

OVIS VERSATILIS
ICELANDIC SHEEP FARM AS LAND ART MUSEUM AS EVOLUTION LAB

A Thesis Submitted to the Department of Landscape Architecture,
Harvard University Graduate School of Design

by

Joanne Li

In Partial Fulfillment of the Requirements for the Degree of

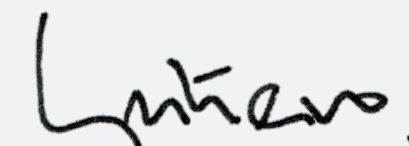
MASTER IN LANDSCAPE ARCHITECTURE

May 2021

The author hereby grants Harvard University permission to reproduce and distribute copies of this
Thesis, in whole or in part, for educational Purposes.



Student: Joanne Zhenheng Li



Advisor: Sergio Lopez-Pineiro

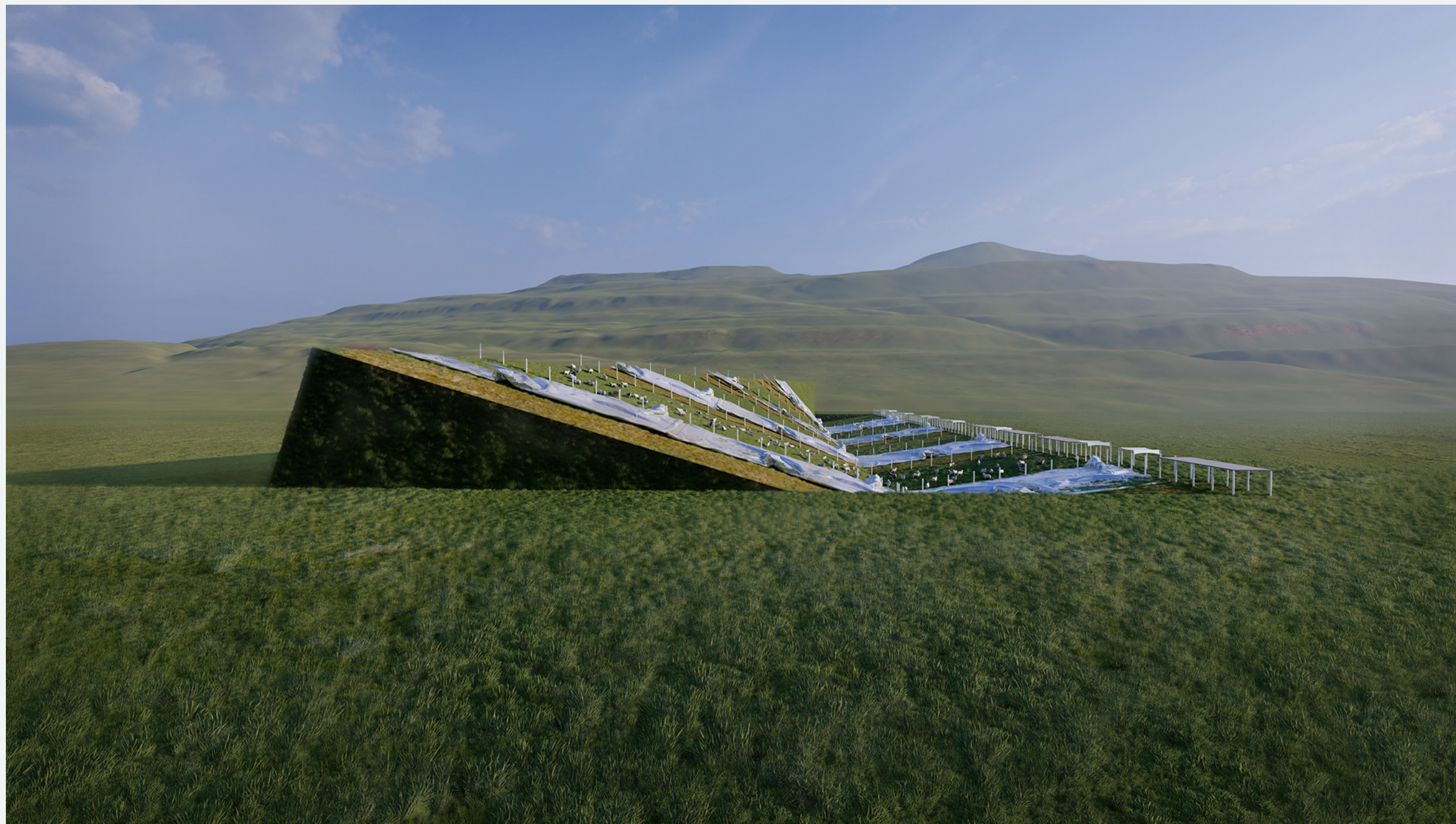


OVIS VERSATILIS

ICELANDIC SHEEP FARM AS LAND ART MUSEUM AS
EVOLUTION LAB

JOANNE ZHENHENG LI

ADVISED BY SERGIO LOPEZ-PINEIRO



ABSTRACT

This thesis explores the role of evolutionary biology in landscape architecture, examining designed landscapes as potential drivers for species evolution. It argues that any landscape design makes direct and immediate impacts on the fitness level of the inhabiting species. Therefore, landscape designs need to consider evolutionary consequences at longer time scales. The proposal focuses on the evolution of Icelandic sheep (*Ovis aries*) and designs a sheep farm network that serves as a land art museum and evolution lab in a northern Icelandic valley. The farm consists of an assemblage of landforms with farming and lab infrastructures designed for sustainable sheep farming, ecological restoration, and sublime visiting experience. The purpose is to create resilient sheep herds (*Ovis versatilis*, the fictional Latin name for the new sheep species) and revive the sheep farming industry, while generating an iconic cultural landscape that celebrates the cultural, economic, and ecological sheep farming traditions of Iceland.

CHAPTER I OVIS ARIES

- The Icelandic Farming System
- Individual Aesthetics vs Evolution
- Icelandic Sheep Crises



In 1995, a couple rented 50-hectare of farmland in a northern Icelandic valley called Skagafjörður and started their sheep farming business with 33 Icelandic sheep. Sheep was the number one meat source in Iceland at the time, and the future looked bright.

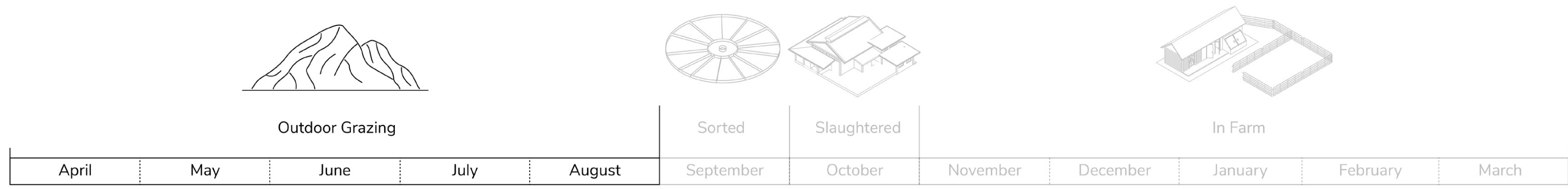
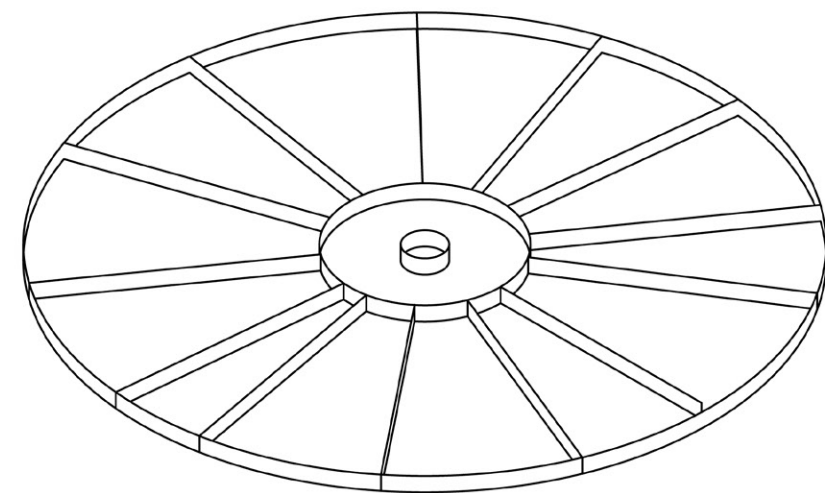
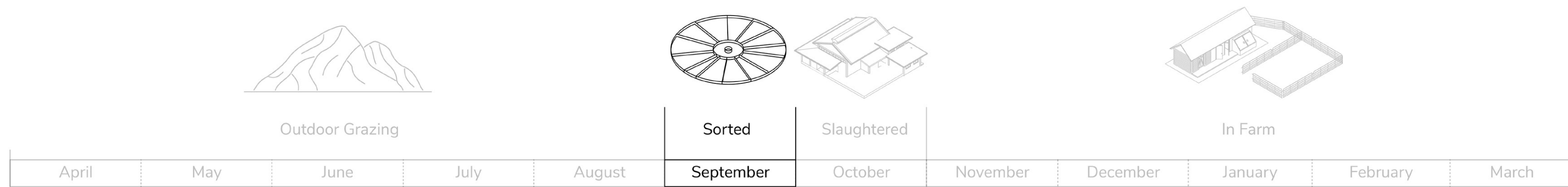


Figure 1 Icelandic Sheep Grazing in Valley

In spring and summer, they release the sheep into the valley and let them graze freely.

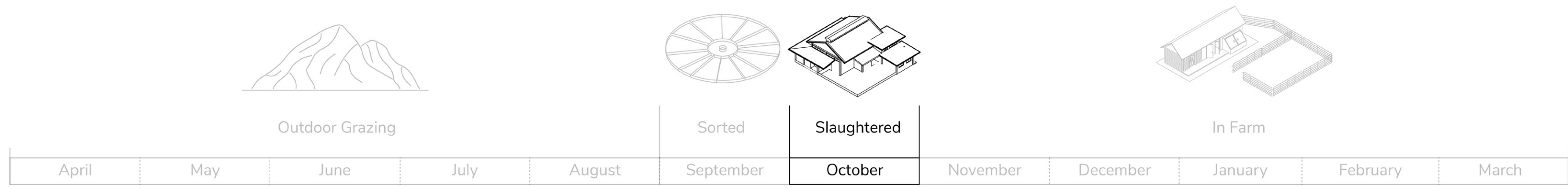


Sorting Ring



Figure 2 The Sorting Ring

In September, they collect the sheep into the sorting ring. Sheep start in the center of the ring before farmers sort the sheep into their own sections of the grid.



In the fall, sheep are sent to slaughterhouses, or to be bred for their good genes.

Figure 3 Slaughter House, Figure 4 Sheep Weighing before Slaughter, Figure 5 Carcass Rack

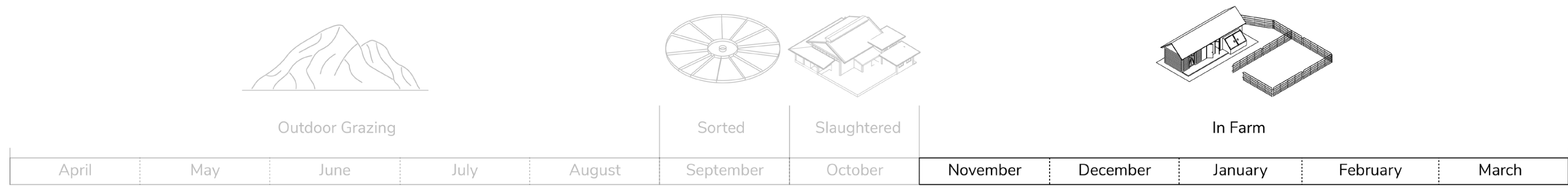
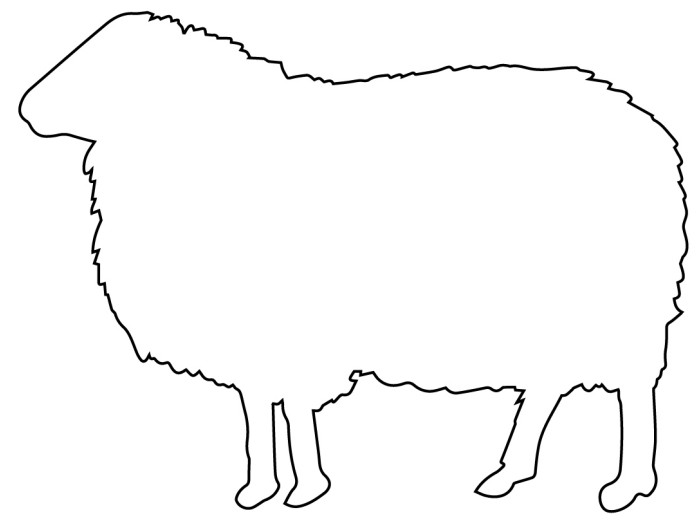


Figure 6 Icelandic Sheep Farm

The rest of the sheep are housed on the farm during winter.



