comes from factory farms where animals are not able to engage in their natural behaviors and are so distressed that they often self-mutilate.⁵ The most common animals raised for fur are mink, foxes, chinchillas, raccoon dogs, and rabbits. Europe and China are the largest producers.⁶

Welfare Issues

Animals raised for fur are confined to wire cages and are denied their most basic, natural instincts and as a result, animals in farms express stereotypic signs of intense psychological distress: pacing endless circles in their cages, abnormal repetitive head nodding, self-mutilation, and even cannibalism.⁷ [The Five Freedoms \(see page 22\)](#) is a common way to analyze the treatment of animals in farms. According to animal-behaviorists, fur farming violates all of animals' Five Freedoms.⁸ Is our fashion really worth this pain and suffering?

The excitement of next-gen materials is that the industry can create a new future based on our values. When we imagine the future, we think it is worth moving beyond the Five Freedoms to ensure we are not taking away animals' abilities to live a life worth living.

In their natural habitat, animals raised for fur would engage in significantly different behaviors. The vast majority of animals raised for fur are mink and fox, both carnivores, that animal-behaviorists have concluded cannot be humanely farmed.⁹ For example, mink are a semi-aquatic species, love to swim, spend a lot of their time in water, diving as deep as 5-6 meters and swimming underwater for up to 30-35 meters.¹⁰ In farms, they do not have the ability to swim. In the wild, mink's territory ranges from 1.1 to 7.5 km whereas their cages in farms are around 1 square meter.¹¹ In the wild, mink often have half a dozen dens, sometimes two dozen.¹² Mink are also solitary creatures whereas in farms, they are forced to live in groups.¹³

Foxes are also carnivores, spending most of their days foraging and moving.¹⁴ In fur farms, foxes are limited to 10 million times less space than in the wild.¹⁵ Foxes' natural habitat is between 0.2km to 15 km whereas in farms, they are limited to a 1 square meter cage.¹⁶ Foxes also have 1-2 preferred larger dens plus a number of smaller dens.¹⁷

Is our fashion worth this pain and suffering?



Image Credit: Jo-Anne McArthur / We Animals Media
A heap of dead or dying rabbits fills a rabbit farm dumpster. Spain, 2013.



Image Credit: Jo-Anne McArthur / We Animals Media
Rabbits next in line for slaughter. Spain, 2010.

The Five Freedoms

The 'Five Freedoms' are a widely used international framework for animal welfare assessment.¹⁸ Farming systems for animals raised for fur fail to satisfy any of the Five Freedoms:¹⁹



Freedom from hunger and thirst: Restrictive feeding of overweight animals in preparation for breeding results in hunger and increased stereotypic behavior.



Freedom from discomfort: Animals farmed for fur in cages have very little control over their physical and social environment. For example, foxes are mostly kept without access to a nest box. Handling procedures cause significant stress and discomfort.



Freedom from pain, injury and disease: Common problems include fur-chewing, injuries (both self-inflicted and from other animals), high levels of infant mortality, deformities (bent feet), difficulty in moving, diarrhea, and inhumane killing methods.



Freedom to express normal behavior: The small and largely barren cages used to house animals on fur farms do not allow the animals to swim, climb, run, dig, hunt/forage or range/disperse. Maternal deprivation and social stress can result from abrupt early weaning, isolation in individual housing, aggression in group housing and the close proximity of socially dominant animals.



Freedom from fear and distress: Fear is a major welfare problem for animals farmed for fur because the majority of the animals used on fur farms are not domesticated and thus highly stressed when around humans.



Image Credit: Jo-Anne McArthur / We Animals Media.

Mink frequently wound and cannibalize one another in the cramped conditions of fur farms. Sweden, 2010.



Image Credit: Jo-Anne McArthur / We Animals Media

Mink in filthy cages at a fur farm in Quebec. Quebec, Canada, 2014.

Slaughter

Animals on fur farms are killed so that blood does not ruin their pelts. Rather than traditional slaughter methods used in animal agriculture, such as bolt-stunning and throat-slitting, animals on fur farms are killed through gassing and head-to-tail electrocution.

Larger animals like foxes and raccoon dogs are generally electrocuted by inserting an electric rod up their anus, causing severe pain and distress to the animal. Animals are not sedated before the electrocution. Experts in animal health and welfare argue that this methodology is inhumane and animals need to be killed through intravenous drugs, a practice incompatible with the current financial model of the industry.²⁰

Mink are generally gassed to death. As mink are semi-aquatic animals and are highly evolved physiologically to hold their breath, they are prone to hypoxia (oxygen deficiency), leading to significant suffering during gassing.²¹ The pain and suffering mink experience during gassing has led the Scientific Advisory Committee on Animal Welfare in Ireland to conclude that “[t]he use of carbon dioxide for killing mink is not acceptable and should not be permitted.”²²

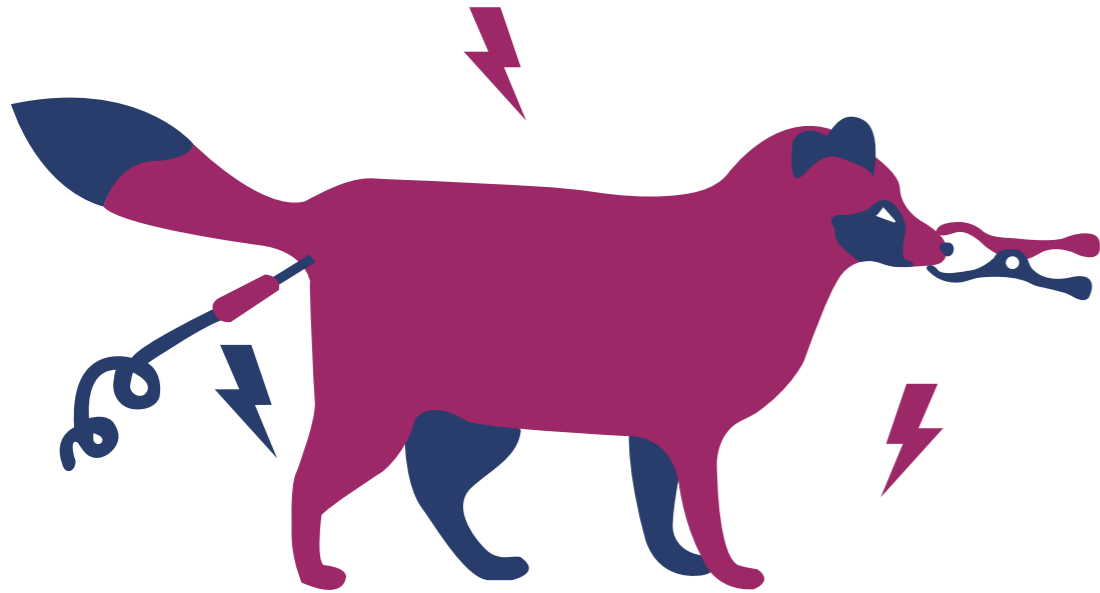


Fig. 8. Some animals such as foxes and raccoons are killed with head-to-tail electrocution by inserting a rod into their anus and clamping their mouth. This avoids the soiling of their fur with blood caused by more common slaughter methods.



Image Credit: Andrew Skowron / We Animals Media
Several juvenile silver fox pups, one with a wound on their shoulder, share a small cage at a fur farm in Poland in 2015.

Animals Trapped for Fur¹

Each year, fur trappers kill more than five million wild animals for fur. Animals caught in the wild for their fur are almost always caught using steel-jaw leghold traps, body-gripping traps, and wire neck snares. These traps are designed to hold the animal, rather than kill them, inflicting great pain and suffering while the animal slowly dies or is killed by predators.

Many animals die from dehydration, blood loss, hypothermia, or trying to free themselves. Often animals become so desperate to escape that they resort to chewing off their own trapped limb(s) to escape, often breaking teeth and bones in the process. Trappers usually check their traps from once every 24 hours to once every 14 days. If the animal does not die before the trapper returns, the animal is then killed through bludgeoning, choking, or stomping to death to avoid damaging the pelt.

The steel-jaw leg trap is so cruel that it has been banned in over 100 countries, including the EU and China, but it is the go-to tool for trappers in the United States. Both the American Veterinary Medical Association (AVMA) and the American Animal Hospital Association have declared the steel-jaw leghold trap to be inhumane. In September 2019, California became the first state in the US to ban trapping for commercial and recreational purposes.

Each year, traps in the United States injure and kill millions of non-fur animals including pet dogs and cats, deer, birds, and even endangered species. Referred to as “trash” animals, these mistaken catches are often just thrown away.

The regulations on trapping are weak and difficult to enforce and thus the extent of the animal welfare issues related to trapping are not fully understood. In addition, trappers rarely leave identification on their traps, so enforcement is even more difficult.



**5 million animals
trapped for fur
annually.**

Image Credit: The Fur-Bearers

Fur's Impact on People

To prevent pelts from rotting, animal fur is processed using chemicals like formaldehyde and heavy metals.¹ Thirty-three toxic chemicals banned across Europe are used in processing fur in China.² The surfactants, solvents, acids, tannins, fungicides, dyes and bleaches used in fur dressing can cause both acute and chronic health issues for workers. These conditions can range from skin and eye irritants to cancer and even death.³ Not only are these chemicals bad for the workers, they also end up in the end products. Testing of fur sold across Europe revealed substantial contamination of hazardous chemicals, breaching legal industry standards.⁴ Studies also found similar levels of carcinogenic and allergenic toxic residue on fur garments found across China.⁵

Zoonotic diseases can spread from farmed animals to humans and, for any animals who manage to escape fur farms, diseases can also infect wild animals. As with all factory farming, animals raised for fur are confined in high-density environments and undergo significant stress, allowing for the rapid spread of viruses to each other, humans, and wild animals. Mink, in particular, are highly susceptible to infection with several viruses that also infect humans.⁶ During the COVID-19 pandemic, government agencies and academics in Europe and North America repeatedly documented farmed mink infected with SARS-CoV-2.⁷ They also documented viruses from the mink within the local communities, showing viruses were jumping from animals to people.⁸ See also the section [Covid-19's Impact on Fur Farming Legislation](#).



Image Credit: Oikeutta Eläimille / We Animals Media
Workers on a Finnish fur farm in the midst of an avian influenza epidemic, 2023.

Environmental Impact

Like all textiles, there is often insufficient or out-of-date data for life cycle assessments (LCAs) for animal fur and synthetic fur. Therefore it is difficult to find reliable LCA data on fur from all species used to make animal fur and to reliably compare this to other textile materials on the market. However we can point to an LCA study on mink, the most popular animal fur in current use, for general learnings on the impact of animal fur. The authors note that they took conservative estimates for certain data and methods, and therefore the actual impacts of mink fur may be even higher.

In this 2011 study by CE Delft covering European mink fur, there were several important findings regarding the inefficient and high environmental impact of this material:¹

- Of 18 environmental themes covered by the study (e.g., greenhouse gas emissions, ecotoxicity, eutrophication, water use, land use, etc), fur had a higher impact than all other compared textiles in nearly every category (17/18).²
- It was found that finished mink fur contained hazardous substances such as formaldehyde at levels exceeding those of European regulations.
- Eutrophication issues can also be high with fur – ammonia and phosphorus from manure can pollute surrounding waterways and create dead zones where aquatic life struggles to survive.³
- See also Fig. 10.

Mink fur also has enormous land use and air quality impacts compared to other textiles (see Fig. 9).

