

Regenerative garment design within a Colorado Fibershed

Katie Miller, Sonali Diddi, Kristen Morris, Colorado State University, USA

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Contextual Review & Design Concept: This project sought to design and prototype a size-inclusive locally-grown wool wrap dress inspired by the Indigenous mindset of maintaining a mutually beneficial relationship with the Earth (Kimmerer, 2013). This mindset was implemented via the Fibershed approach, a circular ‘soil-to-soil’ approach to locally producing garments that can be composted to enhance soil health at the end of their lifecycle (Fibershed, 2020). By creating clothing within regional regenerative fiber systems (i.e. ‘Fibersheds’), the Fibershed approach aims to create clothing in a manner that benefits the environment. This is illustrated below in Figure 1, which diagrams the regenerative Fibershed approach of enriching soil health and sequestering carbon through each production-consumption cycle. The Fibershed approach falls within the Circular Economy (CE) model, in which systems are cyclical and regenerative (Geissdoerfer et al., 2017). This model (Figure 1) aims to transition from the current “make-take-use-dispose” economy to a closed-loop economy that benefits the environment by adhering to four main principles: (1) designing out waste, (2) keeping products and materials in use, (3) regenerating natural systems, and (4) radically improving recycling (Morlet et al., 2017). The Fibershed approach ties the concept of CE to a specific, regional level. There is evidence to support that this local CE approach is more beneficial to the environment than our current global approach, as the transition from non-domestic manufacturing to local manufacturing has been shown to reduce emissions from production and transportation (Ashby, 2016).

This has been found to hold true when specifically examined in the context of the apparel industry (Sirilertsuwan et al., 2018). In addition to environmental benefits, Fibersheds represent a way to design for greater connection between people and product. This connection may help consumers make choices that positively impact places that are meaningful to them, such as their local Fibersheds. By using place to foster person-product attachments to clothing and reduce less meaningful consumption, we can extend garment lifespans and reduce the large number of garments that end up in landfills annually (Loureiro & Hine, 2002; Niinimäki & Armstrong, 2013; Sullins, 2014). Inspired by this potential, this project prototyped a garment in Colorado using the Fibershed approach. To do so, three shades of locally grown and locally milled yarn (80:20 Corriedale wool:Huacaya alpaca blends) were sourced from within a 20-mile radius and used to handweave a wrap dress. Comprised entirely of naturally colored animal fiber, the dress was created to be 100%



Figure 1. A Fibershed approach consists of: a) enriching soil and sequestering carbon, b) regenerative fiber farming, c) ethical manufacturing, d) circular design and construction, e) use, and f) composting.

biodegradable and soil-enhancing when composted (i.e. regenerative), allowing it to renew the Fibershed it came from.

Aesthetic Properties and Visual Impact: In line with the CE principle of keeping products and materials in use, the garment type and aesthetics were designed to translate across age ranges and to be appropriate across a range of settings. A wrap dress design was chosen as it can be worn as a dress or as a cardigan, both of which are size inclusive options (to accommodate for weight fluctuations) that can be dressed-up or dressed down depending on the occasion. The natural greys of the locally sourced yarn were chosen partially for their lovely neutrality that can easily be paired with many different colors. The design also offers the wearer visual customization, as the sleeves can be gathered at the wrist (as shown in Figure 2) or open (as shown in garment images) and the garment can be worn tied as a wrap dress or un-tied as a cardigan. The fabric was handwoven in a plain-weave structure for maximum durability with decorative hand-manipulated lace details woven near the wrists and collarbones.

Process, Technique, and Execution: In line with the CE principle of designing out waste, this project used zero-waste methods to eliminate waste from the design process. This project used CLO3D to digitally simulate the pattern-making and fitting processes – avoiding the excessive water and raw material waste that is typically generated during these processes (see Figure 2) (Nissen & Nerup, 2020). After the design was finalized, the fabric was handwoven on a four-shaft floor loom to exact specifications of the CLO3D-generated pattern. This resulted in precisely the amount of fabric needed for garment production. Once woven, the garment was constructed with zero-waste finishing techniques that used the ‘warp-waste’ to connect and finish garment edges.



Figure 2. CLO3D render of garment.

The prototype was evaluated on how well it embodies the principles of the CE model (derived from the 2017 report by Morlet et al. on CE in the fashion industry) using a rubric completed by three professors with expertise in design scholarship and/or CE in the fashion industry. Their assessment concluded that the garment embodied the CE principles of (1) designing out waste and (2) regenerating natural systems due to the zero-waste design methodology employed and use of entirely renewable regenerative resources. The principles of (3) keeping products and materials in use and (4) radically improving recycling were assessed to be less fully embodied by the prototype, feedback that will be used to inform and refine future regenerative design work.

Design Contribution and Innovation: Overall, this project represents a regenerative garment designed using the Fibershed approach. Its connection to its Fibershed means it may have a longer lifecycle than conventionally sourced garments, and it can be used as nutrient-rich compost at the end of that lifecycle. Ultimately, it can be returned to the local environment it came from in accordance with the mindset of maintaining a mutually beneficial relationship with the Earth.

References

- Ashby, A. (2016). From global to local: reshoring for sustainability. *Operations Management Research*, 9(3–4). <https://doi.org/10.1007/s12063-016-0117-9>
- Fibershed. (2020). *Our Mission & Vision*. Fibershed. Retrieved 2021, from <https://Fibershed.org/about/>
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, 143. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- Kimmerer, R. W. (2013). *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Milkweed Editions.
- Loureiro, M., & Hine, S. (2002). Discovering niche markets: a comparison of consumer willingness to pay for local (Colorado grown), organic, and GMO-free products. *Journal of Agricultural and Applied Economics*, 34(3).
- Morlet, A., Opsomer, R., Herrmann, S., Balmond, L., Gillet, C., & Fuchs, L. (2017). *A new textiles economy: Redesigning fashion's future*. Retrieved 2021, from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report_Updated_1-12-17.pdf
- Niinimäki, K., & Armstrong, C. (2013). From pleasure in use to preservation of meaningful memories: A closer look at the sustainability of clothing via longevity and attachment. *International Journal of Fashion Design, Technology and Education*, 6(3), 190–199. <https://doi.org/10.1080/17543266.2013.825737>
- Nissen, B., & Nerup, L. (2020). Using 3D Apparel Visualisation and Teaching to Develop New Skills and Possibilities [E-book]. In *Fashion at a Turning Point* (pp. 55–62). KEA - Copenhagen School of Design and Technology.
- Sirilertsuwan, P., Ekwall, D., & Hjelmgren, D. (2018). Proximity manufacturing for enhancing clothing supply chain sustainability. *The International Journal of Logistics Management*, 29(4). <https://doi.org/10.1108/IJLM-09-2017-0233>
- Sullins, M. (2014). Zia Taqueria: Building a local supply chain in Southwestern Colorado. *Journal of Food Distribution Research*, 45(3).