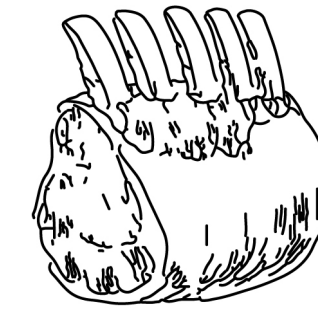
10th Century: Vikings introduced sheep

10th - 21st Century
Evolution



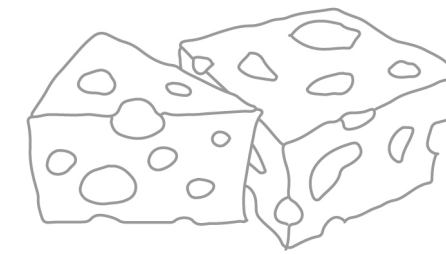
Ovis aries
Icelandic Sheep

Evolution Purpose



Current Market Demand

High in Muscle, Low in Fat



Farmers have been breeding Icelandic sheep since the 10 century, when the Vikings introduced sheep to Iceland. Sheep evolved based on the farmers' needs. Today, farmers breed sheep based on the commercial trends, to produce meat high in muscle and low in fat.



Figure 7-10 Amazon Forest's Birds of Paradise

The sheep is an example of evolution based on human selection. In nature, animals mate freely and evolve features they appreciate, like the extreme coloring or showy behavior of the Amazon forest's birds of paradise.



Wild Bighorn Sheep



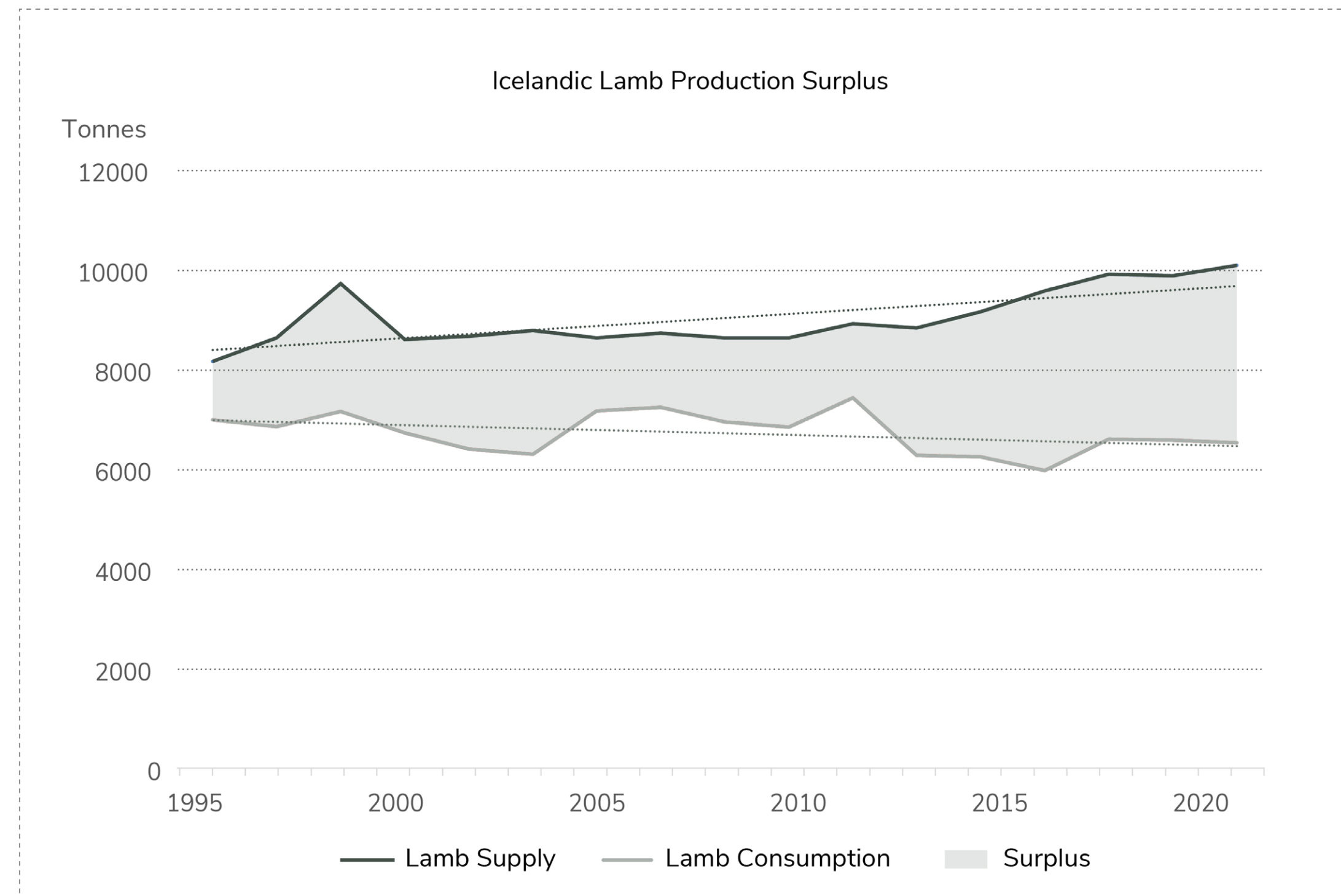
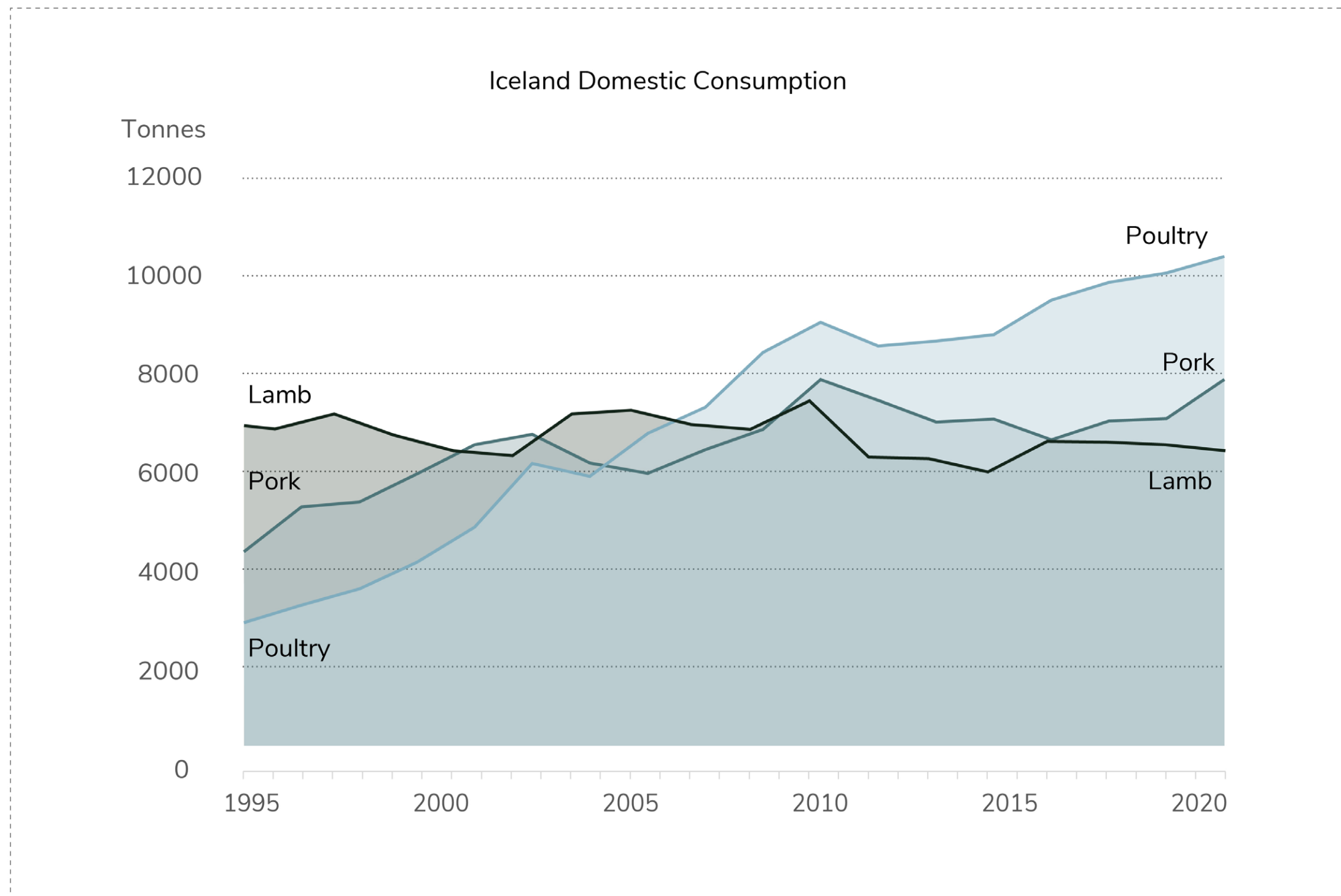
Icelandic Sheep

Icelandic sheep, on the other hand, are bred for meat, wool, milk, and for companionship. Compared with their wild equivalents they have a larger head-body ratio and more voluminous wool, so they look tame. Humans breed them to grow fast so they can be slaughtered for meat at an early age. As a result, Icelandic sheep have evolved to eat as much food as quickly as possible. However, this causes a mismatch between the resulting animal and the Icelandic ecosystem.



Figure 13-15 Icelandic Barren Landscape

Icelandic sheep's rapid growth makes them chew down everything they can find when they are released into the valley to forage on grasses. There isn't enough natural grasses in the valley to satisfy the sheep, so Iceland now faces a serious ecological crisis.



Export data from union of slaughterhouses and HS export data.

Moreover, Icelandic sheep is not as popular today as it had been. When the couple started the Icelandic sheep business in 1995, they hadn't imagined that 20 years later, lamb would become the least favored meat compared to imported pork and poultry. Lamb is also expensive, contributing to a massive surplus in lamb production.

Soil erosion and land use policy in Iceland in relation to sheep grazing and government subsidies[☆]

O. Arnalds^{a,*}, B.H. Barkarson^b

^a Agricultural Research Institute, 112 Reykjavik, Iceland
^b Soil Conservation Service, Gunnarsholt, 851 Hella, Iceland

There are about 1950 sheep farms in Iceland (FAI, 2001). Most of them also have dairy cows. Increasing numbers of sheep farmers have other sources of income through off-farm employment. All recent contracts made between sheep farmers and the government have emphasized more economical production by reducing the number of sheep producers and increasing the farm size. Considerable resources have been used to buy farmers out of business. There was sharp decrease in the number of sheep after 1980, but this trend halted after about 1992. However, farms have become bigger; the average number of sheep per farm has increased by 13.4% since 1995, from 142 to 161 winterfed ewes (FAI, 2001; note that many of these farms also have dairy production). The subsidies are about half of the income of the sheep production industry.