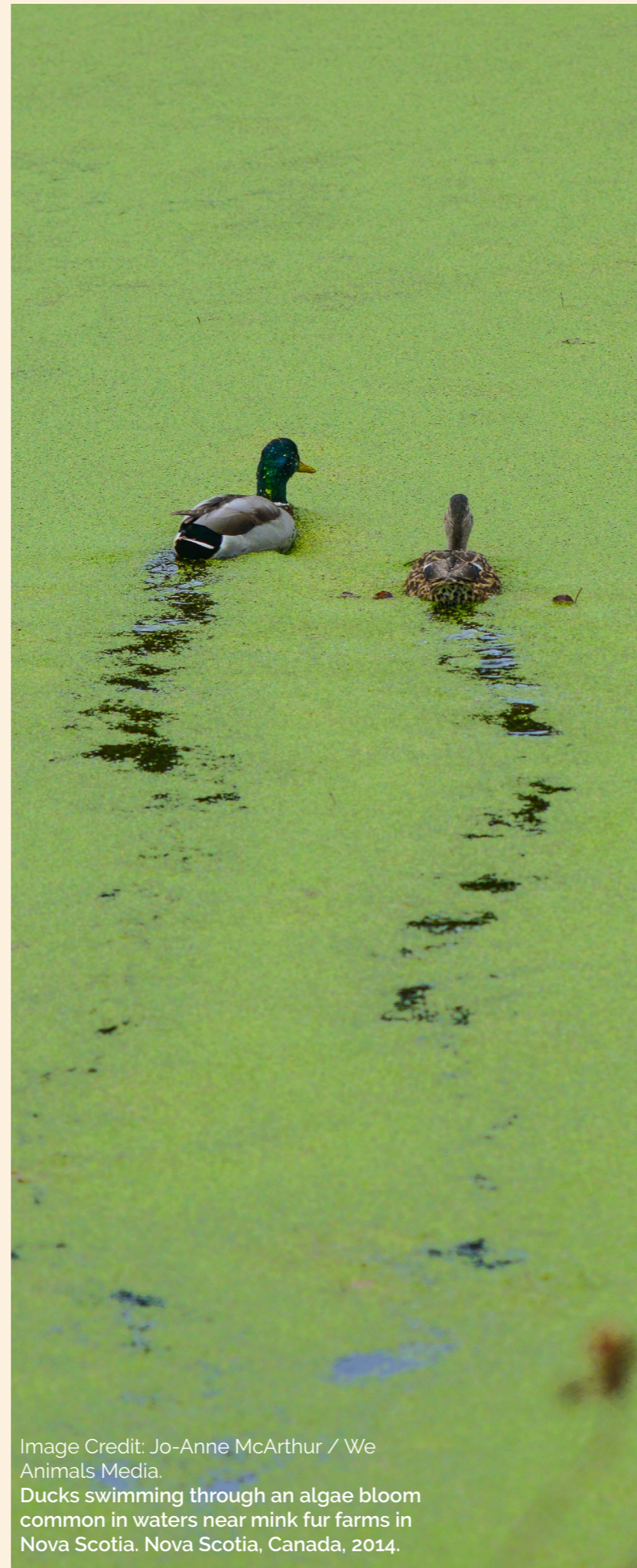
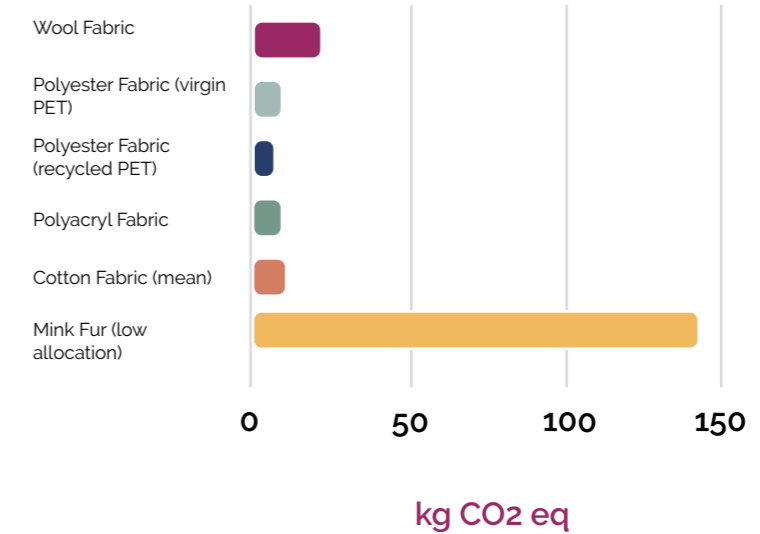
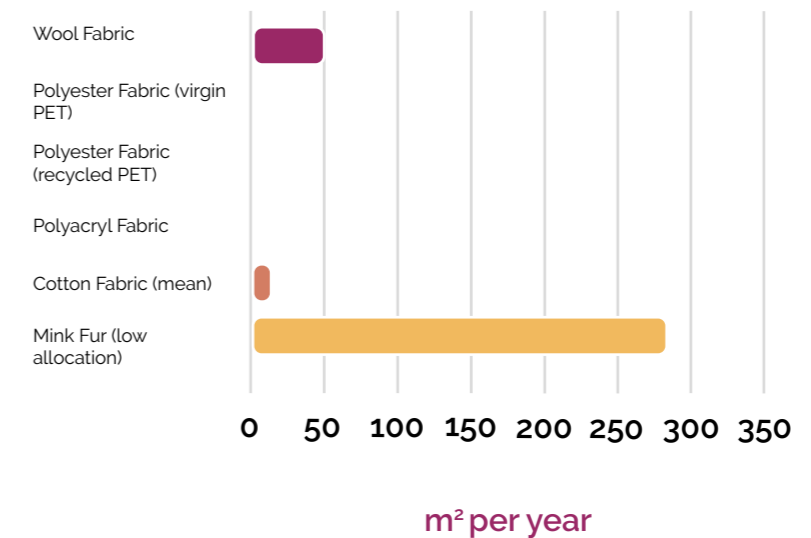


Image Credit: Jo-Anne McArthur / We Animals Media.
Ducks swimming through an algae bloom common in waters near mink fur farms in Nova Scotia, Nova Scotia, Canada, 2014.

CLIMATE CHANGE IMPACT OF 1KG



AGRICULTURAL LAND OCCUPATION OF 1KG



PARTICULATE MATTER FORMATION OF 1KG

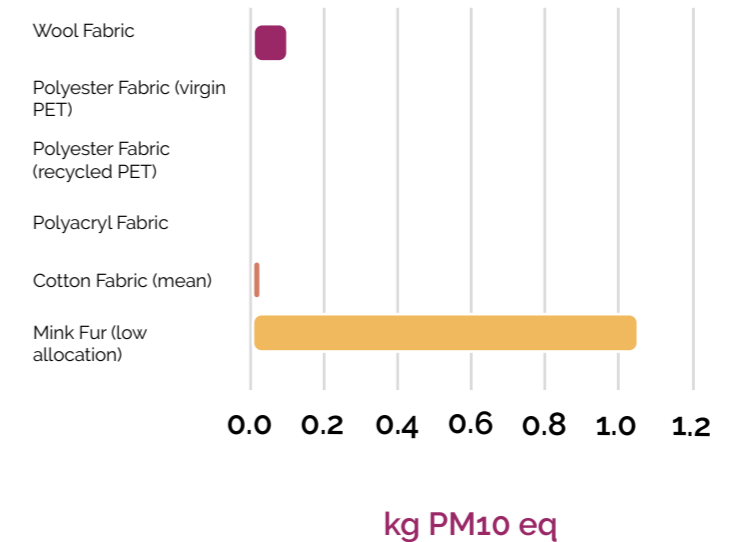


Fig. 9. Comparative LCA data for mink fur versus other textiles across categories such as climate change, land use, and air quality.⁴

To produce fur, animals like chicken and fish are first raised and killed as feed, which are fed to more animals (e.g., mink) that are raised and killed for their fur. The process of breeding and rearing many animals to make only a small output of fur is extremely inefficient. The manure from these animals is another major contributor to environmental impacts where emissions and eutrophication are major consequences. Then the fur must be processed, treated, and finished, often in a variety of far-reaching locations, before it can be made into articles or garments - all of which requires the use of electricity, transportation fuel, and hazardous chemicals. At the end of life, most animal fur is not recycled or responsibly degraded and ends up in a landfill.

Overall, it is clear that there must be better ways to make fur, without this laborious and destructive manufacturing process. Although the fur industry tries to paint a sustainable picture of animal fur, this is clearly greenwashing: a French advertisement in Vogue Paris referring to fur as 'natural' and 'eco-friendly' was banned by the French advertising authorities, and found to be 'strongly misleading'.⁵

There is an opportunity for next-gen fur, manufactured with sustainable raw fibers and materials to overcome the high environmental impacts of incumbent animal fur and current-gen synthetic fur. See more in ["Key Targets for Creating Fur."](#)

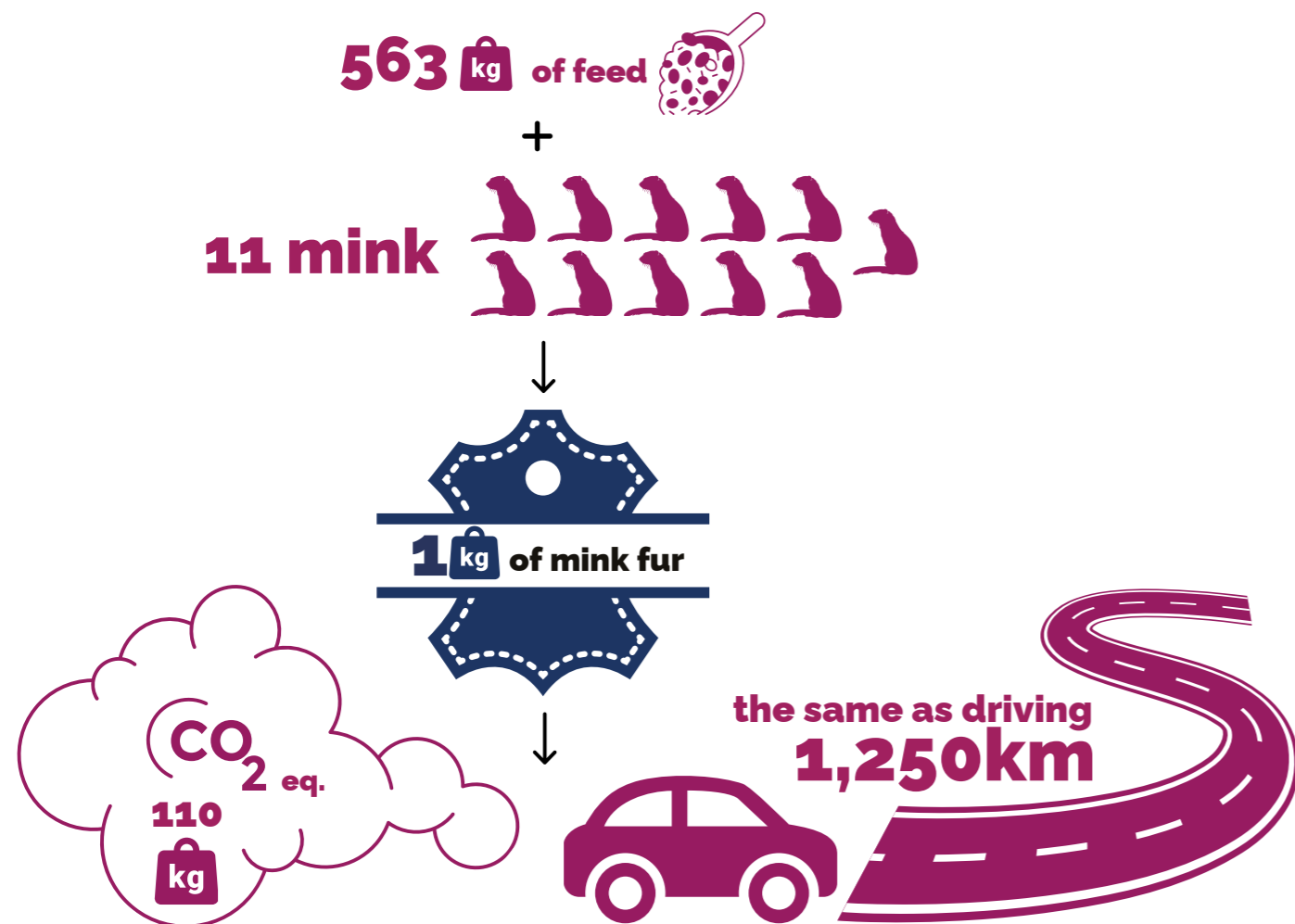


Fig. 10. It takes 563kg of feed to produce just 1kg of fur, coming from about 11 mink. This is equivalent to 110kg CO₂ or driving over 775 miles.⁶



Image Credit: Jo-Anne McArthur / We Animals Media
Aerial view of a fur farm in Nova Scotia, Nova Scotia, Canada, 2014.



“ A more sustainable future can't contemplate the use of animal fur.” **”**

Fedele Usai, Communication and Marketing Officer, Dolce & Gabbana's Group

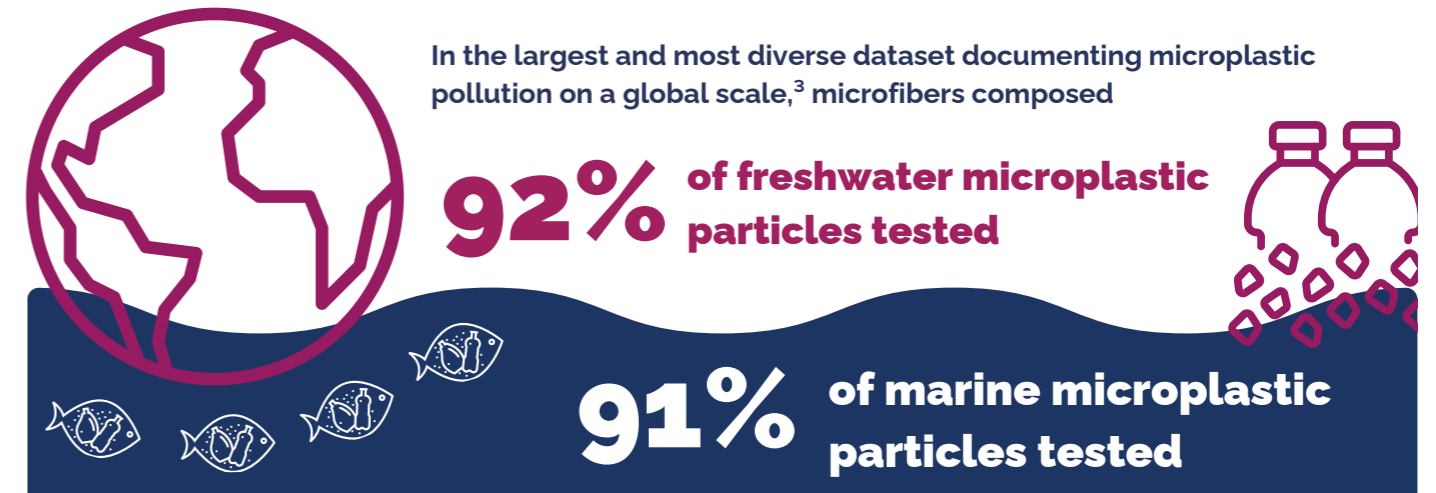
Synthetic Fur's Impact on Animals and the Environment

Animal-based furs are clearly bad for the environment and animals but moving to synthetic fur is not the solution.

Synthetic “faux fur” alternatives to animal fur contain microplastics, which can accumulate and persist in ecosystems for hundreds of years, as well as toxins that poison ecosystems, harm people and animals, and fuel climate change.

Conventional synthetic fur is nonbiodegradable, toxic, and a lucrative profit source for the petrochemical industry, which is the third largest industrial CO2 emitter globally.