Iceland's Looming Sheep Crisis

Published August 28, 2017



Words by
Andie Soehla Fontaine
Photo by
Art Bicnick

One explanation would be the Progressive Party. This political party, which has been around for over a century, has traditionally advocated on behalf of Icelandic farmers, and their strongest base of support is in rural areas (with the exception of fishing centres, which tend to support the Independence Party). The Progressive Party has, until last year's elections, also been a part of the Icelandic government since 1988, apart from a brief respite from 2006 to 2013.

“The only question remaining is whether anyone should be guaranteed to make a living in their chosen profession, whatever the cost to the nation as a whole.”

Last December, the Icelandic government allocated 100 million ISK to promoting the sale of lamb meat abroad, at a time when the health care system is in dire need of reform and the housing market is becoming increasingly inaccessible to local residents. Then Minister of Agriculture, Gunnar Bragi Sveinsson, who defended the allocation to reporters, happens to hail from the Progressive Party.

Maybe we should let the market decide

As it stands now, Icelandic sheep farmers are

Economic Crisis

- Decrease in market demand
- Lamb out-competed by imported meat
- Surplus in lamb production

Political + Cultural Crisis

- Government's intention in subsidy cut
- Abandonment in traditional sheep farming practice

Ecological Crisis

- Land degradation and soil erosion
- Biodiversity loss

In order to keep the sheep farming business running and protect Iceland's national heritage, the government gives subsidies to sheep farmers. The subsidy is more than 40% of the couple's income. However, due to the economic crisis, the government wants to cut the subsidy. The couple could lose their business to industrialized farming. According to the report done by the Icelandic Institute of Natural History, traditional farming has declined in Iceland in the last 20 years.

CHAPTER II
A THESIS ON THE ICELANDIC LANDSCAPE

- The Icelandic Landscape
- The Programs
- Landscape Aesthetics vs Evolution

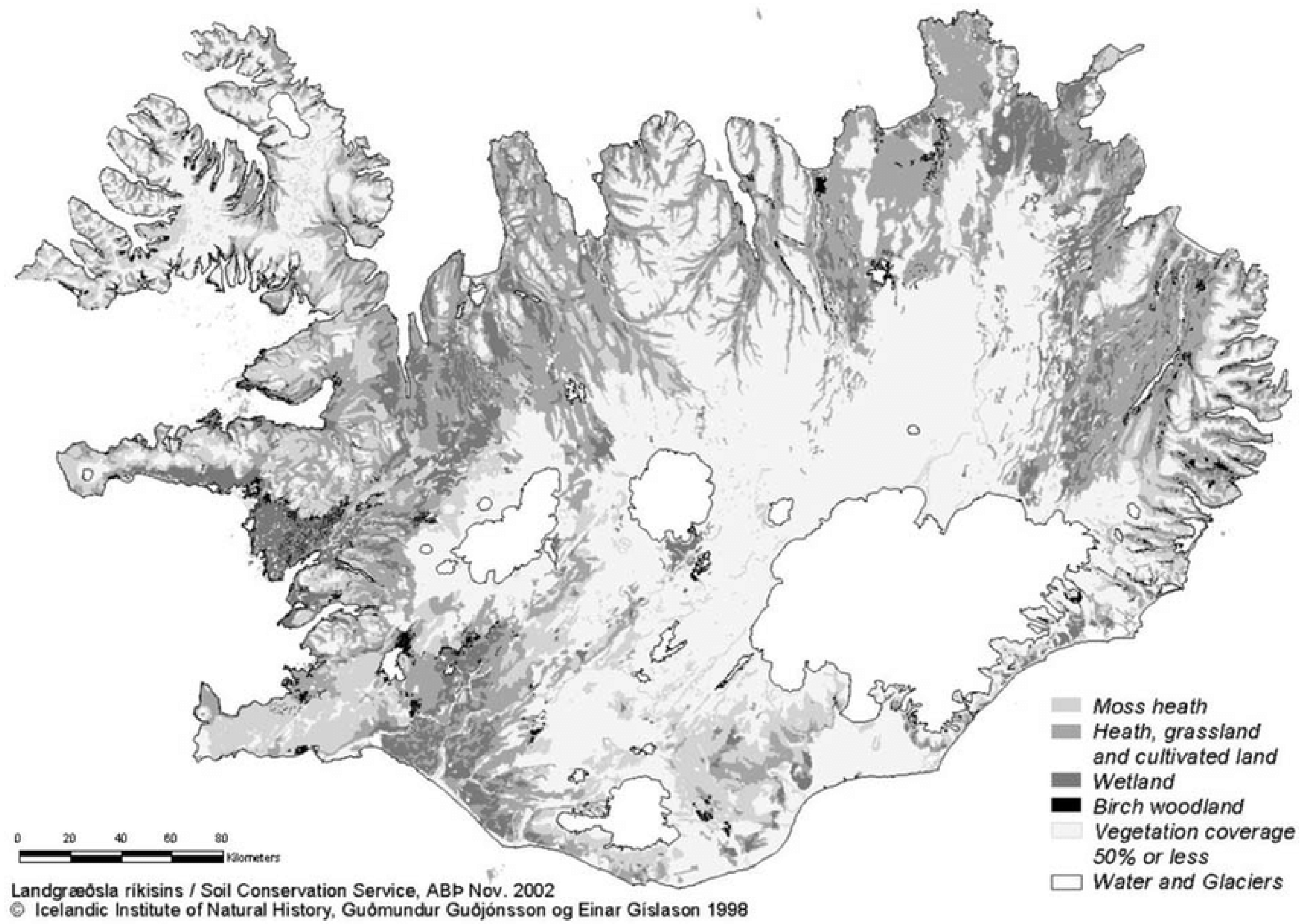


Figure 16 Iceland Vegetation Coverage

Today's Iceland is barren without forests and with little ground vegetation. This is largely due to a millennium of uncontrolled sheep grazing. As Icelandic soils are mostly volcanic, the loose soil type gets eroded easily without plant roots holding soil particles together.



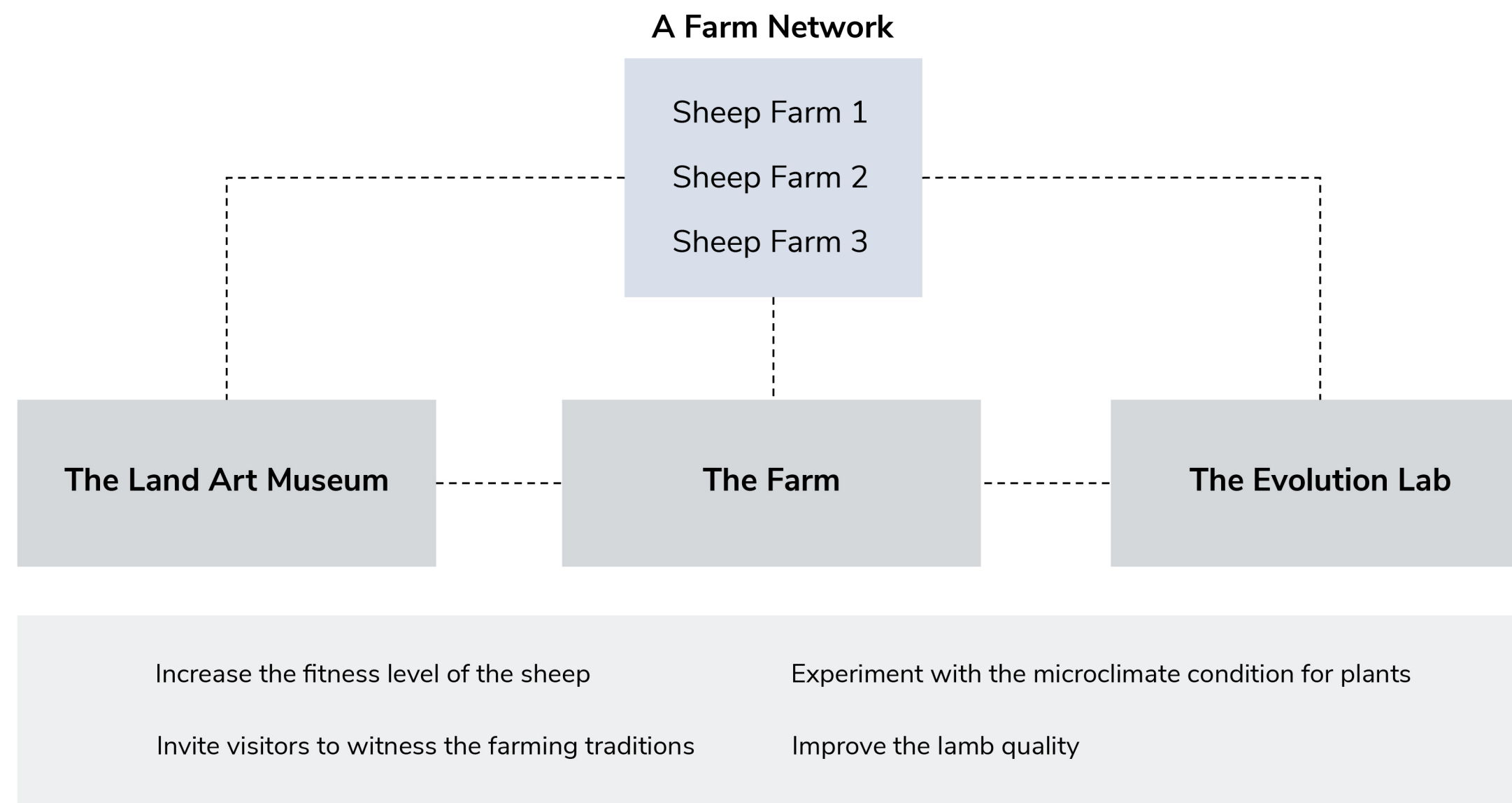
Figure 17-18 Icelandic Sorting Ring. Figure 19-20 Icelandic Sheep Carcasses and Slaughterhouse

Meanwhile, the sheep crises I mentioned are forcing the farming system to produce a commercial product with ever-increasing efficiency. Farming devices are flexible for scaling up to accommodate the increasing number of sheep. Slaughterhouses are built for mass-scale killing.



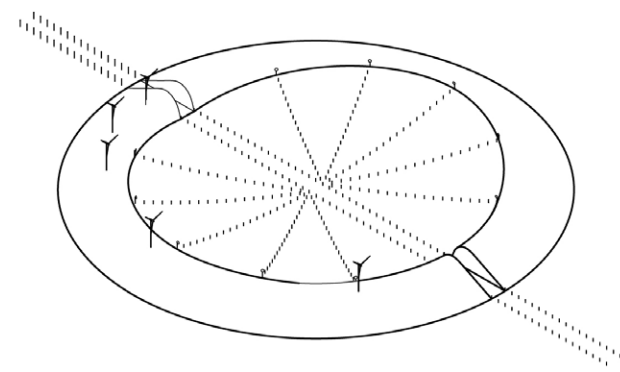
Figure 21-24 Icelandic Sorting Ring and Farm in Mid-20th Century

About 60 years ago, farming devices were made through heavy earthworks and embedded in the ground for environmental control, including blocking sand and wind. Today, the sheep farming practice exacerbates land degradation.

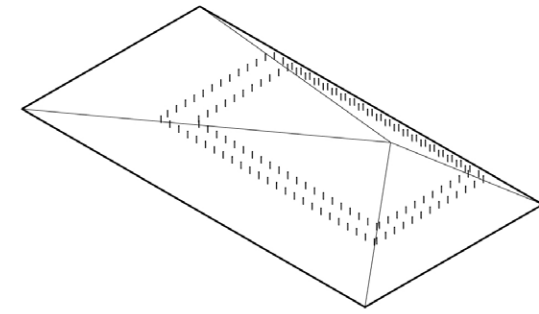


To bring back the competitiveness of Icelandic sheep farming, my thesis proposes a farm network that increases the fitness level of the sheep, improves the meat quality, experiments with the microclimate condition for plants, and invites visitors to witness Icelandic farming tradition. I propose three parallel programs: the museum, the farm, and the evolution lab.

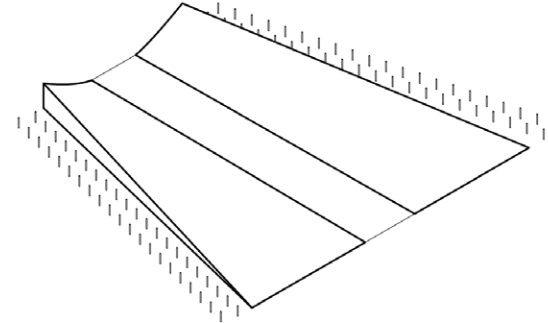
Landform Pastures



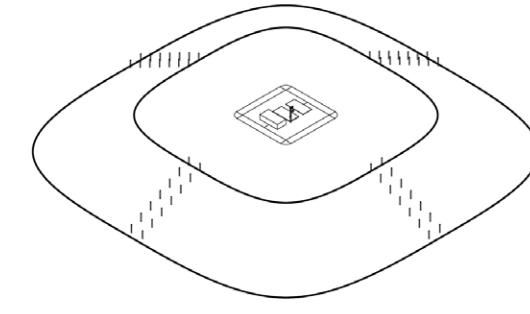
● The Enclosed



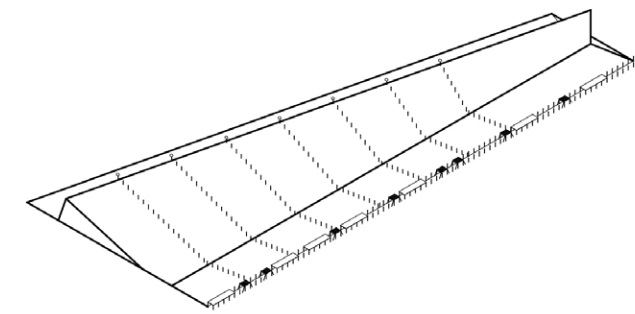
▲ The Pyramid



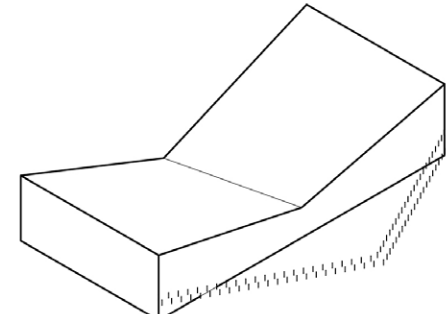
▼ The Take-off



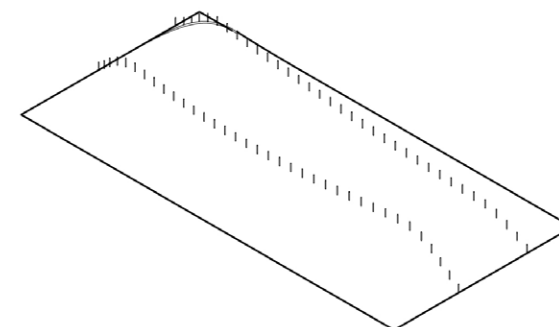
▬ The Platform



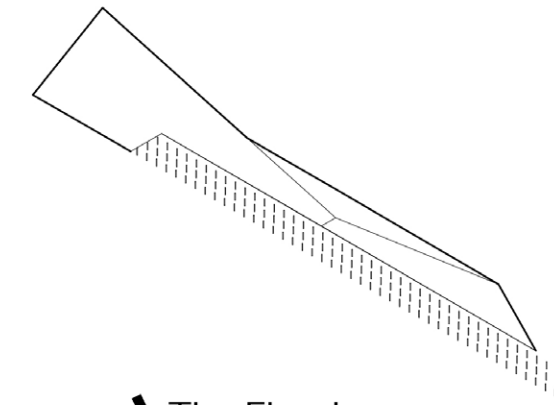
▼ The Fold



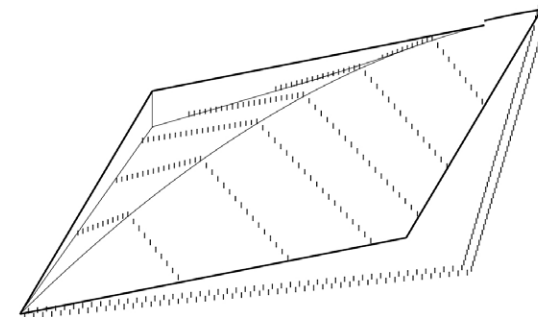
▼ The Triangle



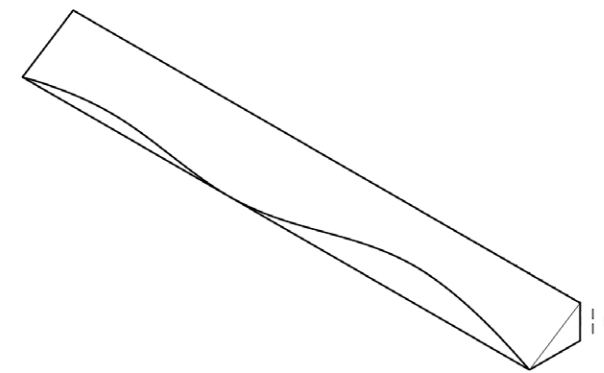
▬ The Twist



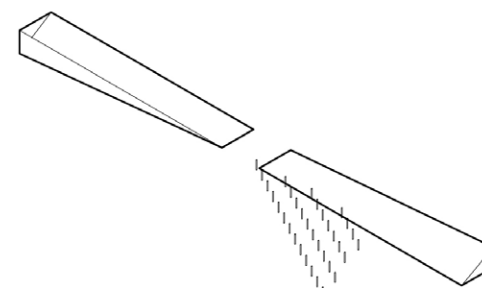
▼ The Flood



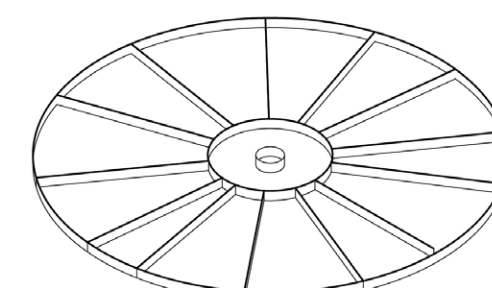
▬ The Diamond



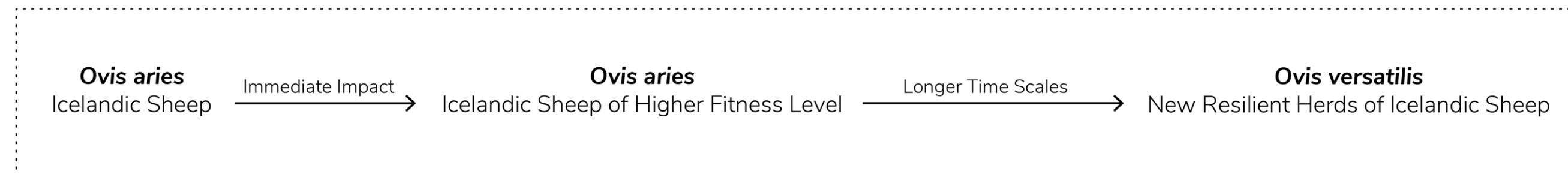
▬ The Ribbon



▬ The Double



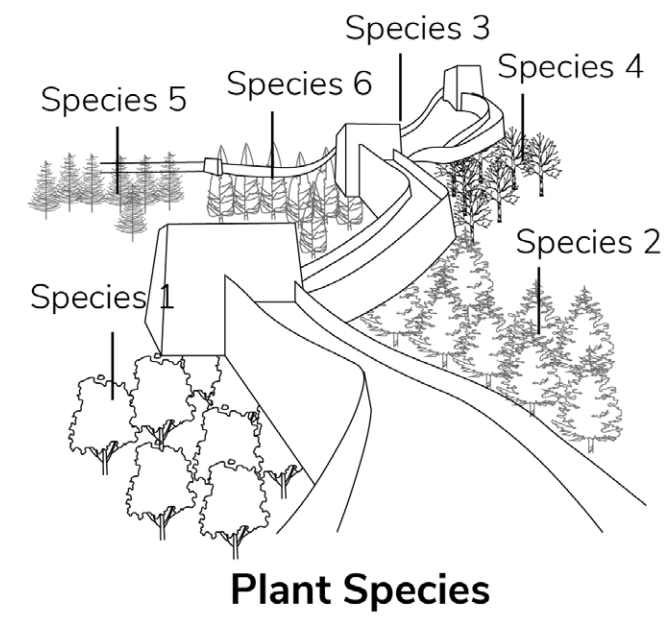
⊗ Rétt



Ovis noun (Latin)
 A genus of Bovidae consisting of sheep.

Versatilis adjective (Latin)
 Versatile.

The farm is an assemblage of landform pastures with farming and lab infrastructures. These landforms immediately impact the fitness level of the Icelandic sheep, *Ovis aries*. With longer time scales, these landforms will produce evolutionary consequences on *Ovis aries*, creating the resilient sheep herd, "*Ovis versatilis*." This thesis argues that any landscape design makes a direct and immediate impact on the fitness level of the inhabiting species. Therefore, landscape designs must consider evolutionary consequences at longer time scales.



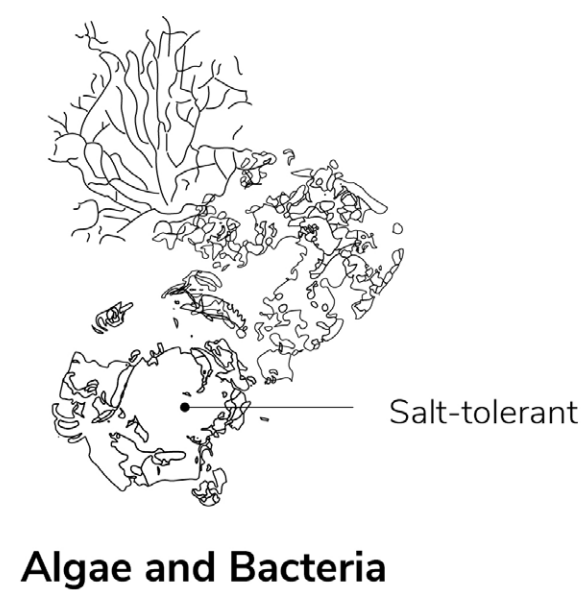
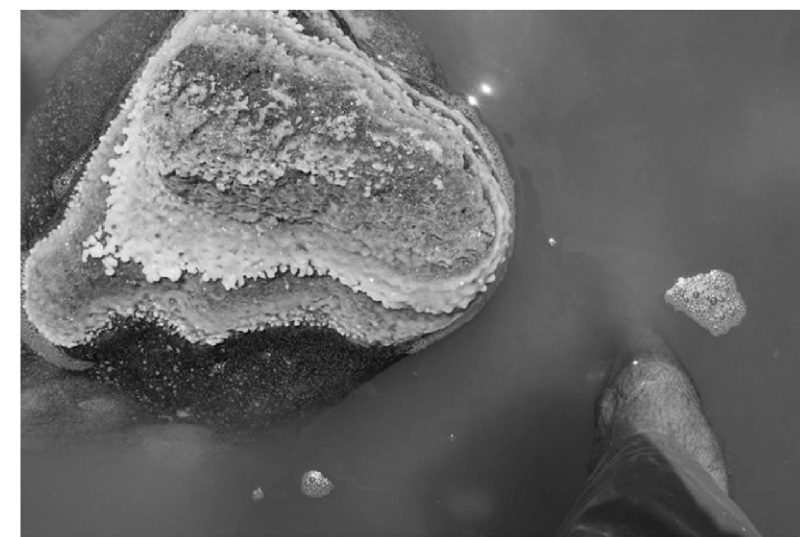
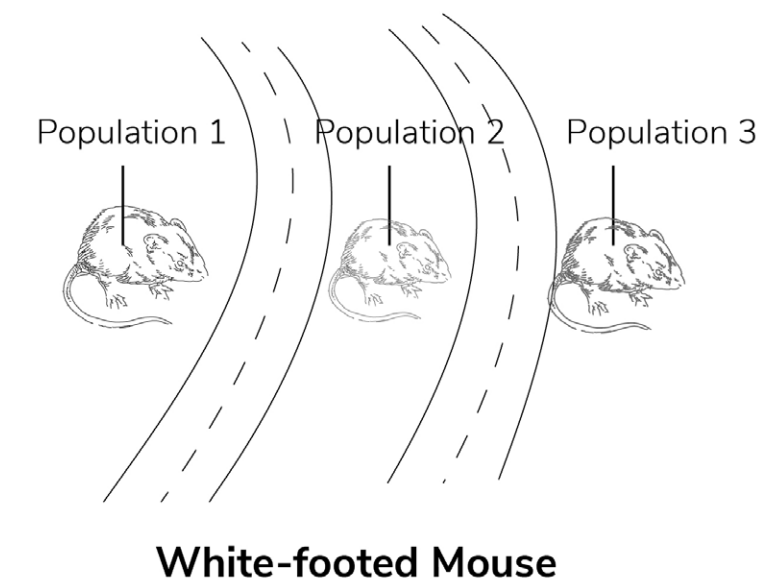
“This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection.”