Synthetic fur also sheds microplastics, which are proliferated around the globe by rain, lakes, rivers, air, ocean currents, and ocean circulation patterns. They have been found in the Amazon River and estuaries, the Mariana Trench, remote lakes, Swiss Alps snow, Arctic ice, all major oceanic basins, and in nearly every other environment tested for their presence¹ Microplastics can persist in these ecosystems for centuries and are nearly impossible to remove using current technologies.²



Microplastics harm ecosystems and trillions of animals in myriad lasting ways, including by reducing their food intake, delaying their growth, altering their natural behaviors, decreasing their reproductive capabilities, causing inflammation and oxidative damage, poisoning them with toxins, and leading to premature death.⁴

Microplastics cause the most damage to ecosystems by harming keystone species that play critical roles in supporting entire ecosystems.⁵

For example, some keystone zooplankton species, which are primary consumers in marine ecosystems, have been proven to grow more slowly and lay fewer eggs as a result of consuming microplastics, thereby decreasing food available to entire ecosystems.⁶



Image Credit: Shutterstock

Microplastics in Corals, an Emergent Threat



Effects on Corals:⁷

- Reduced growth
- Increased mortality among Symbiodiniaceae, the unique algae that live inside corals and supply them with vital nutrients
- Impairment of reproduction
- Coral bleaching
- Increase in diseases
- Increase in the activities of antioxidant enzymes
- Tissue inflammation
- Decrease of detoxifying and immune enzymes
- Decreased calcification
- Impairment of feeding performance
- Decrease in food intake
- Necrosis
- Reduction of fitness
- Changes in photosynthetic performance
- Increased exposure to contaminants and diseases
- Alteration of metabolites profiles
- High production of mucus
- Lower fertilization success

Synthetic fur that ends up in landfills leeches not only microplastics but also dioxins, nitrous oxide, hydrogen cyanide, flame retardants, antimicrobials, PCBs, and other dangerous pollutants. Though recycling is an option for some synthetic fibers, almost none of the synthetic fur we wear or use is recycled, and microplastics are released during the recycling process.



Coral reefs are among the most biodiverse ecosystems on Earth. They are essential for the survival of more than one million species, including approximately 25% of fish in the ocean. The irreparable damage microplastics cause to coral reefs and other ecosystems around the world is profound.

PUBLIC OPINION ON FUR

In this section, we explore how consumers feel about fur, what motivates their purchases, and where next-gen fur fits into the modern person's mind and wardrobe.

Consumers are Largely Anti-Animal Based Fur

Of all the animals killed for fashion, those used for fur receive the most concern from people across the world.¹ This broad consumer distaste is especially clear in Europe, where citizens have led efforts to ban fur farming in 20+ countries [\(see the next section for more on bans\)](#). Nearly six in ten Europeans (57%) consider that fur farming should be strictly banned in the European Union.² The UK was the first country to ban fur farming on the grounds of public morality in 2000 and 95% of British citizens say they would not wear real fur.³ 9 out of 10 would not buy real fur even if it was cheaply available.⁴ Beyond just farming, almost 3 in 4 people (72%) support banning the importation and sale of fur in the UK, too.⁵

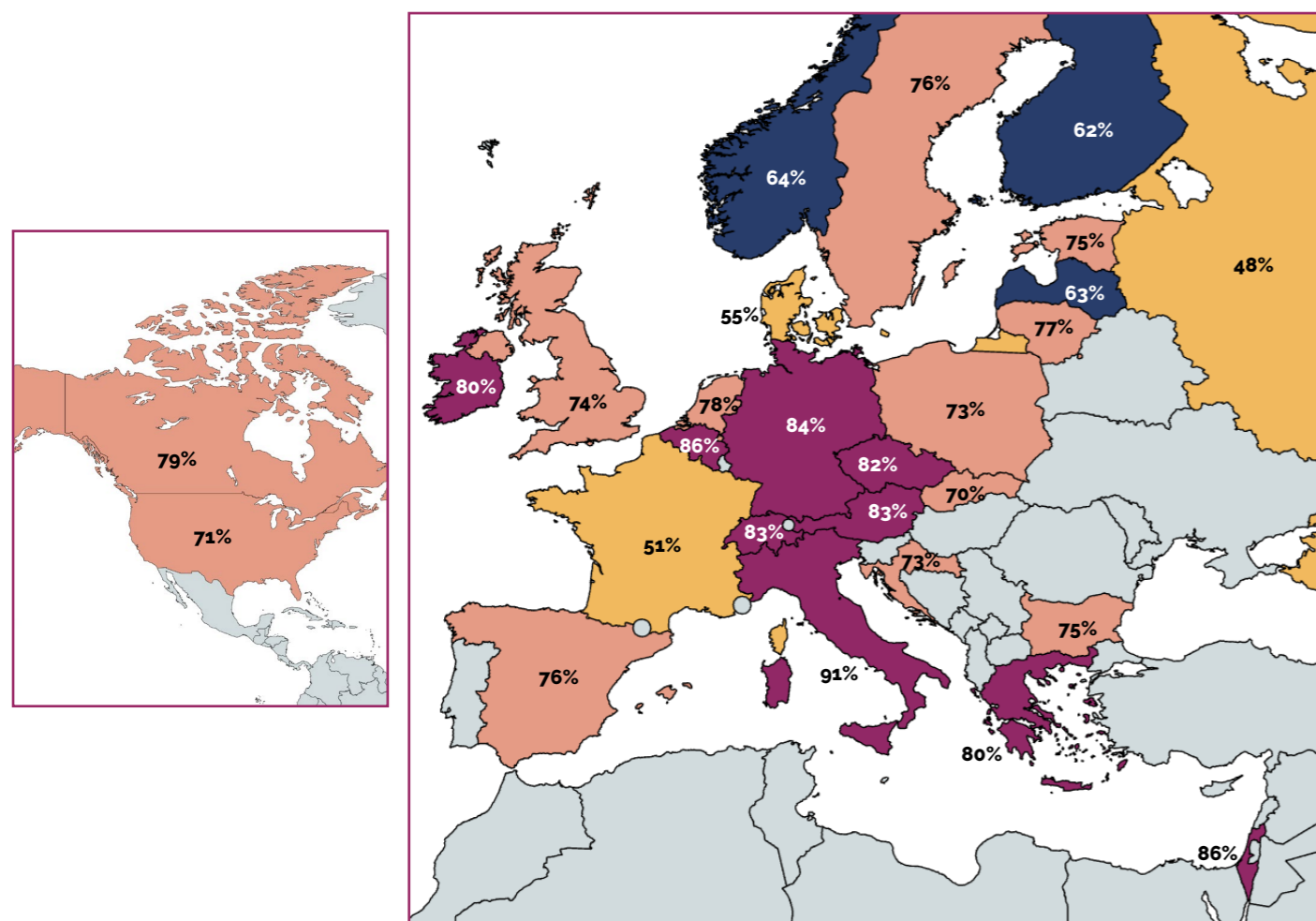


Fig. 11. Percentage of Public Opposition Towards Fur by Country.⁶

Across the world, majorities of citizens oppose fur farming:

- **Austria:** 83% of the Austrian population considers keeping and killing animals for fur for the fashion industry unjustifiable.⁷
- **Belgium:** 86% favor a ban on breeding animals for their fur.⁸
- **Bulgaria:** 75% of the population does not consider fur farming justifiable.⁹
- **Canada:** 79% of Canadians oppose killing animals for their fur.¹⁰
- **Croatia:** 73% agree that breeding animals for fur should be legally banned in Croatia.¹¹
- **Czech Republic:** 82% of Czech citizens do not agree with killing animals for fur.¹²
- **Denmark:** 55% of Danes are against the production of fur.¹³
- **Estonia:** 75% of the Estonian population disapproves of raising and killing of animals (such as foxes and minks) for fur.¹⁴
- **Finland:** 62% of the Finnish population thinks that breeding and killing animals for fur is not acceptable.¹⁵
- **France:** 51% think the breeding of animals for fur should end.¹⁶
- **Germany:** 84% of Germans consider that keeping and killing animals for fur for the fashion industry is unjustifiable.¹⁷
- **Greece:** 80% of the Greek population oppose the breeding and killing of animals for the commercial exploitation of fur.¹⁸
- **Ireland:** 80% of the Irish population considers breeding and killing animals just for fur unacceptable.¹⁹
- **Israel:** 86% believe killing animals for fur is immoral (and nearly 80% would support a bill calling for the ban of the fur trade in Israel).²⁰
- **Italy:** 91% of Italians are against the activities linked to the production of fur using animals.²¹
- **Latvia:** 63% of the Latvian population does not support raising and killing animals for fur.²²
- **Lithuania:** 77% of Lithuanian citizens consider the raising and killing of animals for fur unacceptable.²³
- **The Netherlands:** 78% considers fur farming unacceptable.²⁴
- **Norway:** 64% think it is wrong to farm animals in cages for fur production.²⁵
- **Poland:** 73% think the breeding of foxes, raccoon dogs and mink for fur should not be allowed.²⁶
- **Russia:** 48% of the Russian population agrees that the making of fur coats from animal fur is unacceptable.²⁷
- **Slovakia:** 70% of the Slovakian population considers breeding and killing animals just for fur unacceptable.²⁸
- **Spain:** 76% consider it unacceptable to breed and kill animals for their fur.²⁹
- **Sweden:** 76% think it should not be allowed to breed mink in cages for fur.³⁰
- **Switzerland:** 83% of Swiss consider it unjustifiable to keep and kill animals for fur for the fashion industry.³¹
- **United States of America:** 71% of Americans oppose killing animals for their fur.³²
- **UK:** 74% think that using animals for the production of fur for the fashion industry is wrong.³³

Unethical. Outdated. Cruel. Out of touch.

- Words **79%** of people most closely associate with a fashion brand selling fur.³⁴

In North America there appears to be mixed findings on public opinion towards fur. In 2010 and 2023, different pollings both found that 60% of U.S. citizens found it morally acceptable to wear fur, but other research paints a different picture.^{35,36} In 2020, one study found that 71% of Americans and 76% of Canadians opposed the killing of animals for their fur.³⁷ And in 2019, a poll of American residents by Morning Consult in partnership with Vogue Business found that 47% deemed fur inappropriate.³⁸

U.S. consumers who reported it was morally acceptable to wear fur might have done so because of their perception that the industry is highly regulated, not because they lack concern for animal welfare. Focus groups conducted with U.S. women who owned or intended to buy fur products found that both categories expected the fur industry to treat animals humanely, thought that cruelty was rare, were opposed to inhumane treatment of animals, and expressed affection for animals.³⁹ They were not knowledgeable about fur ranching and trapping and assumed the government would regulate the fur industry to prevent inhumane treatment (as described in our [Animal Cruelty section above](#), this reliance on government regulation is unfounded).

The pandemic raised awareness of the public health risks fur farms can cause in spreading zoonotic diseases, largely due to a mass killing and disposal of 17 million mink in Denmark, along with swathes elsewhere.⁴⁰ This prompted several countries to consider legislating against fur farming. A 2021 international survey of 13,500+ adults found that, post-pandemic, almost a third (31%) were seeking sustainable fashion with higher animal welfare standards or avoiding animal-based apparel completely.⁴¹



Image Credit: Andrew Skowron / We Animals Media
Monika, a rescued mink from a Polish farm.

Chinese Consumers' Preference for Animal-Based Fur Declining

Consumer sentiment towards animal-based fur in China, the world's biggest producer and consumer of fur, is slowly shifting against the industry.⁴² In 2018, 83% of Chinese fur-buying consumers bought at least one item containing mink fur. Fast forward to 2022, and that number dropped to 34%. Demand for fox and rabbit fur continues to fall but raccoon dog demand is increasing due to use in popular trims.

The pandemic also changed views in China. In 2020 when non-fur consumers were asked if animal fur causes a threat to human health, 21% strongly agreed. In 2022 this figure rose to 61%, indicating increased understanding of the health risks associated with the wildlife trade and fur farming.

Despite the popularity of fur in China, there is a broad awareness of fur's negative discourse, with both pro and anti fur consumers agreeing that they expect retailers to go fur-free in the future.

Education Accelerates Consumer Change

Notably, research has shown that education on fur industry practices is effective at changing views and purchasing habits. Ongoing consumer education and polling in China has found that a significant 84% of participants said they will not buy fur again after learning about industry practices.⁴³ This shows that raising awareness of fur-related issues is a vital component to consumer change.



As awareness around the cruelties of fur production grew, the shift away from animal fur was inevitable. Once fashion brands saw that animal welfare was a priority for consumers, they realized the marketing potential of going fur-free, and that has led to policy reform in the shape of bans on fur production and sales. Now, innovative alternatives that are better for animals and the environment can scale quickly to meet that demand. The fur-free movement is a helpful case study for how we can create a more humane fashion industry.”



PJ Smith, Director of fashion policy for the Humane Society of the United States.

Consumers Care About Animal Welfare and the Environment

Consumer attitudes towards fur align with broader research showing growing consumer concern for animals and the environment. In 2018, Yoox Net-a-Porter surveyed 24,000 customers: 72% said social or environmental considerations influenced their purchasing decisions at least some of the time, while 58% said having more information about the ethics and sustainability of a product would influence their shopping choices⁴⁴. In the purchasing of luxury goods, environmental and animal concerns are the top two considerations for consumers.⁴⁵ A 2021 report by Accenture and Vogue found that to consumers, animal welfare is the most important of various environmental factors when buying apparel.⁴⁶

A 2021 international survey of 13,500+ found that nearly two thirds (64%) of adults are aware of cruelty to animals in the fashion industry. 86% think brands should make animal welfare a priority alongside sustainability and worker standards. 60% said brands should assure animal welfare is upheld in their supply chains and 54% want transparency on brands' animal welfare policies.⁴⁷

In our own research on Chinese consumers and next-gen leather, we found that the potential early-adopters (70% of the total) were heavily motivated to purchase for environmental (72%) and animal welfare (68%) reasons. For all responders who would pick a next-gen leather over an animal-based leather, 76% said sustainability was a major motivating factor while 71% said animal-welfare was.⁴⁸

86% think brands should make animal welfare a priority

54% want transparency on brands' animal welfare policies

64% are aware of cruelty to animals in the fashion industry

58% say having more information about ethics and sustainability would influence their choices

60% say brands should assure animal welfare policies are upheld

72% say social or environmental considerations influence their purchasing decisions at least some of the time



Image Credit: Getty Images
Model Natalia Vodianova wears a Stella McCartney coat made from Ecopel's KOBA® in 2020.

Consumers Prefer Synthetic Fur

Although there are fewer studies examining consumer preferences for synthetic fur, in all studies we found, consumers prefer synthetic fur to animal-based fur.