Charles Darwin, *On the Origin of Species*

“Many forms of human intervention have the capacity to create trauma in the ecosystem, interrupt the food chain, and disrupt the system of relations among life forms.”

“Nature itself is inherently inventive, and all life forms have the capacity for self-transformation.”

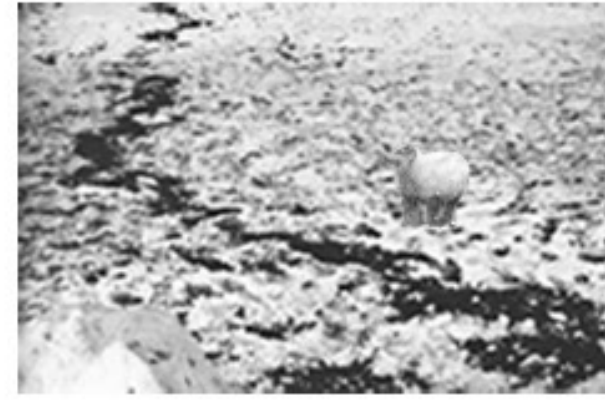
Gilles Clément, *Working with (and never against) Nature*



In the previous chapter, I mentioned that the evolution of Icelandic sheep is controlled by human selection. My thesis transfers that controlled quality to the landscape, making aesthetic landscapes the grounds for natural selection and the drivers of sheep evolution.

A few examples here show how design interventions have impacted species evolution: The Great Wall has prevented the gene flow of 6 plant species for more than 600 years. In Ottawa, roads are physical barriers to the genetic features of white-footed mice. The Spiral Jetty pattern produces higher salt sedimentation in the center, where algae and bacteria have evolved to be salt-tolerant.

Figure 25-26 The Great Wall, Figure 27 Highway in Ottawa, Figure 28 White Footed Mouse, Figure 29 Spiral Jetty, Figure 30 Salt Sedimentation in Spiral Jetty



In landscape architecture, landforms are largely used for aesthetic purposes. My thesis uses landforms to reconcile the century-long divergence between human and environmental selection of Icelandic sheep.

CHAPTER III
THE MUSEUM, THE FARM, THE LAB

- Landform Pastures
- Program Interrelationships
- National Network
- Store

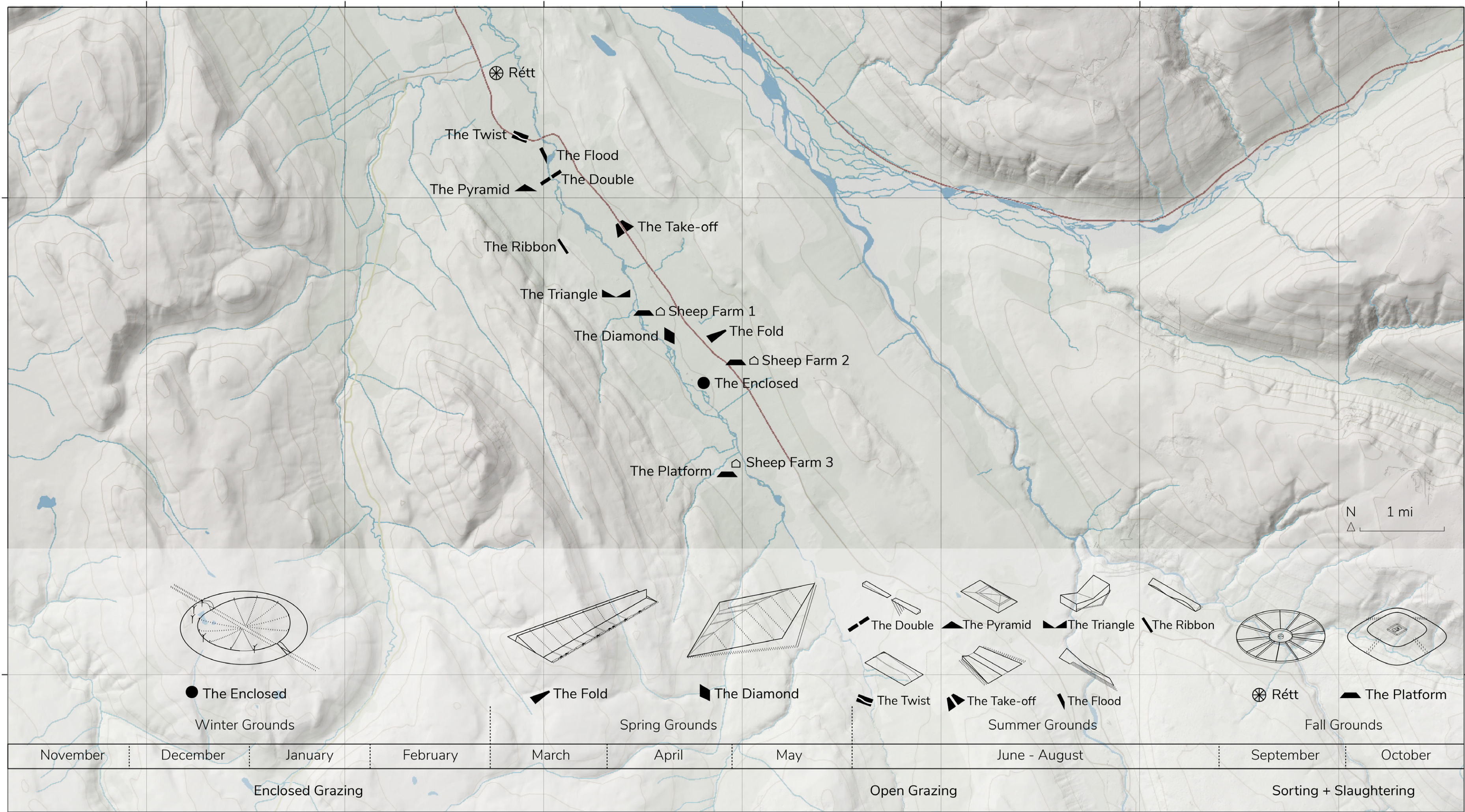
19°30'0"W 19°25'0"W 19°20'0"W 19°15'0"W 19°10'0"W 19°5'0"W 19°0'0"W

65°25'0"N

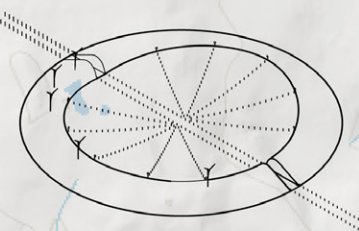
65°25'0"N

65°20'0"N

65°20'0"N

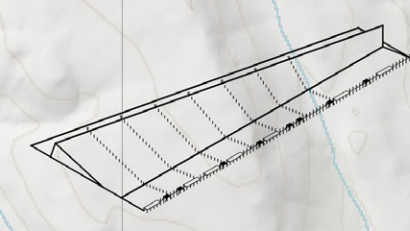


N 1 mi



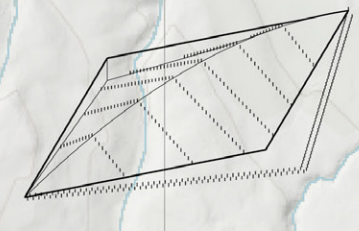
● The Enclosed

Winter Grounds

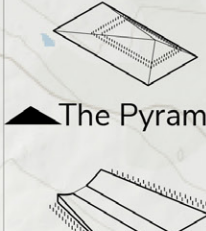


▲ The Fold

Spring Grounds



▲ The Diamond



▲ The Double

▲ The Twist



▲ The Take-off



▲ The Pyramid



▲ The Flood



▲ The Triangle



▲ The Ribbon



⊗ Rétt



▲ The Platform

November

December

January

February

March

April

May

June - August

September

October

Enclosed Grazing

Open Grazing

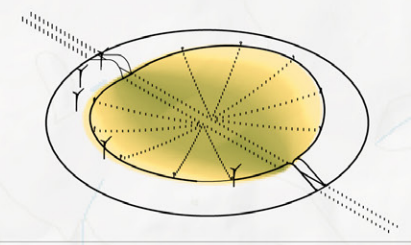
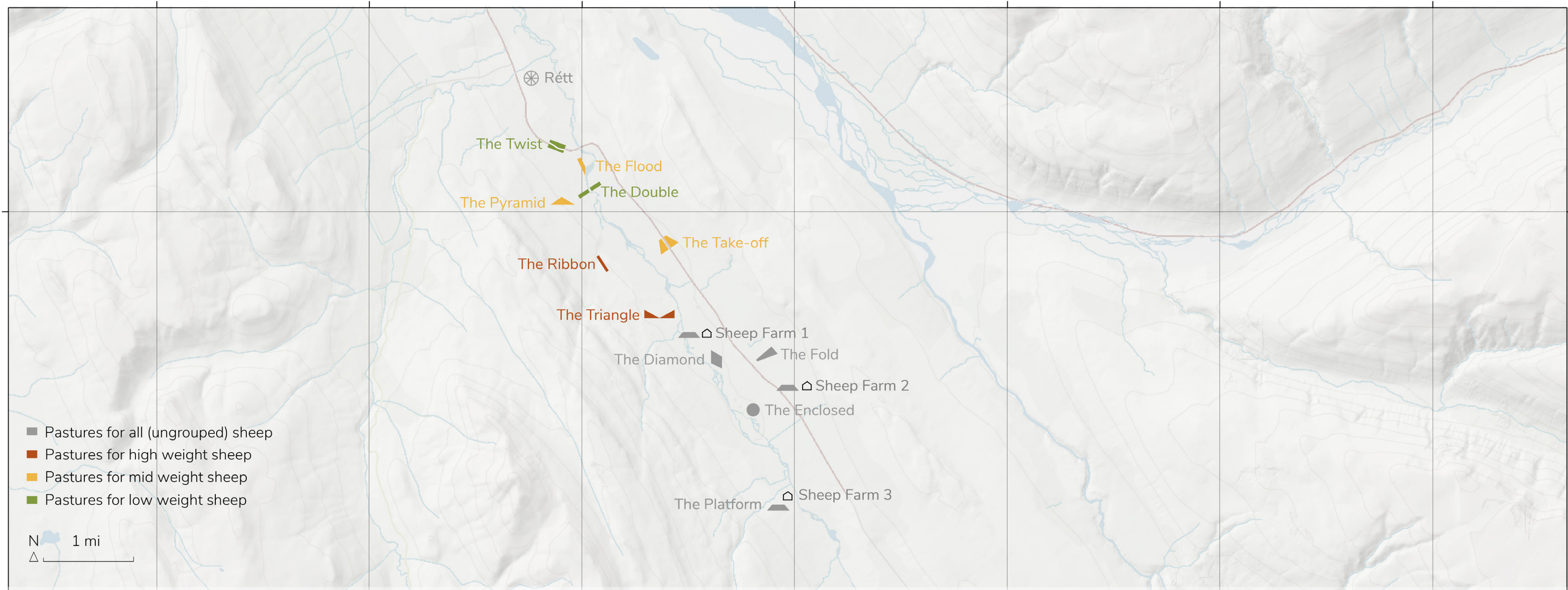
Sorting + Slaughtering

Currently, the government subsidies that makeup 40% of farmers' income are tied to government stipulations, like monitoring soil quality. I propose that in 2022, Ovis Versatlis becomes one of the stipulated projects. The couple joins the project together with two nearby farms.

19°30'0"W 19°25'0"W 19°20'0"W 19°15'0"W 19°10'0"W 19°5'0"W 19°0'0"W

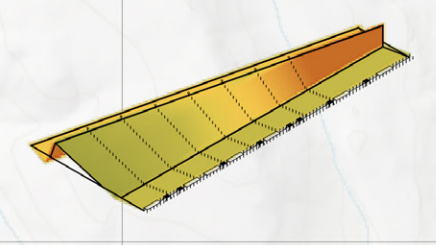
65°25'0"N

65°25'0"N



● The Enclosed

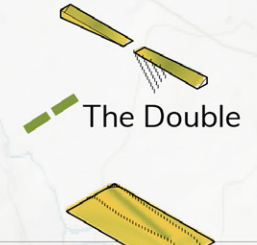
Winter Grounds



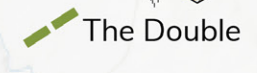
▲ The Fold



■ The Diamond



■ The Twist



■ The Double



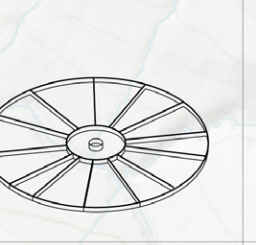
▲ The Take-off



▲ The Flood



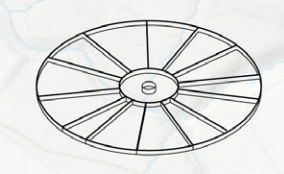
▲ The Pyramid



▲ The Triangle



▲ The Ribbon



⊗ Rétt



■ The Platform

65°20'0"N

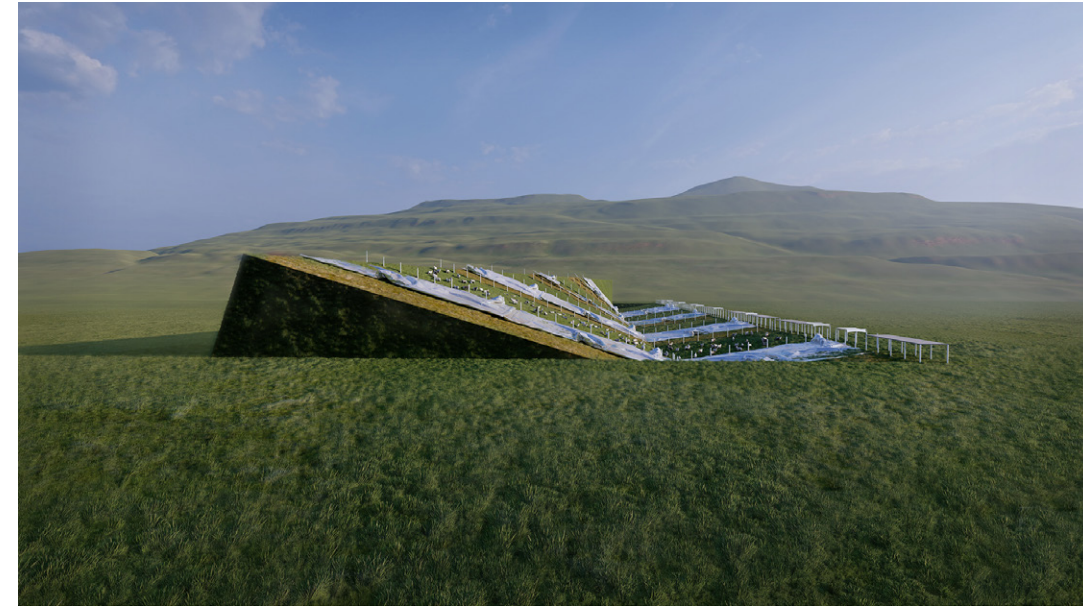
65°20'0"N

November	December	January	February	March	April	May	June - August	September	October
Enclosed Grazing				Open Grazing			Sorting + Slaughtering		

The landform pastures are situated along the river and the road in the valley. The farmers lead sheep onto the pastures and perform grazing management according to the schedules. The pastures vary greatly in slope and are used in different seasons, which will support a wide array of grazing needs.



The Enclosed



The Fold



The Diamond



The Flood



The Double



The Take-off



The Twist



The Triangle



The Pyramid

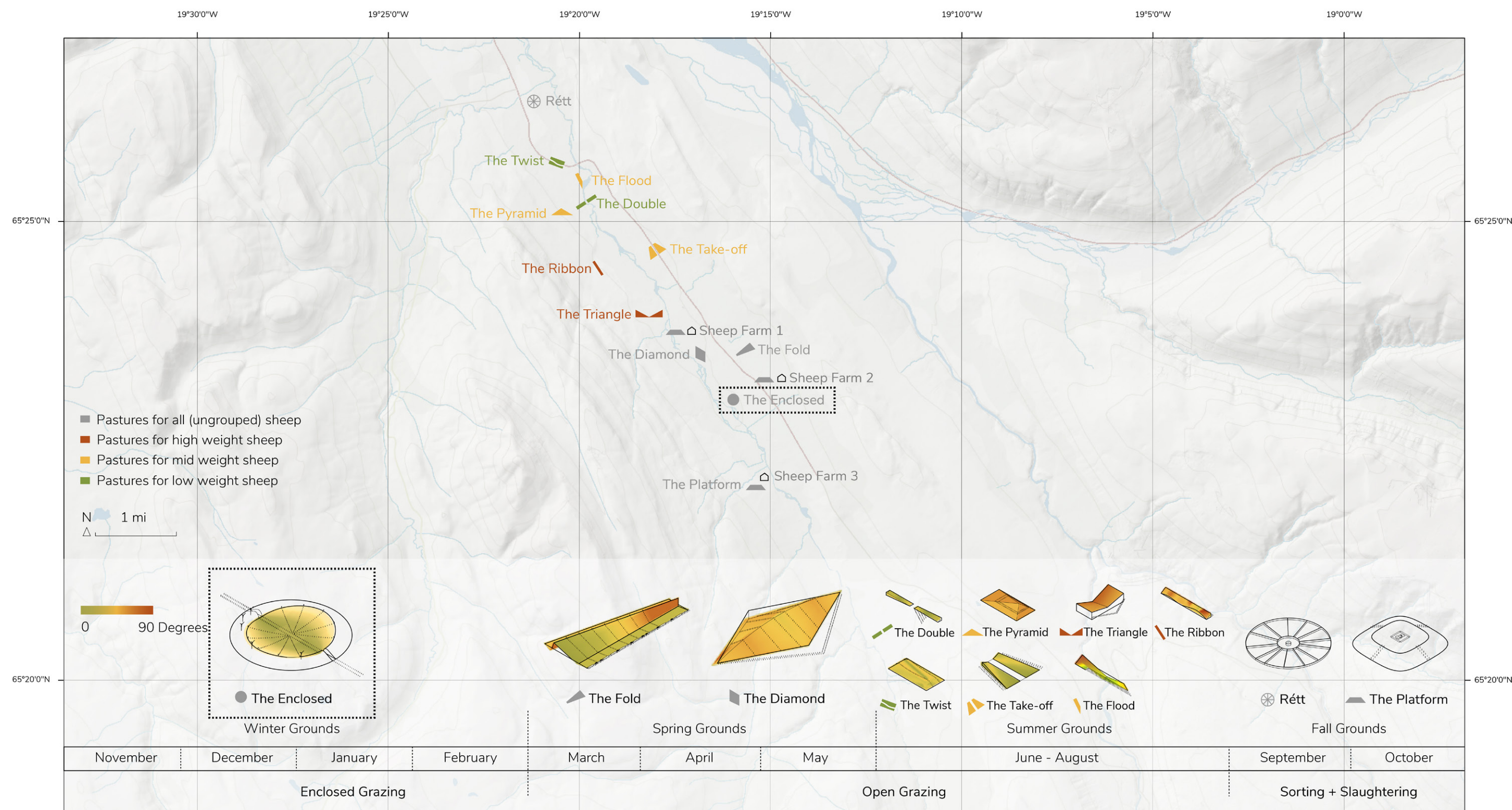


The Ribbon



The Platform

There are eleven landform pastures. The geometries of all the pastures conform to the same rule: two simple curves with their angles or lengths varied to create a continuously curved surface.



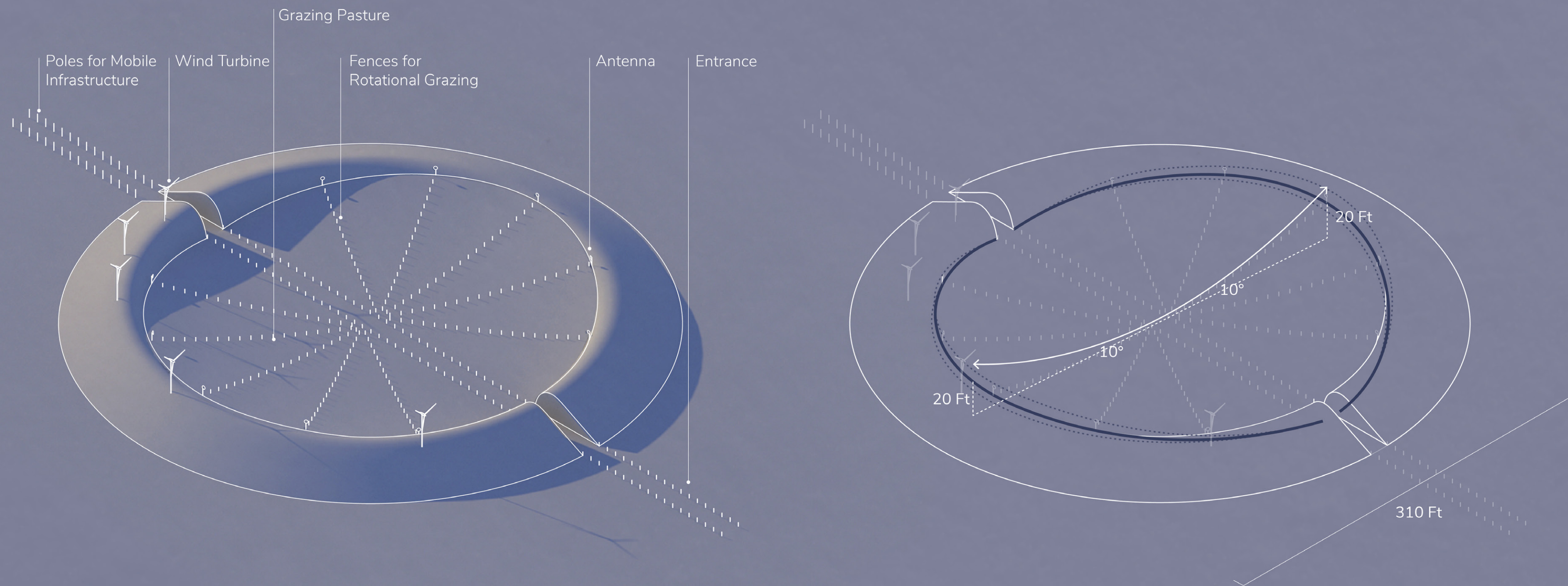
THE ENCLOSED

“The Enclosed” is located near the base of the three farms so farmers can manage the sheep without traveling far in the cold winter. As farmers lead the sheep into the pasture, the early winter sun aligns with the entrance pathway, which allows appreciation of the last sunrays before the long winter starts. The pasture is symmetric and enclosed to augment its presence in the Icelandic winter landscape and to block the wind for the sheep.