A study of German consumers found that:

- 84% of women and 71% of men cite animal welfare or fur scandals as the reason for buying synthetic fur.⁴⁹
- Female fur consumers in particular prefer synthetic fur (60% of consumers) to animal-based fur (29%).⁵⁰
- More consumers wear artificial fur (66% of consumers) than animal fur (34%).⁵¹

In the UK, 9 out of 10 people want clearer labeling for animal-based and synthetic fur, and 4 in 10 always check labels to ensure the fur does not come from an animal.⁵²



Image Credit: Vanessa Bruno
French designer Vanessa Bruno released a coat made from Ecopel's Cannaba Wool in 2020.

Consumer Preferences for Next-Gen Fur

Until recently, consumers have had two choices for fur:
(1) animal-based fur and
(2) synthetic petrochemical derived fur.

Within the last year, more companies are offering a third alternative, next-gen fur, which uses little to no petrochemicals and no animal products. Given consumers' preferences for products which are animal-free and better for the environment, their preference for next-gen materials is unsurprising.

In the U.S. 92% of survey participants stated they were at least somewhat open to purchasing next-gen materials including 51% who were somewhat/moderately likely to purchase and 41% who were very/extremely likely to purchase.⁵³ In China, 70% reported a high likelihood of purchasing and 90% reported a preference for next-gen leather over conventional leather. While this concerned next-gen leather, we expect a similar openness to next-gen fur in China.⁵⁴

U.S. Consumers are also specifically open to purchasing next-gen fur. Of those surveyed, 54% indicated they would purchase some type of fur product (whether animal, synthetic, or next-gen) in the next five years, and of those, 62% would purchase a next-gen product over a conventional one (see Fig. 12).⁵⁵ Of all next-gen materials, fur had the highest potential market share.

In addition, consumers see the value in next-gen materials and say they are willing to pay more. In the U.S., 29% of those surveyed said they would pay more for next-gen materials. In China, 62% of early adopters for next-gen leather would be willing to pay more for it. For standard consumers, 57% would pay more (again, this was for leather but we expect a similar openness to next-gen fur) (see Fig. 13).

FUR POTENTIAL MARKET SHARE

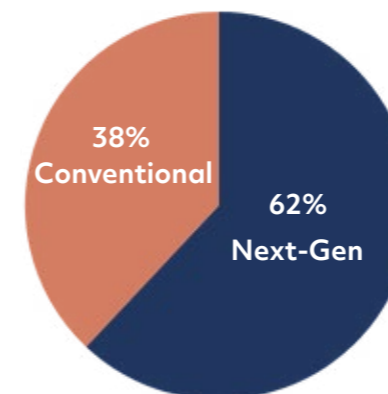


Fig. 12. 62% of consumers looking to purchase fur in the near future prefer next-gen over conventional fur.

NEXT-GEN MATERIAL MARKET APPETITE

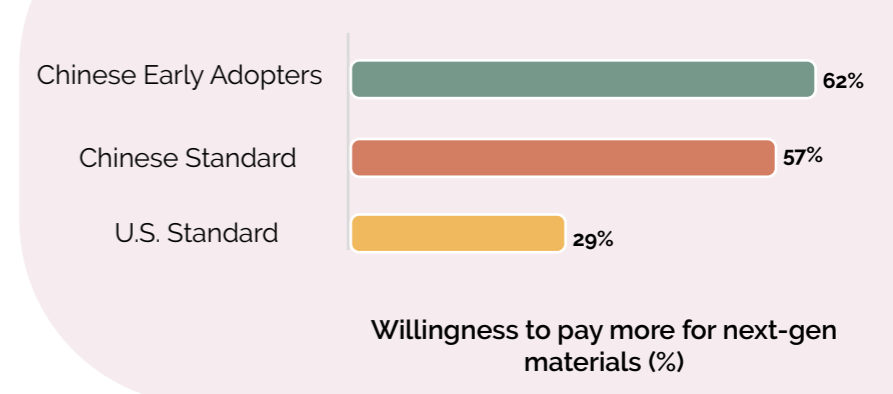


Fig. 13. Percentage of Chinese and U.S. consumers that are open to paying more for next-gen materials.

BANS ON FUR

Animal-fur is one of the most highly regulated materials used in the fashion industry. Generally, there are two types of fur legislation:

- (1) bans on the sale of fur and
- (2) bans on the production of fur.

Bans on production may take two forms: either a full ban or a partial ban, such as limits to certain species.¹

Fur Farming Bans

In 2000, the U.K. became the first country to ban fur farming.² Across the next two decades, over twenty countries soon followed suit (see Fig. 14).³

The vast majority of countries (20) with fur farming bans are located in Europe.⁴ This makes sense, as Europe is the second greatest producer of fur, second only to China.⁵ Of note are The Netherlands and Norway, both of which have banned fur, once significant producers of mink and fox fur, respectively.^{6,7} At the time the ban was passed in The Netherlands in 2013, they were the fourth largest fur farming operation in the world, with over 6 million animals killed each year.⁸ The Netherlands closed their last fur farm in 2021.⁹ Norway's prominence had decreased prior to the passing of their ban. In 1939, Norway was the largest producer of fox fur in the world, with 20,000 fur farms in operation. By the time the ban was passed in 2018, these numbers had already dwindled to around 250 farms.¹⁰

Another top European fur producer, Lithuania, recently banned fur farming in September of 2023 (with plans to phase out the industry completely by 2027). Lithuania is home to 44 mink farms and 30 chinchilla farms, and approximately one million animals every year will be saved as a result of this legislation.¹¹

“Modern luxury is also ethical luxury. Stopping the use of fur is another step forward in our commitment to animal welfare, and is in line with our commitment to sustainability...the decision is an ethical one that reflects a larger shift in fashion, and trends in luxury in particular.”



Marie-Claire Daveu, Chief Sustainability and Institutional Affairs Officer, Kering

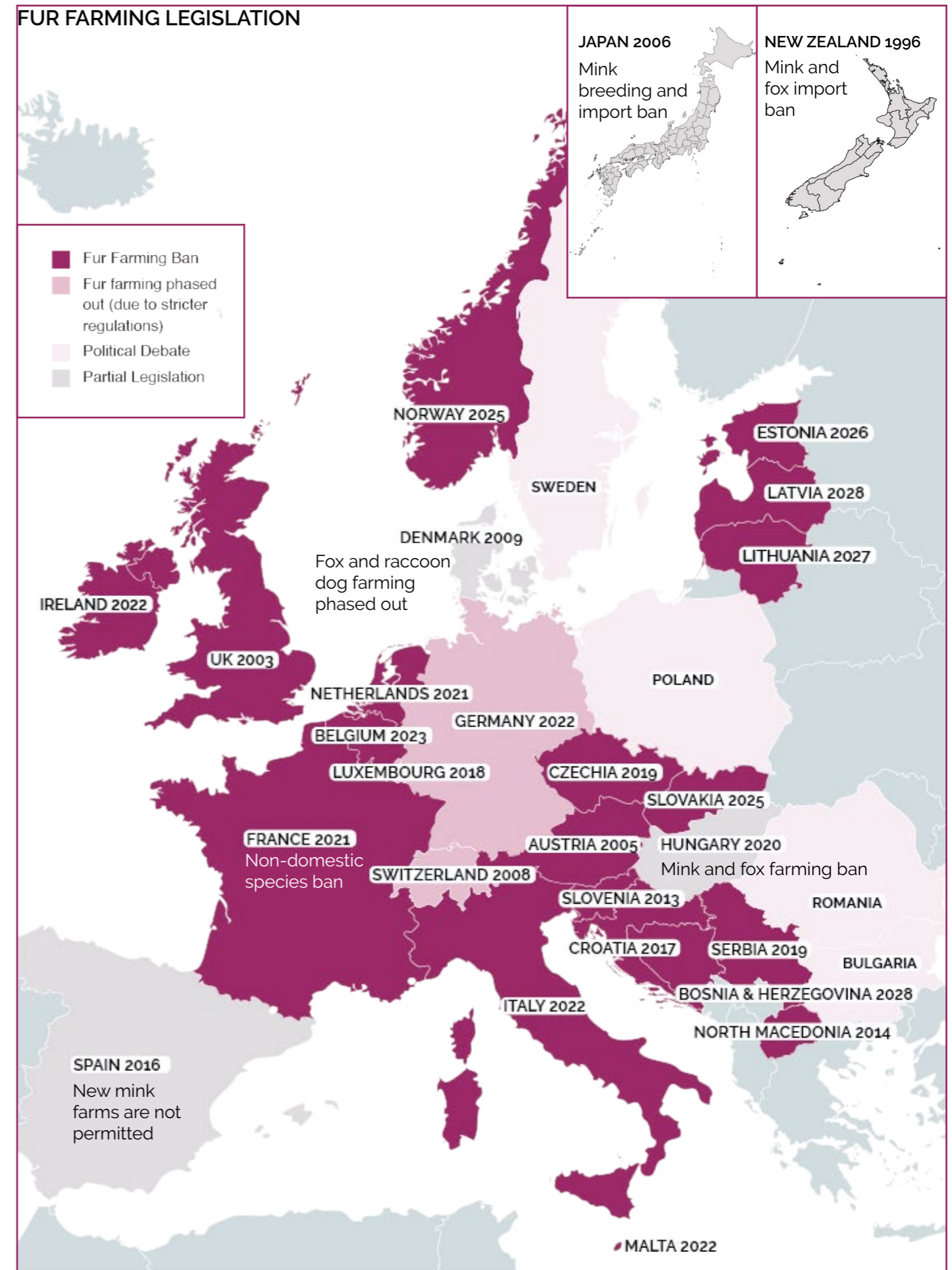


Fig. 15. Fur Production (m) (number of animals)
Source: Recreated from the original by Humane Society United States.²³

COVID-19's Impact on Fur Farm Legislation

The 2020 COVID-19 pandemic had a significant impact on the fur industry due to animals' ability to transmit COVID-19 and other zoonotic diseases (see Fig. 15.) In the past four years, there has been a greater urgency in passing and implementing fur farming legislation. Since 2020, Bulgaria, Estonia, France, Hungary, Ireland, Italy, Latvia, Lithuania, and Malta have all introduced fur farming bans.¹²

In 2023, United States Representative Adriano Espaillat from New York introduced the "Mink: Vectors for Infection Risk in the United States Act" (Mink: VIRUS Act) to Congress. If passed, the bill would prohibit mink farming across the United States, citing public health and safety concerns.¹³

The pandemic also accelerated existing legislation, with many countries culling significant amounts of their animal stock and shortening their timeline for phasing out the industry.¹⁴ The Netherlands and Norway both closed down their last remaining farms years earlier than originally intended.^{15,16}

Fur Sales

In 2021, Israel made history as the first and only country to ban the sale of fur.¹⁷

In the United States, several municipalities across Massachusetts, Michigan, Florida, Pennsylvania, Colorado, and California have banned the sale of fur.¹⁸ Etna, Pennsylvania, and Lexington, Massachusetts both passed fur sale bans in 2023.¹⁹

Most notably, in January of 2023, California's fur sale ban (passed in 2019) went into effect.²⁰ This bill is no small feat, as California accounts for nearly one-quarter of all fur sales in the U.S.²¹ Because of California's reputation as a pioneer and trendsetter in progressive policy making, it's reasonable to expect many states will soon follow their lead.²²

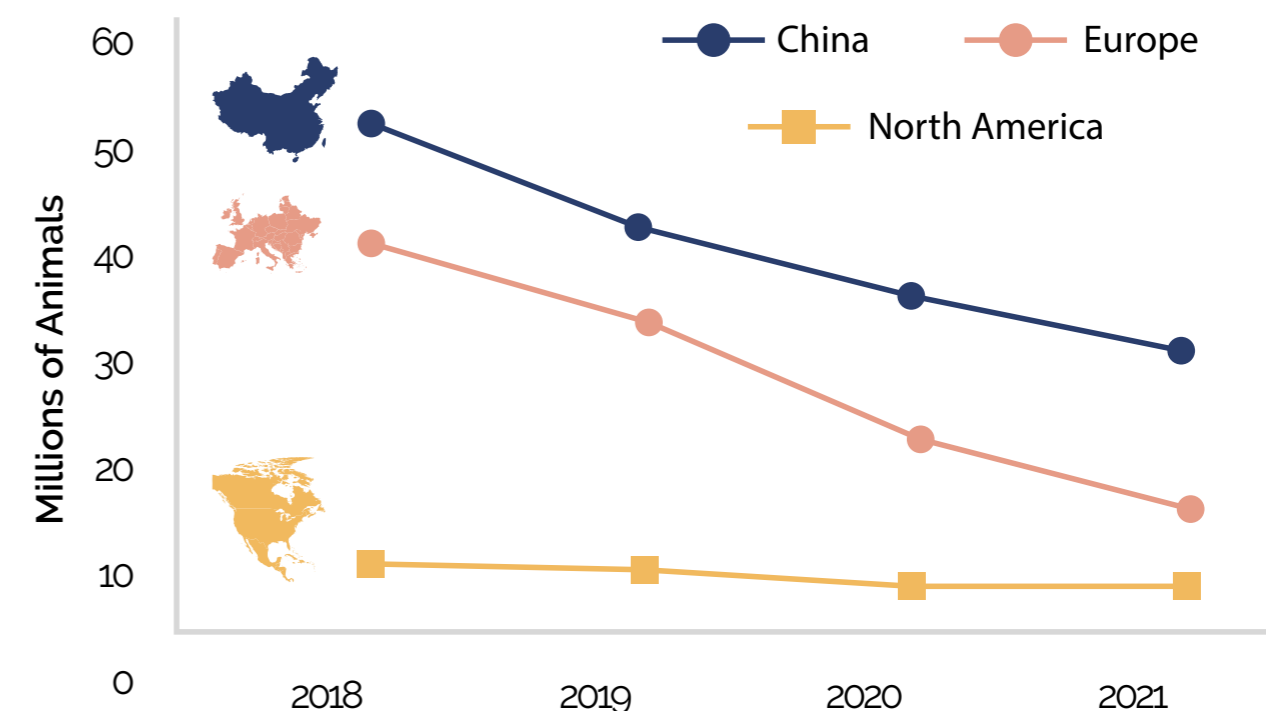


Image Credit: Henning Bagger / Ritzau Scanpix / AP
A mink breeder holds up a mink in Denmark, 2020.