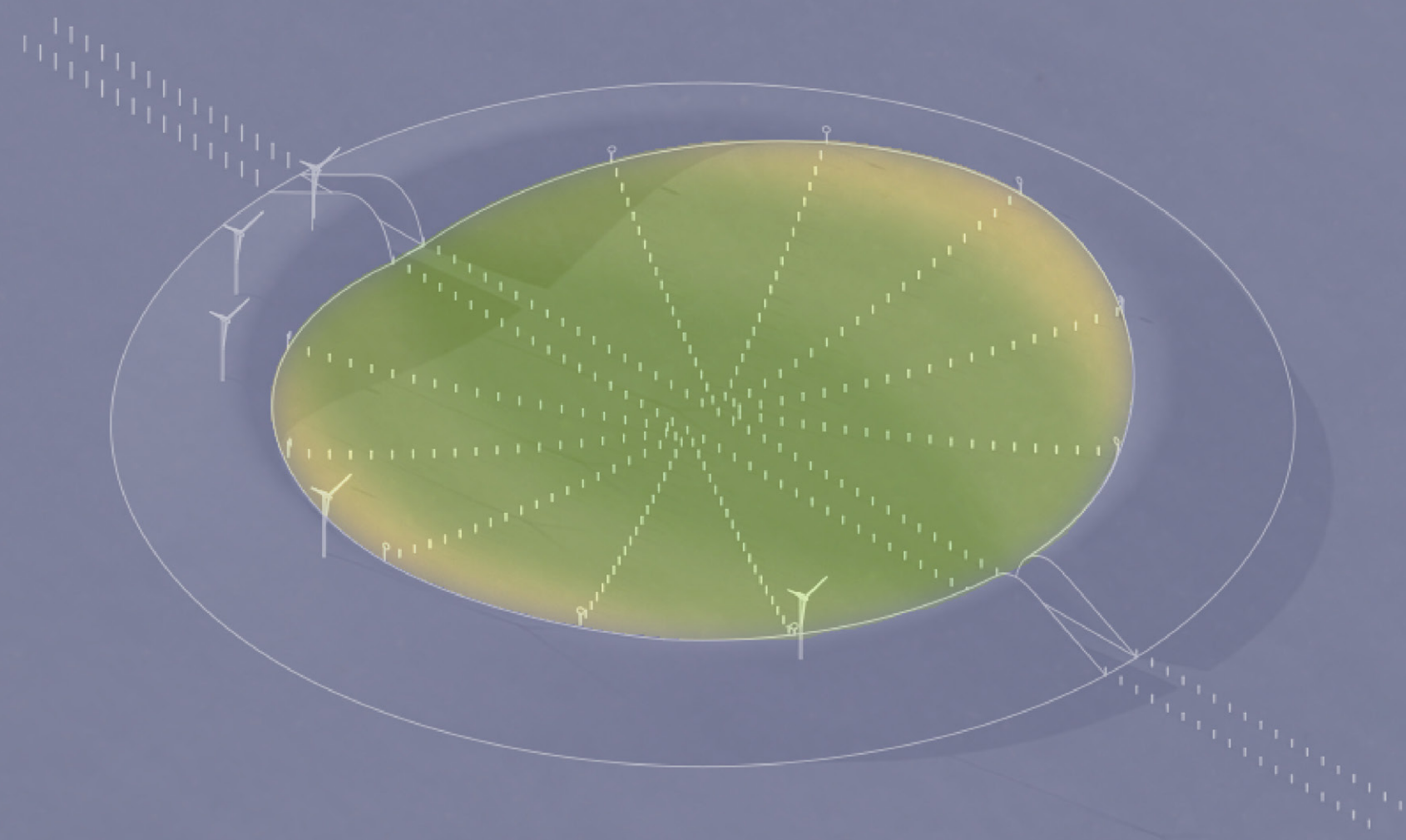




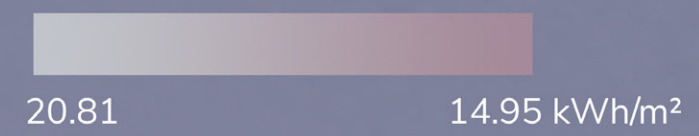
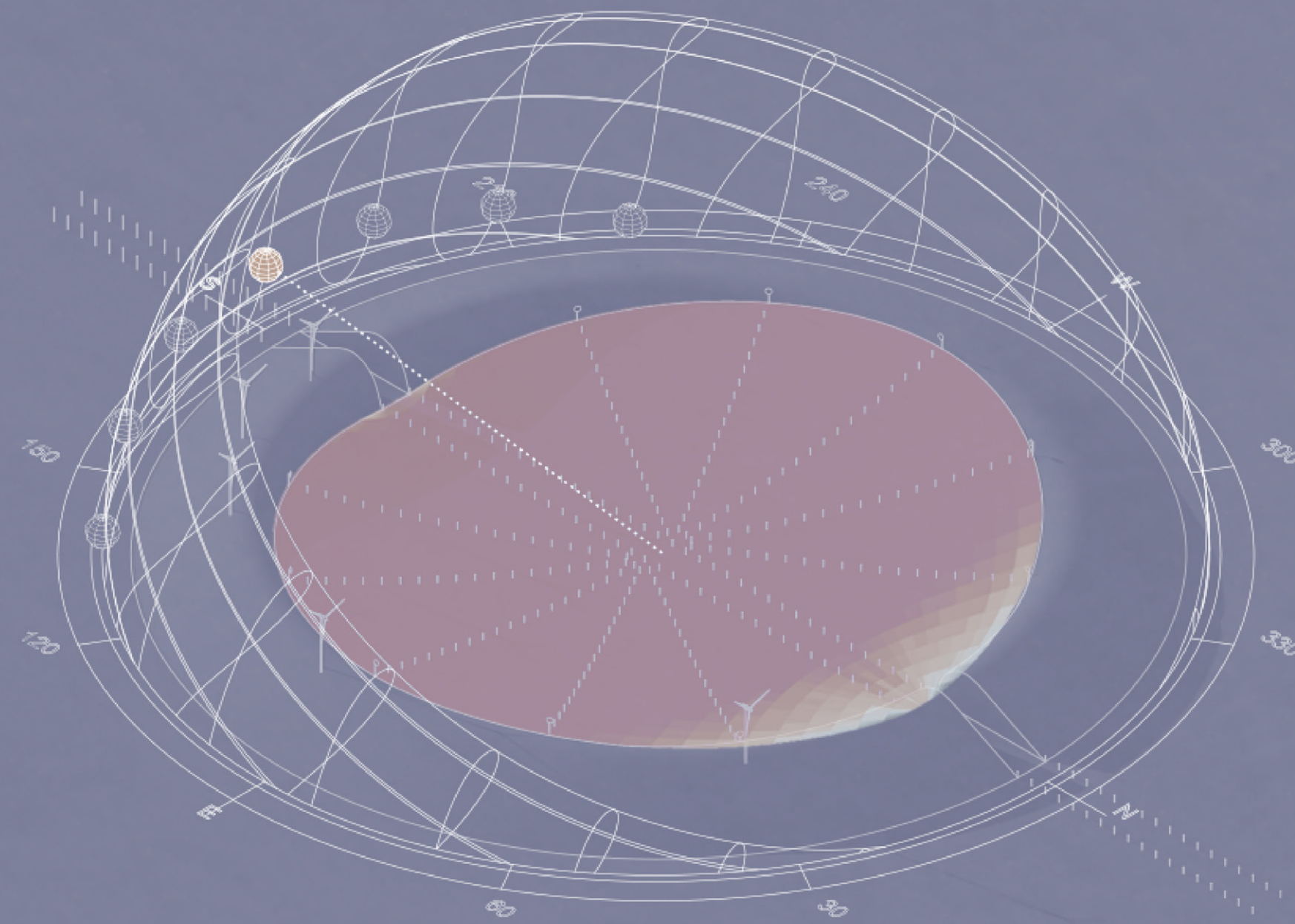


The geometry is designed through balancing between slope range, pasture size, and aesthetic experience

The two curves, as highlighted in blue, are rotated 10 degrees to create a bowl-shaped pasture. The size of the pasture is calculated based on the need for wintertime grazing.