Image Credit: Ritzau Scanpix/Mette Moerk/Reuters
Mink culled due to Covid-19

FUR PRODUCTION



During the pandemic, fur production declined as COVID-19 passed from humans to captive mink on fur farms to wild mink, and sometimes back to humans. More than 20 million animals on 483 farms in Europe, Canada, and the United States were killed to stop the spread of the disease.

Fig. 15. Fur Production (m) (number of animals)
Recreated from the original by Humane Society United States.¹⁵

Potential EU-Wide Fur Ban

The European Commission is considering a ban on all fur farming and the sale of fur products. In 2023, over 1.7 million Europeans signed a petition calling for an EU wide ban on fur production and sale, citing public health, the environment, and animal welfare.²⁴ In late 2023, the European Commission released its response to the proposition, citing a need for an updated analysis of the welfare of farmed animals before they can go ahead with developing legislation. Their response is due by March, 2025.²⁵

Fashion Takes a Stand on Fur

Fashion brands, retailers, magazines, and fashion weeks have been banning fur since the 1990s.

In 1994, following a targeted PETA campaign, Calvin Klein was the first major fashion brand to institute a fur-free policy.²⁶ Since then, over 1500 companies have adhered to a fur-free policy, or have committed to doing so in the future.²⁷ Some notable fashion companies include: Burberry, Chanel, Selfridges, Kering, Macy's, Canada Goose, Dolce&Gabbana, Versace, Neiman Marcus, Nordstrom and so many more.²⁸ Just this past year, Italian luxury goods group Herno and Aeffe Group (owner of Moschino, Alberta Ferretti, Philosophy and Pollini), Canadian holding group Hudson Bay Company (owner of Saks Fifth Avenue), and British department store Harvey Nichols have pledged to go fur-free.^{29,30}

In 2018, InStyle became the first magazine to ban fur from its pages.³¹ Three years later, ELLE did the same. Fully going into effect in 2023, all ELLE editions will no longer feature or promote animal fur in any manner, including runways, editorial, street style, etc.³²

London Fashion Week has also gone fur-free, with the British Fashion Council announcing in late 2023 that the fashion event will no longer allow fur from 2024 onwards.³³ London is the second major fashion week to make this commitment, with Copenhagen doing so in 2022.³⁴



Fur? I'm out of that. I don't want to kill animals to make fashion. It doesn't feel right."



Donatella Versace, 2018



Image Credit: Richard Vogel / AP
An anti-fur protest organized by PETA in Los Angeles, California, 2018.

1,500+

DESIGN AND RETAIL BRANDS HAVE PLEDGED TO NOT USE OR SELL ANIMAL FUR



Fig. 16. Design and retail brands who have pledged not to use or sell animal fur. Recreated from the original by Humane Society United States.³⁵

“

Even if people don't extend their compassion to animals like raccoons and foxes, they generally abhor the killing of dogs, which are commonly used for fur and falsely labeled as another animal.”



Nicole Rawling, CEO, MII

Challenges and Concerns with Enforcement and Efficacy

Despite marked progress in the past two decades, existing fur legislation has many issues.

Mislabeling

Legislation banning fur is incredibly difficult to enforce because of inadequate textile labeling regulations, which results in a significant amount of genuine fur products being labeled, and sold to consumers, as synthetic. This problem is especially prevalent in exports sold to Europe, Australia, and the United States.³⁶

A 2017 study conducted by the Fur Free Alliance analyzed products containing genuine fur across 10 EU member states (Austria, Czech Republic, Denmark, Finland, France, Germany, Lithuania, Poland, Sweden and the United Kingdom). They found 68% of the fur products analyzed were falsely labeled as not containing fur, with many being marketed as 100% acrylic or polyester. In the nation with the worst compliance record, the United Kingdom, 93% of products were mislabeled.³⁷

The Humane Society of the United States is constantly investigating falsely labeled fur products in the U.S., and even filed legal disputes against several major retailers and fashion brands to the Federal Trade Commission.^{38,39} Despite their advocacy work, misrepresented fur products continue to crop up in stores across the country. Since California's fur sale bill went into effect in early 2023, there have been multiple reported incidences of genuine animal fur being sold as faux fur.⁴⁰⁻⁴²

In order for fur bans to be as effective as possible, textile labeling legislation across the globe needs to be amended.

Another obstacle for enforcement is the resource taxing investigation process for identifying fur. Retailers can get away with mislabeling and selling banned fur products because of the time and resources associated with forensic testing of fur materials. To prove that fur is of illegal origin, prosecutors need laboratory DNA testing by a wildlife specialist, which is made increasingly difficult due to the destruction of DNA through many fur products' manufacturing and production processes.⁴³

In response to continued labeling violations, researchers at UC Davis and the state Department of Fish and Wildlife are spearheading a new project to identify fur from proteins, instead of DNA. They are currently building a database of 44 of the most trafficked fur species' proteins, which they hope will result in a more reliable, expeditious identification process of fur used in products.⁴⁴

Complicating this matter further, the penalties for violating fur bans are often not enough to ensure compliance. The fur trade's high potential earnings, along with relative low cost, make it possible to turn a sizable profit even after incurring fines and penalties.^{45,46} In California's case, first-time offenders of the recent ban need only pay a \$500 fine (repeat offenders can pay up to \$1000).⁴⁷

“I'd rather go naked than wear fur.”

- Christy Turlington



PEOPLE FOR THE ETHICAL TREATMENT OF ANIMALS **PETA** PETA.org.uk

Image Credit: Steve Klein

FUR'S RESURGENCE?

Since the 1980s, fur's prominence in the fashion industry has steadily declined. This trend is largely attributed to increased awareness of the animal cruelty involved in fur production, with organizations like PETA bringing the issue to the forefront with provocative protest tactics and infamous campaigns like “I'd Rather Go Naked Than Wear Fur”.¹

In 2020, after nearly four decades of ardent campaigning, PETA declared that we had finally reached “the demise of the fur trade” and there was no more need for their “I'd Rather Go Naked Than Wear Fur” ad campaigns.² PETA's Senior Vice President, Dan Mathews, further elaborated on their thinking, “Nearly every top designer has shed fur, California has banned it, Queen Elizabeth II has renounced it, Macy's is closing its fur salons, and now, the largest fur auction house in North America [Toronto-based North American Fur Auctions (NAFA)] has filed for bankruptcy.”³

Just one month later, the world closed down due to the COVID-19 Pandemic, with fur farms across the globe shuttering their doors and culling their animal stock for fear of viral transmission. By all accounts, this appeared to be the final nail in the fur trade's coffin. Yet just 3 years later, industry professionals are concerned that fur is making a comeback.⁴

Is Fur Back In Vogue?

Across the runways for the Autumn/Winter '24 season, fur, both synthetic and real, was unavoidable.⁵ Fashion blogs and magazines reported fur among the biggest trends to look out for, and social media trends such as the “Mob Wife Aesthetic” flooded people’s feeds.⁶⁻¹⁰ For those who study fashion and trend cycles, this doesn’t come as a surprise. José Criales-Unzueta, fashion writer at Vogue Runway, noted that fur’s previous retreat from the mainstream is also the reason for its recent comeback, posing “How do you make something new? You use the one thing no one’s using.”¹¹

Will Animal-Based Fur Return?

The fashion industry is cyclical, moving trends from unfashionable to fashionable and back again. Will this trend apply to the use of animal-based fur? Public perception is currently clearly anti-animal-based fur. But, as noted by José Criales-Unzueta, fashion writer at Vogue Runway in 2024, fur’s previous retreat from the mainstream is also the reason for its recent comeback, posing “How do you make something new? You use the one thing no one’s using.”¹²



Image Credit: Vogue / Phil Oh / Backgrid



Image Credit: Nina Filippova

Image Credit: The Sopranos

Edie Falco, as Carmela Soprano, wearing a sable fur coat on the season two finale of The Sopranos.

“

The Sopranos had nothing on the violence of the fur industry which gasses, electrocutes and peels the skin off animals while they’re still alive. No matter if it’s new or vintage, torture doesn’t belong in our closets. So, if you’re after the trending Carmela Soprano-inspired ‘mob wife’ aesthetic, I suggest grabbing one of the many faux furs out there and leaving animals out of it.”

Edie Falco on the ‘Mob Wife Aesthetic’¹³



Image Credit: Andrew Skowron / We Animals Media

Image Credit: Filippo Fior / Gorunway.com

LaQuan Smith, in collaboration with Saga Furs, used real fur in his Fall 2024 Ready-to-Wear collection.¹⁴

Just over half of the 342 brands covered by Vogue Runway incorporated fur (or synthetic fur) in their Autumn/Winter '24 collections.¹⁵ This is not atypical for high fashion runways.¹⁶ In 2018, Vogue noted that fur appeared on approximately 60% of the runways. With fur appearing in similar quantities as in previous years, the outsized attention is most likely due to the way it was used in these collections. Major fashion designers like Off-White, Marni, Prabal Gurung, Alexander McQueen, Moncler Grenoble, Dolce&Gabbana, Louis Vuitton, Miu Miu, and Simone Rocha (just to name a few) created over-the-top and elaborate fur coats, hats, gloves, stoles, boots, shorts, and dresses.

Despite fur's return to prominence at recent fashion weeks, fashion policy director at the Humane Society, PJ Smith, remains confident that recent progress towards greater animal welfare and policy will outlast this fur fad.¹⁷ This regression on acceptance of fur in our daily lives can be attributed to complacency, a return to fervent activism/campaigning is needed to combat this.



Image Credit: Andrew Skowron / We Animals Media

Image Credit: Umberto Fratini / Gorunway.com
For fashion brand Puppets and Puppets' latest runway show at New York Fashion Week, real, vintage fox fur was used in their Fall Ready-to-Wear '24 collection.¹⁸



Image Credit: Alexander McQueen
Alexander McQueen showcased larger-than-life synthetic mongolian sheep fur outerwear for their Fall 2024 Ready-to-Wear collection.¹⁹

WHAT MAKES FUR SPECIAL?



Image Credit: We Animals Media

Fur is a unique material from both a design and scientific perspective.

Diversity of Applications

- Fur has multiple applications including apparel such as coats, linings, and trims; accessories like bags, hats, ear muffs, scarves, boots (shell and lining), and keychains; and home products like blankets, throws, pillows, and rugs.
- Fur is one of the few materials which can simultaneously conjure luxury and rustic images. We may see ermine draped over the shoulders of kings and queens or envision the protective pelts worn on the American frontier. It is luxurious and warm. It can be playful or dramatic.

Elicits Emotion

- Perhaps no other material comes with such emotional attachments as fur. When we see a soft looking, long haired, or thick-pile fur, we have an involuntary urge to touch it. Our emotions are stirred; it speaks to us through our senses. Humans are drawn to fur, perhaps more than any other material. It seems to promise physical and emotional protection.
- How people see fur also varies widely and is an emotional subject. Some see fur as the height of luxury and aspiration while others see it as the ultimate human disregard for animal suffering.



Image Credit: Daniele La Malfa
Design Studio BLESS wrapped ordinary household cleaning products in leftover fur materials from fashion brand Fendi.

Variety of Aesthetics and Hand-Feel

- Animal-based fur comes from a variety of animals and thus is also available in a variety of colors, textures, and hand-feels. Some furs look exactly like the original coat from the animal while others are dyed in “natural” or unnatural bright fashion colors from pastel pink shearling to long haired Mongolian fur dyed fuschia. Fur’s texture can be curly like the sheared coat of a lamb or straight and silky like a rabbit. Patterns can appear to be sculpted into fur through patchwork, using multi-colors, changing direction of hair or nap within a finished product by piecing and, of course, trimming the hair to design specifications. Fur can also be printed to mimic a pinto horse or a cow to conjure a more rustic look.
- One cannot overlook the complexity and dimensionality of animal fur when trying to parse out why it is so special. Most animal furs are multi-layered – a short dense undercoat and a longer protective layer on top. Combined, these layers add visual diversity, appeal, depth of color and contribute to the overall handfeel experience.



Image Credit: Spectorfiona.



Image Credit: Bottega Veneta
Shoulder bag is realized in soft Mongolian sheepskin.

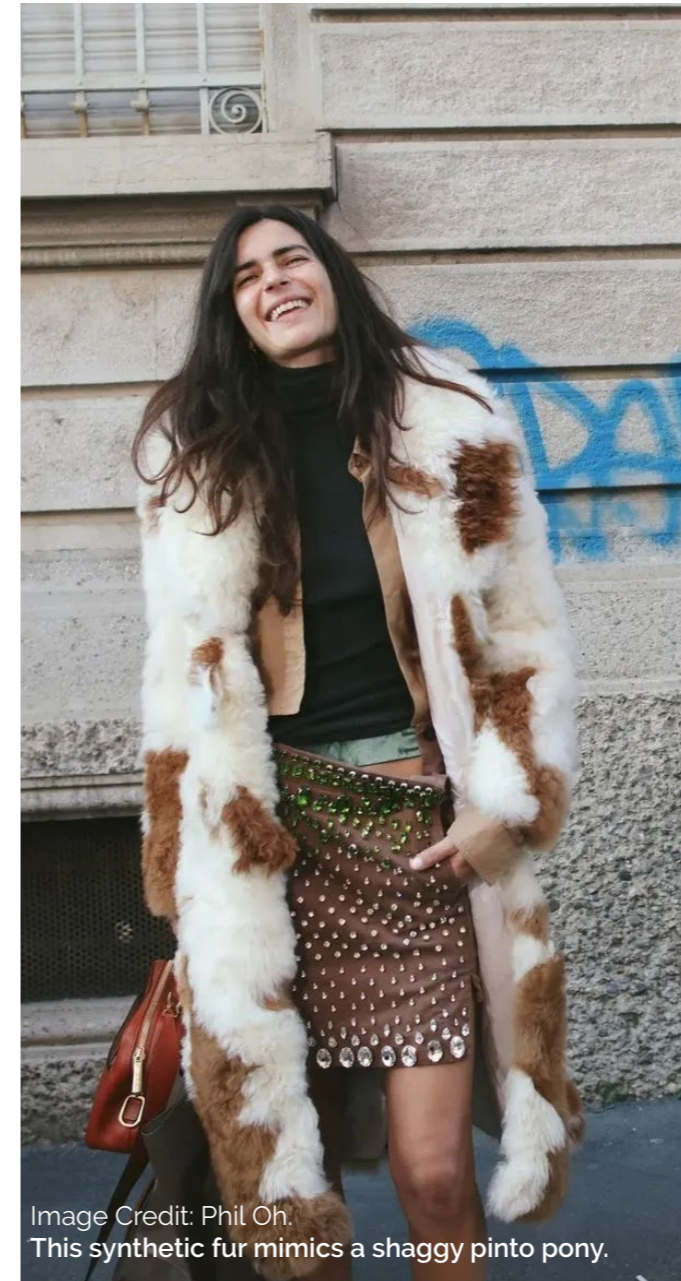


Image Credit: Phil Oh.
This synthetic fur mimics a shaggy pinto pony.



Image Credit: Adrienne Landau
Synthetic fox fur trapper hat

Functionality

- Fur is one of the most thermally insulating animal-based materials. It keeps the wearer both warm and dry.
- Animal-based fur can get wet, like getting caught in the rain, without concern for ruining the material. A true soaking requires a trip to the fur care professionals. Similarly, synthetic fur can also get wet and requires drying naturally in a warm and dry environment.
- Animal fur is naturally flame retardant while many synthetic furs require added flame retardants. Protein-based fibers like wool and fur have limited flammability and can often be exempt from flammability testing requirements.

Structure

- Fur contains both skin and fiber, unlike other animal-based materials which are either a skin or a fiber. Synthetic fur is a pile fabric which mimics this structure.

HOW CAN FUR BE IMPROVED?

As we have seen in the [“Why Next-Gen Materials”](#) section, animal-based fur and synthetic furs are rife with animal welfare and sustainability issues. Public perception is overwhelmingly against animal-based fur and animal rights advocates will continue to advocate for additional fur bans and moving consumer sentiment against fur. We have the opportunity through science and technology to develop new materials which mimic the valuable aspects of fur while also removing the negative externalities. There are also ways new material development can improve on the performance aspects of animal-based and synthetic fur.

Inefficient Sourcing and Manufacturing

- Animal-based fur is a highly inefficient process. In factory farms, the source of the vast majority of animal furs, the process requires the breeding, care, feeding, and slaughter of animals. In wild trapping, the system is even more inefficient, requiring extensive work in carrying large numbers of traps through the wilderness, laying traps for wild animals, monitoring those traps, and carrying the deceased animals back from the wild.
- Manufacturing fur products from small animals is also very inefficient and time intensive. It takes 150-300 chinchillas or 50-60 minks or 15-40 foxes to make a full length coat. There can be a lot of waste when using animals because the furrier will want the patterns to line up and have consistent color around the body. Needless to say, small parts of the animal – head and legs will also be waste as they are too small to use and the fur tends to be of a shorter length and different texture in those areas.^{1,2}

Fur’s Contribution to Global Pandemics

- During the Covid-19 pandemic, there was a great deal of culling due to disease concerns passing between animals and humans. This resulted in a decrease in the availability of mink and other furs. Up to 35% of the raw mink pelt trade was eliminated due to Covid-19 outbreaks at mink farms.³ Moving away from animal-based materials to plant-based sources will remove the risks to the supply chain and global health from pandemics and other zoonotic diseases.



Image Credit:
Jo-Anne
McArthur / We
Animals Media

Image Credit: Backgrid
Hailey Bieber steps out wearing a long-haired shearling jacket from Ferragamo.

Improvement on Performance Metrics

- Thermal properties are not practical for many climates - next-gen fur can tune performance properties using custom composition, thereby making fur less season specific.
- The properties of fur, such as strength and fiber length, are biologically determined by the species of animal and tanning process. Innovators are figuring out how to mimic these characteristics and expand beyond them, opening up the potential for more creativity and unique designs.

Extensive Care

- When cared for properly, animal fur is a high maintenance product. Animal hides can dry out and become fragile or brittle. Specialized cleaning professionals are always recommended for animal-based fur products. Next-gen fur can significantly reduce the care and maintenance required.

Expense

- Despite common misperceptions, animal-based fur is not a good investment. Fur products do not appreciate in value over time. In fact, they are much like cars or boats – they depreciate the moment you take them off the lot. They can lose 18-25% of their value annually.⁴ Through more efficient manufacturing, next-gen fur can be created to meet many price points.

Next-gen furs using sustainable and renewable inputs along with green chemistry will end the animal-cruelty associated with fur production and have the potential to decrease negative environmental impacts while meeting the desirable aspects of animal-based fur.

Animal-Based Fur Maintenance is High-Effort⁵

- Cold storage is recommended with a consistent temperature of 50-60°F/10-15°C and 45%- 55% humidity, this slows down the degradation process of fur.
- Furs should be wrapped in a cotton cloth with plenty of room between each garment. Plastic bags or crowded closets prevent air circulation causing the pelts to dry out or crack.
- Fur coats must be hung on a broad-shoulder, sturdy hanger in a non-cedar wood closet without mothballs, as these would dry out and damage the fur.
- If fur gets caught in a downpour and is completely soaked through, it will need immediate professional fur care.
- Mongolian lamb and long hair goat garments require a special combing process.
- Fur accessories such as hats, scarves and neck warmers require special cleaning attention to remove oils and make up.
- Mink requires cleaning every other year, a fur coat should be professionally cleaned and conditioned often, due to exposure to the elements and airborne pollutants, all of which can damage and degrade the fur. Dry cleaning is not recommended.



With the launch of their new 100% plant based product “FLUR”, Ecopel’s CEO Christopher Sarfati said “This is really a revolution for the market, and I believe more and more the customer who buys polyester or recycled polyester will move to this kind of product.” He anticipates that both animal welfare and environmental concerns will drive customer acquisition.



If a faux fur looks too much like animal fur – could one be called out by an animal lover? Living in NYC, I see the fur trend all over the streets of downtown Manhattan. The sidewalks serve as runways for the stylish. Some are obviously faux but, I must admit, I find myself squinting and staring for socially-unacceptable long amounts of time to glean if it is real or not. It is almost impossible to not consider the scenario of how or where that coat came from – vintage, re-sale, inherited, or a really great faux.”



Thomasine Dolan, Director of Materials Innovation and Design, MII



Image Credit: Jo-Anne McArthur / We Animals Media

Image Credit: Daniele Oberrauch / Gorunway.com
Miu Miu brushed shearling jacket, Fall 2024

KEY TARGETS FOR CREATING FUR

In order for next-gen fur to be successful, it needs to improve upon the existing material. While all next-gen furs should (by definition) have a lower environmental impact without the animal-cruelty, these factors alone are not sufficient for success. Next-gen furs must also improve on the performance attributes of fur and be cost-competitive.

Consumer research has found that status-seeking consumers want synthetic fur options to look as real as animal fur, and this type of consumer has a high purchase intention towards fur.¹

Environmental Targets

The structure and composition of the material should lead to an environmentally preferable product compared with incumbents. Focus on these key areas:

- Material inputs should be majority biobased or recycled.
- The product should be recyclable, biodegradable, or otherwise responsibly disposed of at end-of-life.
- Microfiber shedding and release should be mitigated as much as possible through design and manufacturing.
- Innovators should focus on green chemistry for dyes, additives, and treatments.
- Innovators should target reductions in carbon emissions, water use, and land use among other environmental impact categories during production.



Image Credit: Phil Oh
Two-tone synthetic fur clutch.



Image Credit: Moncler Grenoble

Tunability and Variety

It is critical for next-gen fur innovators to understand that to be successful they must be able to offer a portfolio of fur product offerings for adoption by brands. Animal-based and synthetic furs have a wide variety of colors, prints, patterns, textures, and lengths. Next-gen materials will need to meet this variety of options but also have the potential to expand beyond, akin to the novel colors and textures offered by current-gen synthetic fur. Brands can get frustrated when new solutions don't provide them the choices they are accustomed to. While brands may understand that innovation takes time, innovators will need to be thinking about meeting those expectations long-term. For this industry to succeed it will need a suite of pile fabrics offering the look, handfeel, and warmth of the incumbent textiles.

Color, Print, and Pattern:

- The textile must be able to accept non-toxic dyes without crocking, bleeding, or fading.
- On offer should be natural colors that mimic the animal and/or dyed fashion colors.
- Color tipping or piecing multi-color fur (like patchwork) can inspire design teams.

Textures:

- Luster, softness, and handfeel are critical attributes. The material should be similar to the incumbent animal or, at minimum, current-gen synthetic furs.
- Tight curls like shearling or loose silky curls like the hairs found in Mongolian sheep are always popular with fashion
- Low thick piles that are soft and velvety with dense fiber placement and sheared to one length, like beaver, are timeless and have broad product application.

Lengths and Diameter:

- Generally speaking, fibers need to be continuous filament, or of a long staple length to work as a pile.
- Innovators should consider the fiber diameter, length, taper, density (or placement of fibers) and texture needed to replicate the desired material.
- Fur comes in a variety of lengths. For example, rabbits, mink, and chinchillas have flat, short, shiny hairs. Foxes have long fine tapered hairs with a dense undercoat; and a raccoon's coat is long and thick with comparatively coarse hair.

Backings/linings

Pile fabrics, by necessity, have backings. One should always consider the end use or application for their material when choosing a backing and work with a manufacturing partner to confirm viability. Also consider how the backing will affect your product's sustainability goals/claims – biodegradability, recyclability, etc.

- It is important to understand how your material will be handled at the factory in order to be cut and sewn. The backing should be a stable textile that doesn't unravel easily.
- If your textile is to be used as a lining (potentially putting it against the wearer's skin), it is advisable to know if it is hypoallergenic and color safe (will not crock).
- Additionally, if it is to be used as a lining, breathability/moisture management should be similar to, or better than, the incumbent.

Elicit Emotion

The emotional appeal of fur should not be underestimated! As mentioned previously in this report, animal fur and incumbent synthetic furs are known to awaken human emotions. It starts with our eyes and then our brains quickly notify our fingers to touch.

- Performance is important of course, but give due focus and time to esthetics and haptics.
- Emotional attraction will drive the purchase – beginning with the brand and down to the consumer. A 2019 study of fur consumer behavior in Germany found that aesthetic appearance was the top purchase motivator for animal fur consumers, despite knowledge of fur scandals, followed by functionality.²
- Next-gen furs should be so inviting that it is hard not to touch!



Image Credit: Jo-Anne McArthur / Born Free Foundation / We Animals Media

Wear, Laundering, and Care

As discussed previously, animal-based fur has burdensome care requirements. Any improvement in reducing maintenance is an opportunity to improve on the product. The easier to maintain the better...and always include care instructions.

- Pleasant or no smell should come from the textile.
- Flame retardancy should meet international standards for specific applications.
- Having hypoallergenic properties is valuable when considering furs are often used as linings in coats and footwear or trim on hoods and in close proximity to skin.
- Thermal properties are usually expected when purchasing fur apparel and accessories.
- Consumers surveyed in China said the most sought-after qualities in animal fur are: functionality and warmth (top), appearance, and the material and feel of the product (bottom). Meanwhile, Chinese consumers who don't wear fur feel it is not functional or practical due to being too hot, not washable, and not suitable for daily wear.³
- Furs that can simply be 'shaken out' to reorganize and fluff the nap would be a plus.
- Reduce the need for specialist cleaning; home laundering is desirable.
- Reduce the need for special storage. It is critical to perform testing to ensure air, light, dust do not drastically alter the fur.

Consider a Variety of Applications

"Fur" is used to elevate and add novelty to home and fashion collections. The great variety of fur in the marketplace captures many different end uses and innovators should explore these broad applications.

- Home goods include blankets, rugs, pillow shams, and bedding.
- Fashion and accessories capture a wide array of products for men and women in the luxury and mass markets.
- The outdoor apparel market should be a primary target for using environmentally preferable textiles.
- Childrens apparel, furnishings and toys are often overlooked. They have great potential for next-gen adoption.

Remember Your Manufacturing Partner

Next-gen and synthetic fur fabrics are highly specialized. When creating a next-gen fur textile, remember that animal furs often have multi-lengths and multi-layers of hair that add to its luxuriousness and performance. Therefore, it is important to find a manufacturing partner practiced in this textile set up.

- Development work will be accelerated if working with a fur manufacturing partner.
- Tapping into existing synthetic fur manufacturing increases the possibility of a quicker scale-up and brand adoption.
- Manufacturing partners will be able to address if properties such as tensile strength and crocking are sufficient for manufacturing and garment use requirements.
- Identify cut and sew factory partners early on to ensure your textile can successfully go through the existing cut/sew/trim process.

MARKET OPPORTUNITY AND WHITE SPACES

Market Opportunity

Interest in next-gen materials is growing in all sectors. Despite global VC funding falling 42% and deal count falling 30% to reach a 6-year low in 2023, funding for next-gen materials companies increased.¹ The next-gen materials industry enjoyed a 10% rise in investment funding in 2023, showing significantly higher investments than the general market.² Of the 141 companies, the majority (92) work on biomimicry of animal leather and exotic skins. Twenty-four (24) work on biomimicry of silk, sixteen (16) on wool, fourteen (14) on down, and seven (7) on fur.³ Note that some companies work on more than one material and thus the total by material will be higher than the total number of companies.

State of the next-gen material industry at a glance (2023)

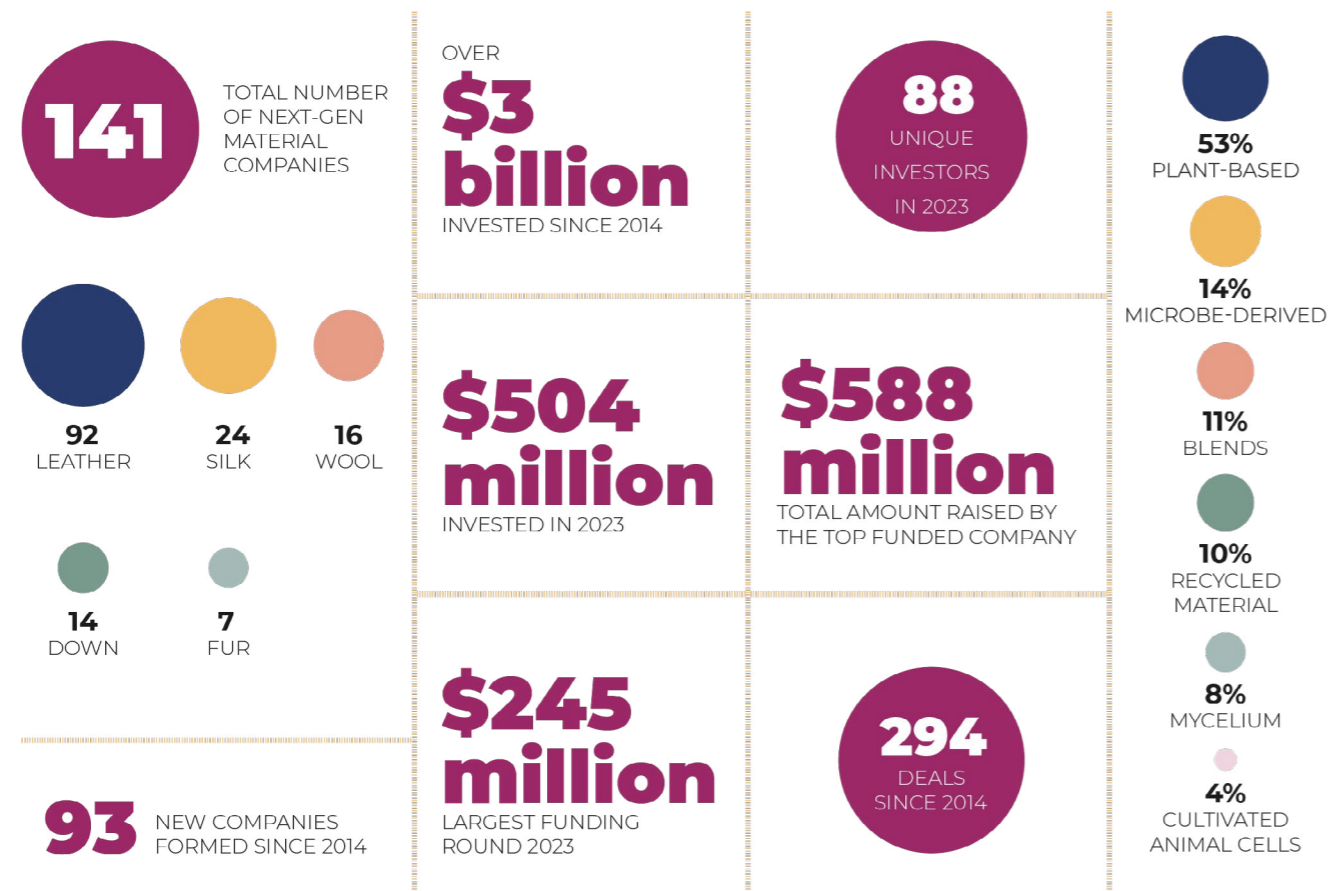


Fig. 17. State of the Next-Gen Materials Industry at a glance 2023

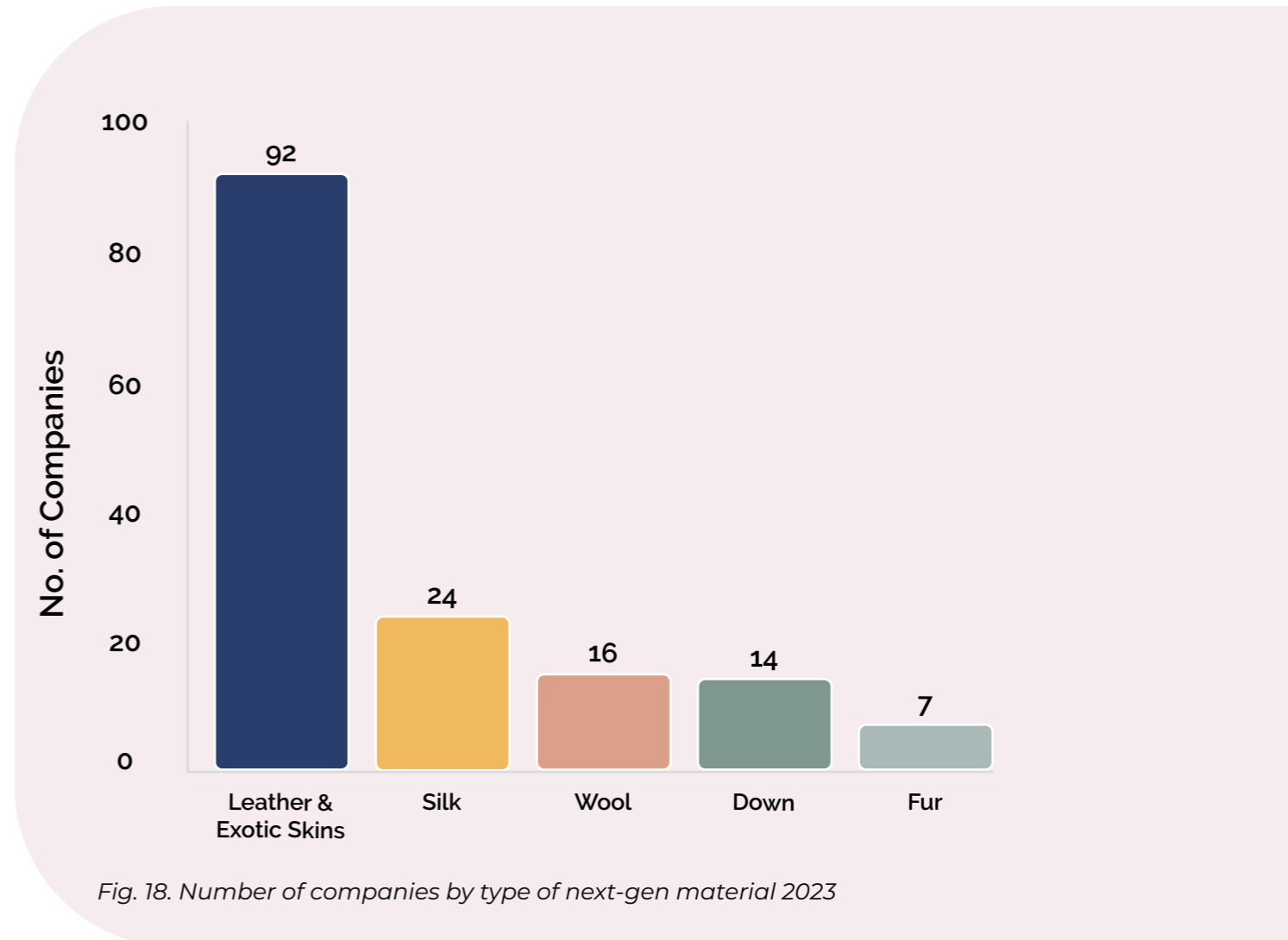


Fig. 18. Number of companies by type of next-gen material 2023

Synthetic Fur Market Is Growing

As we saw in earlier sections of this report, public perception is clearly against animal-based fur and this sentiment deepens the more consumers learn about issues surrounding the lack of animal welfare. This anti-fur mentality along with numerous bans on production and sale of animal-based fur has led to a market decline.⁴ The global production of mink, fox, raccoon dog and other fur animals has fallen from an estimated 140 million in 2014 to 42 million fur animals in 2021.⁵

While synthetic furs are rife with environmental concerns, the public is less aware of these issues. Given the unique and desirable attributes of fur, combined with this lack of awareness on environmental impact, the synthetic fur market is growing, estimated at \$25 billion in 2022, and expected to expand at a CAGR of 8.8% between 2023 and 2031.^{6,7}

Unique to many other materials used in the fashion industry, fur is a high value raw material. As we discussed in MII's White Space Analysis Report, it would be wise for innovators to target these luxury market segments, which offer more potential for profit margins while meeting price parity with incumbents.⁸

Fur Prices

Fur is a luxury material with high price points per unit. This presents a unique opportunity for next-gen innovators to realistically match or undercut prices to compete with the incumbents.⁹

Synthetic fur can have a wide range of prices per yard - from around \$15 a yard to \$70 a yard for higher end synthetic furs.¹⁰



\$10 - \$25
per pelt¹¹

Image Credit: Seb Alex / We Animals Media



\$60 - \$100
per pelt¹²

Image Credit: Andrew Skowron / We Animals Media



\$50 - \$150
per pelt¹⁴

Image Credit: Christian Musat



\$100 - \$150
per pelt¹⁶

Image Credit: Randall Davis



\$80 - \$90
per pelt¹³

Image Credit: Jo-Anne McArthur / We Animals Media



\$40 - \$269
per pelt¹⁵

Image Credit: Andrew Skowron / We Animals Media

Opportunity: Variety of Species

Animal-based fur is currently limited to a few species which are easy to contain in factory farms or are legal to trap in the wild. Without these limitations, next-gen technology could aim to mimic numerous species which are currently unavailable on the market, without harming animals. Below are a few interesting biomimicry opportunities:

- Polar bear fur - here their hollow fibers serve as super insulators trapping air, and their black skin absorbs this light as heat. Innovators could design performance outerwear to mimic this structure for cold weather sports.¹⁷
- Musk ox - their super dense underfur allows them to survive very cold climates. Innovators could be inspired to mimic these fine, dense coats for optimal insulation.¹⁸
- Aquatic mammals like sea otters have unique ovular, interlocking hairs that provide extra waterproofing features. Innovators could tackle moisture management by mimicking these structures.¹⁹



Avg. \$150
per pelt²⁰

Image Credit: Keith Williams / Flickr



\$70 - \$170
per pelt²¹

Image Credit: @takashi_okashi



Over \$1000
for a single
pelt²²

Image Credit: Jo-Anne McArthur / We Animals Media



Image Credit: Salvatore Dragone / Gorunway.com
 Dolce & Gabbana presented a faux leopard fur coat and matching hat for their Fall 2024 Ready-to-wear collection.

White Spaces

Like with all next-gen textiles and fibers, the innovators must seek out environmentally friendly inputs, chemistries, and dyes. They will need to seek out manufacturing partners for proof of concept, feedback, and scalability. Beyond these core challenges that apply to the entire sustainable textile industry, there are some unique challenges that next-gen fur innovators will need to address:

Variety/Tunability

- As discussed in the previous section, matching the variety of animal furs and current gen synthetic furs is a broad challenge. It can be difficult enough to create one viable next-gen product offering, let alone the dozens of options expected of fur. Brands will want choice and customization opportunities to meet their esthetics and innovators will have to plan for these offerings even at early stages of development.

Softeners/Finishing

- If needed, it can be difficult to source sustainable versions of softeners and finishing agents which can be critical to the handfeel and performance of fur. Softeners are often derived from silicones or other fossil-based chemistries which may offer negative environmental impacts and toxicological concerns.

Flammability

- Another factor to consider is flammability. The choice of material input will determine whether flame retardants will need to be added - which can be hazardous and costly. For example, cellulose-rich fibers

like cotton, linen, and viscose are some of the most flammable fibers, while protein-based fibers like wool and fur have limited flammability, and can often be exempt from flammability testing requirements. Synthetics like polyester, acrylic, and nylon often fall in intermediate flammability levels. Modacrylic is the exemption - this synthetic can be exempt from flammability testing as it is difficult to ignite.²³

- Different industries (home, automotive, apparel, children's apparel, toys) and different geographical locations (e.g., US versus EU) may have different flame resistant/retardant requirements.

Microfiber Shedding

- Current synthetic furs are made from fossil-derived plastics like polyester, modacrylic, and acrylic. It is widely known that these shed, particularly when arranged in pile fabrics. For example, in recent studies, polar fleece fabrics (which are functionally similar to synthetic fur) shed 7000 fibers/m²/L, which may be owed to the structure and manufacturing of the pile fabric.²⁴
- Next-gen innovators should focus on materials selection and manufacturing innovation which mitigates microfiber shedding and pollution.

NEXT-GEN FUR INNOVATORS

Image Credit: BioFluff
BioFluff's Savian "Pecora" fur sample

B
I O
F L
U F F

BIOFLUFF

Material: Savian

Founder(s): Martin Stüebler, Roni Gamzon, Steven Usdan

Year Founded: 2022

HQ: USA, France

Category: Plant Derived

B2B/B2C: B2B

Stage: Early-stage commercial

Website: <https://bio-fluff.com/>

BioFluff is a biomaterials company that is creating 100% plant-based and biodegradable materials to replace animal-based and synthetic furs. Their flagship material, SAVIAN, is produced in Italy and can be used in apparel, outerwear, and handbags. SAVIAN is thermo-regulating, hypoallergenic, and has moisture absorption and moisture-wicking properties to create breathability and comfort.

BioFluff's provisional patented technology uses plant fibers from several unusual plants and agricultural waste. Their feedstock does not interfere with food supplies. These feedstocks are augmented in a pre-treatment process to extract technical fibers. Through this process they are able to tune the fibers to mimic animal hair in length, shape, softness, and durability. These fibers are assembled with minor retrofitting of existing mechanical processes to mimic different types of fur and shearling.

As BioFluff grows, they expect to offer diverse product lines including luxury/premium textiles, as well as toys and packaging alternatives.

BioFluff has worked with Ganni and Stella McCartney. They participated in a proof of concept collection called Everloop that featured a SAVIAN next-gen fur 'sweater' debuted at Première Vision 2023.

BioFluff was the youngest start-up to be nominated for the LVMH Innovation Award in 2022.



Image Credit: Stella McCartney



Image Credit: BioFluff



Image Credit: Positive Materials



Image Credit: DevoHome
Produced industrially in large quantities.



Image Credit: DevoHome
DevoHome exhibit



DEVOHOME

Material: Hemp Fur
Founder(s): Oksana Devoe
Year Founded: 2008
HQ: Ukraine
Category: Plant Derived
B2B or B2C: Both
Stage: Commercial
Website: <https://devohome.com/>



Image Credit: DevoHome

DevoHome is a Ukrainian hemp textile producer making a plant-based fabric called Hemp Fur which resembles natural sheep wool and can be used as an alternative to animal and synthetic furs. Hemp Fur is 100% natural and biodegradable, antibacterial, hypoallergenic, thermo regulating, and animal free. Devo Hemp Fur mimics the structure of some animal furs by making a short underlayer and a longer top layer. These multi-length layers help to create warmth for the wearer. Hemp Fur can be used in both fashion and home goods products.

Industrial hemp is grown in Ukraine without pesticides or herbicides and requires very little water. After harvesting, hemp fiber is split into cord and fiber: long fibers are used for hemp fiber, short are used as filler or non-woven mats for blankets.

Composition:

Hemp fiber – 50%
 Viscose – 50%
 Knitted base – 100% cotton
 Glue- starch
 Weight: 319 gr/m²
 Dencity: 475 gr/m²

ECOPEL™

ECOPEL

Materials: KOBA®, KOBA® new generation, Cannaba Wool and FLUR

Founder(s): Gérard and Christopher Sarfati

Year Founded: 2004

HQ: Shanghai

Category: Recycled and Plant Derived

B2B or B2C: B2B

Stage: Commercial

Website: <https://www.ecopel.com/koba---bio-based-faux-fur.html>

Ecopel is a global next-gen fur textile and apparel manufacturer with a vertically integrated supply chain. The KOBA® portfolio of next-gen furs include a range of fur textiles with different characteristics and inputs. Their collaboration with CovationBio™ Sorona fibers (made from corn waste) resulted in the first 37% bio-based fur available on the market. It claims a 30% energy reduction and 63% GHG emission reduction compared to nylon 6 (at fiber level).

Additional product offerings are:

- KOBA® new generation – 100% bio-based
- FLUR® – 100% plant based
- Cannaba wool – hemp and re-poly

Ecopel Faux Fur sourcing currently includes 50% preferred fibers with plans to reach 100% in the coming years. They use recycled inputs and have been developing new technologies using plants and more sustainable fibers. Ecopel product claims are natural touch, high thermal insulation, and easy care. Ecopel is a GRS certified company. In a project initiated by Kering, they have started trials with Dyecoo and have created a water-less dyed faux fur (teddy style) made in recycled polyester using the Dyecoo technology.

Ecopel has supplied next-gen furs for Stella McCartney, Kering Group, Vanessa Bruno, Sézane.

Ecopel's furs are suitable for fashion, accessories, and home.

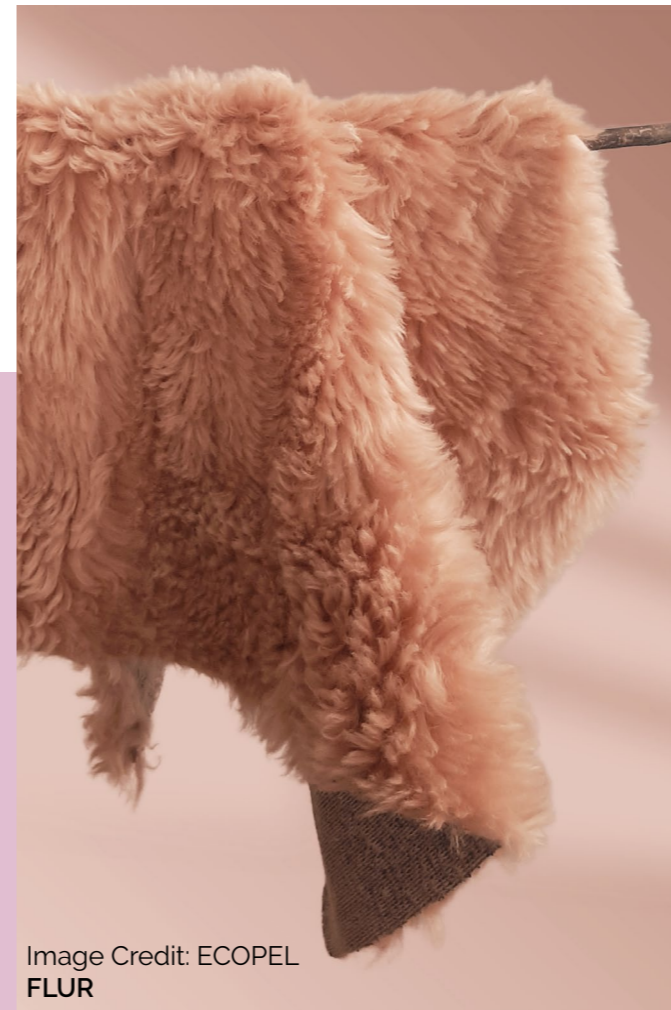


Image Credit: ECOPEL
FLUR



Image Credit: ECOPEL
KOBA New Generation



Image Credit: ECOPEL
Cannaba Wool



Image Credit: ECOPEL
KOBA



Image Credits: Biofur



BIOFUR®

BIOFUR®

Material: Biofur®

Founder(s): Kym Canter working in partnership with Concept III, Senbis Polymer Innovations, Nice Gain

Year Founded: 2023

HQ: USA

Category: Plant Derived

B2B or B2C: B2B

Stage: R+D

Website: Biofurworld.com

BIOFUR® is a recently developed 100% bio based and 100% compostable replacement for animal and synthetic pile textiles. In collaboration with partners in the US, Europe, and Asia, BIOFUR® is shifting the entire value chain to a sustainable and bio-oriented direction which includes the use of bio color pigments, 100% bio coatings and backing yarns. BIOFUR® is in the process of securing 100% bio based certification in Europe and the USA and is on target to begin scalable production later in 2024.

Biofur is focused on creating bio based textiles for fashion, lifestyle, and performance industries.





Image Credit: UGG



LENZING

Fiber: TENCEL™ Lyocell

Year Founded: 2004 Lenzing acquires TENCEL™ brand

HQ: Austria

Category: Plant Derived

B2B or B2C: B2B

Stage: Commercial

Website: <https://www.lenzing.com/products/tencel™>

Lenzing is a cellulose fiber company whose fibers have been used in next-gen fur applications. TENCEL™ Lyocell fibers are USDA Certified Biobased Products and contain 100% USDA Certified Biobased Content made from natural and renewable wood meeting FSC® or PEFC standards[i]. They have been recognized as one of the best performing companies worldwide in Canopy's Hot Button Report in 2023.

Lenzing experts teamed up with UGG mill partners to create a plush pile fur for the "Fuzz Sugar" collection. The Plant Power Collection is made from plant-based, bio-based, and reclaimed materials (82% TENCEL™ Lyocell / 18% recycled polyester).

Lenzing practices a closed loop system for their chemicals so they can be returned to the production process and not the environment.

Their fibers are found in textiles used for fashion, accessories, and footwear.



Image Credit: Kuura by Metsä Spring



Image Credit: Kuura by Metsä Spring



METSÄ SPRING

Fiber: Kuura
Year Founded: 2018
HQ: Finland
Category: Plant Derived
B2B or B2C: B2B
Stage: R+D
Website: <https://www.kuura.io/>

Metsä Spring is Metsä Group's innovation company that develops new businesses related to wood-based value chains. Metsä Spring is using Metsä Group's softwood pulp to produce the Kuura textile cellulose fiber for the fashion industry. The wood used in the production of Kuura is sourced from the renewable forests surrounding the Metsä Group bioproduct mill in Äänekoski, Finland. Their raw materials are 100% traceable.

The company has partnered with Japanese textile company Itochu to develop shearling-like materials. Itochu and Kuura by Metsä Spring have been in development for several years.



Image Credit: Kuura by Metsä Spring

Spiber

SPIBER

Fiber: Brewed Protein™

Founder(s): Kazuhide Sekiyama, Junichi Sugahara

Year Founded: 2007

HQ: Japan

Category: Microbe derived

B2B or B2C: B2B

Stage: Commercial

Website: <https://spiber.inc/en/>

Spiber is a protein fiber company that works with brand and manufacturing partners to create next-gen textiles. Their proprietary fiber can be used on its own or blended with other environmentally preferred fibers.

Through key partnerships and collaborations, Brewed Protein™ fiber has the potential to create fur-like textiles. They have had several successful partnerships blending their proprietary protein fibers with a range of cellulosic, biosynthetic, and other fiber types. They are actively engaged in developing and creating alternatives to fur using their Brewed Protein™ fiber.



Image Credit: Spiber Inc.
Spiber materials



Image Credit: Spiber Inc.
Spiber Brewed Protein™ staple fiber fluff

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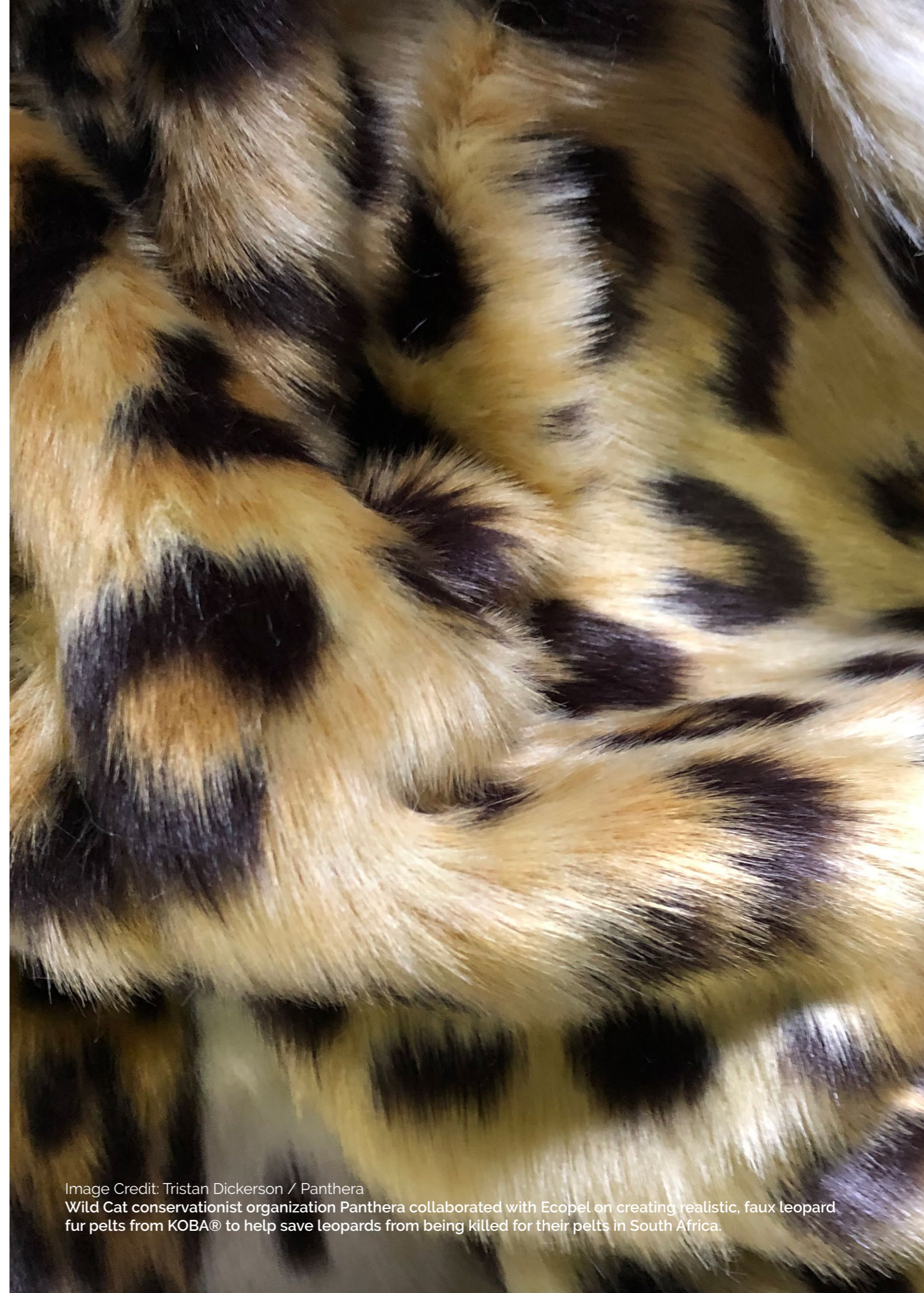


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Wild Cat conservationist organization Panthera collaborated with Ecopel on creating realistic, faux leopard fur pelts from KOBA® to help save leopards from being killed for their pelts in South Africa.

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About MII

The Material Innovation Initiative is a nonprofit think tank that accelerates the development of high-performance, animal-free, and environmentally preferred materials with a focus on replacing silk, wool, down, fur, and leather and their synthetic alternatives. We advance the next-gen materials revolution by connecting science and big ideas. We focus on research, knowledge-sharing, and fostering connections to fast-track the development of environmentally preferable and animal-free materials.

We work to cultivate a global market for next-gen materials across the fashion, automotive, and home goods industries. We work for materials that can do more while requiring less of the planet, animals, and people involved at every stage.

We imagine a circular future where the default choice for your sweater, sneaker, or seat is humane and sustainable. A future where animals are allowed to live free and thrive, the planet is saved from pollution and degradation, and workers are treated fairly and with respect.

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