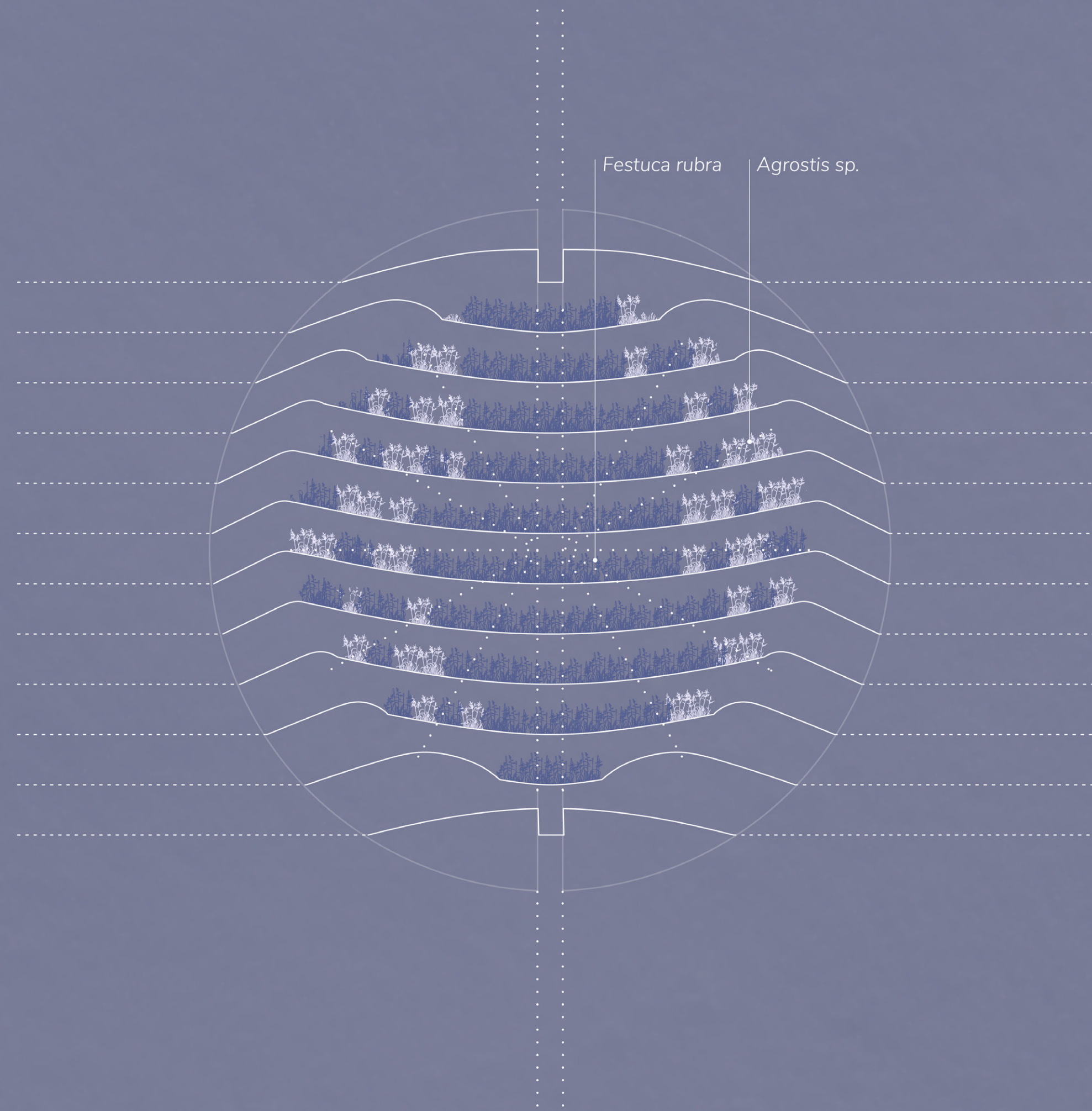
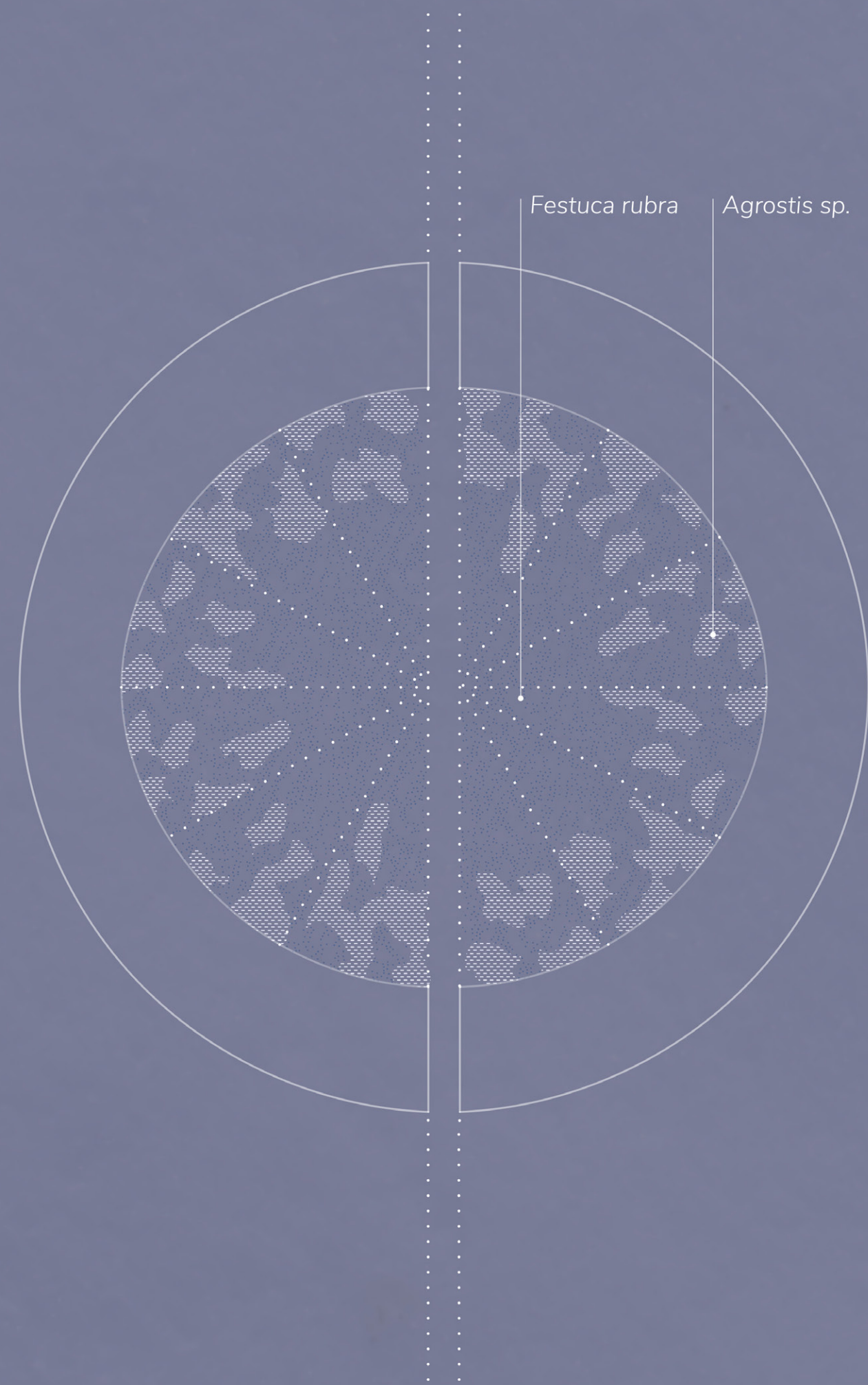


Slope Analysis

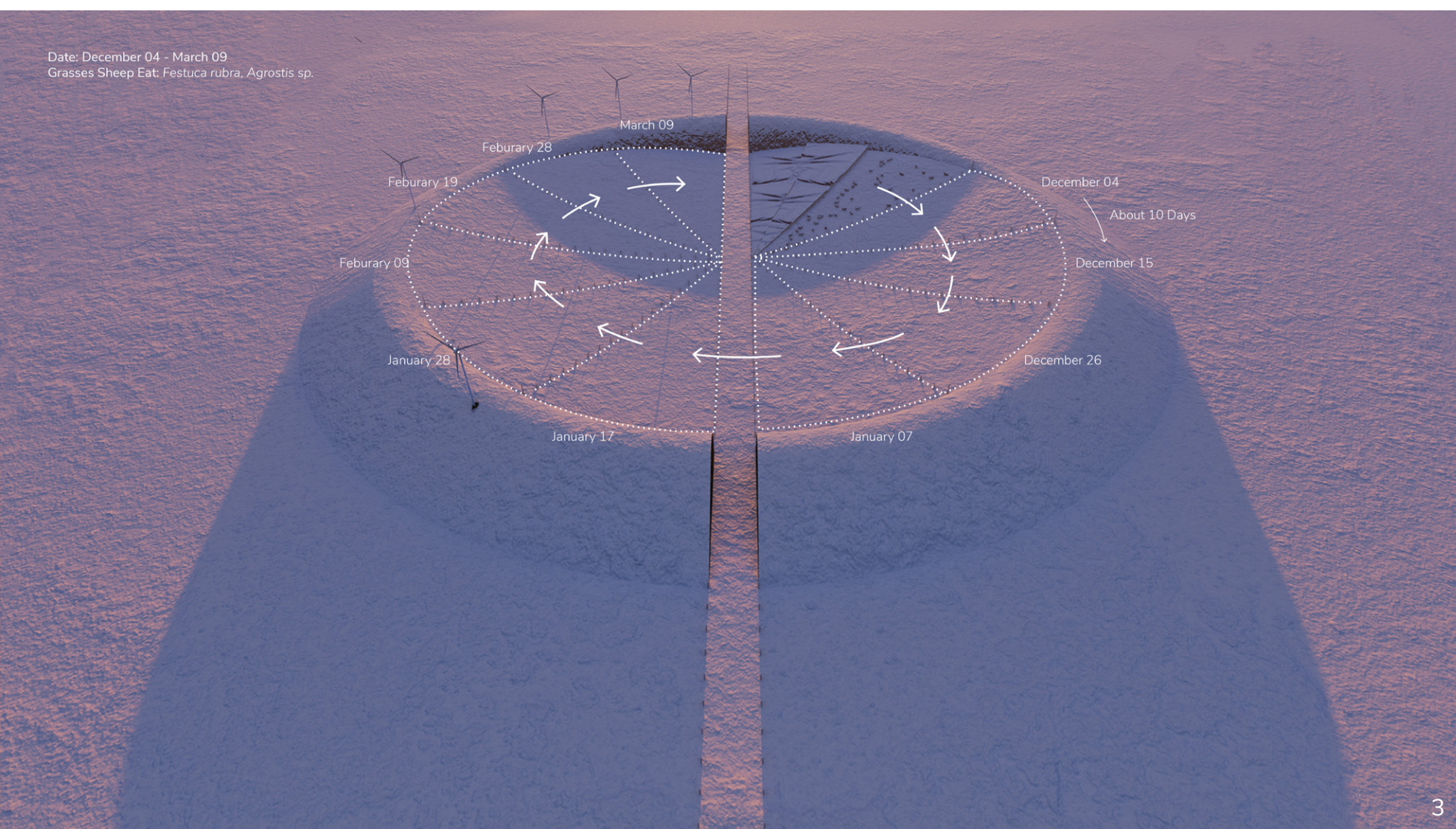
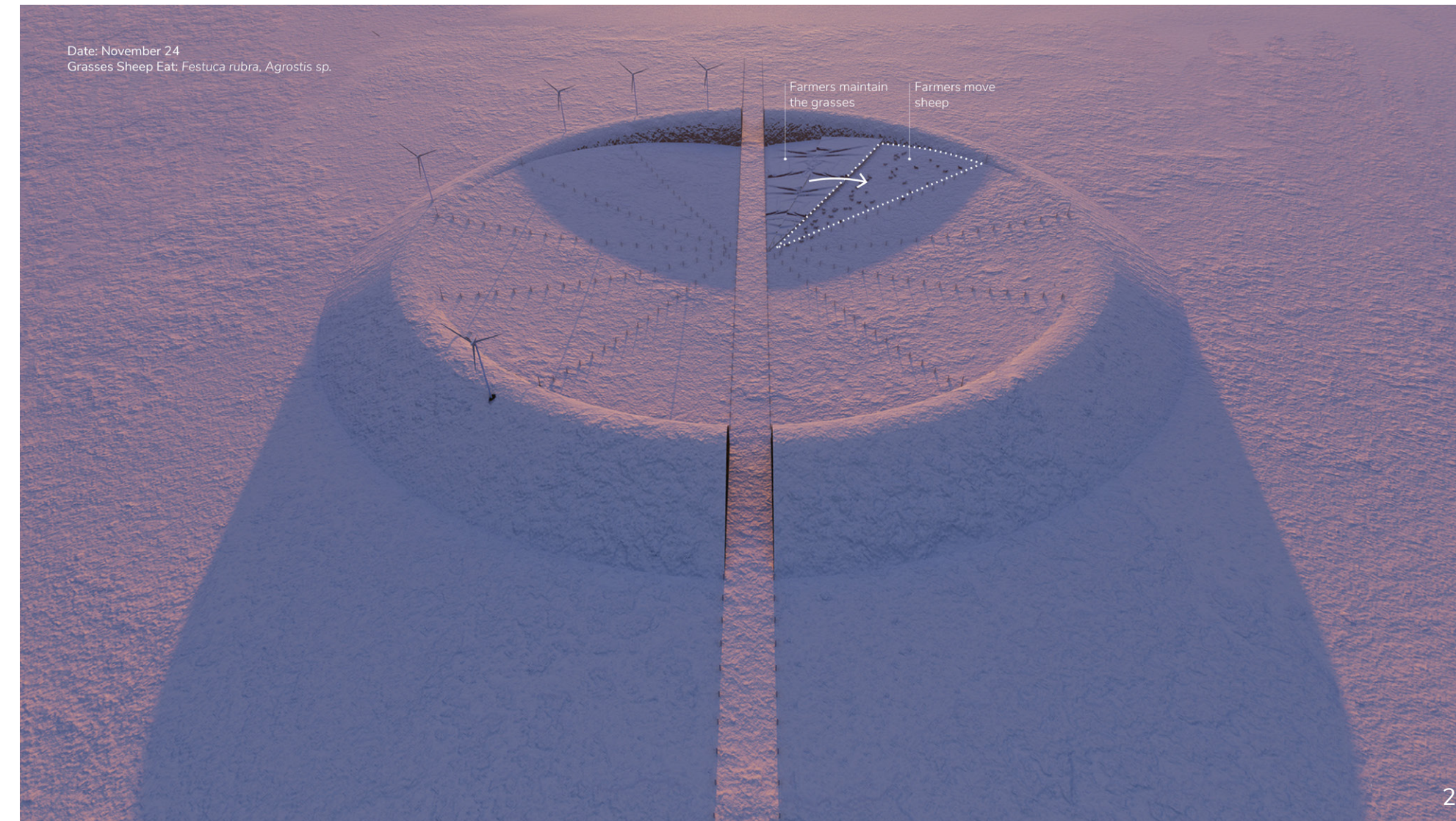
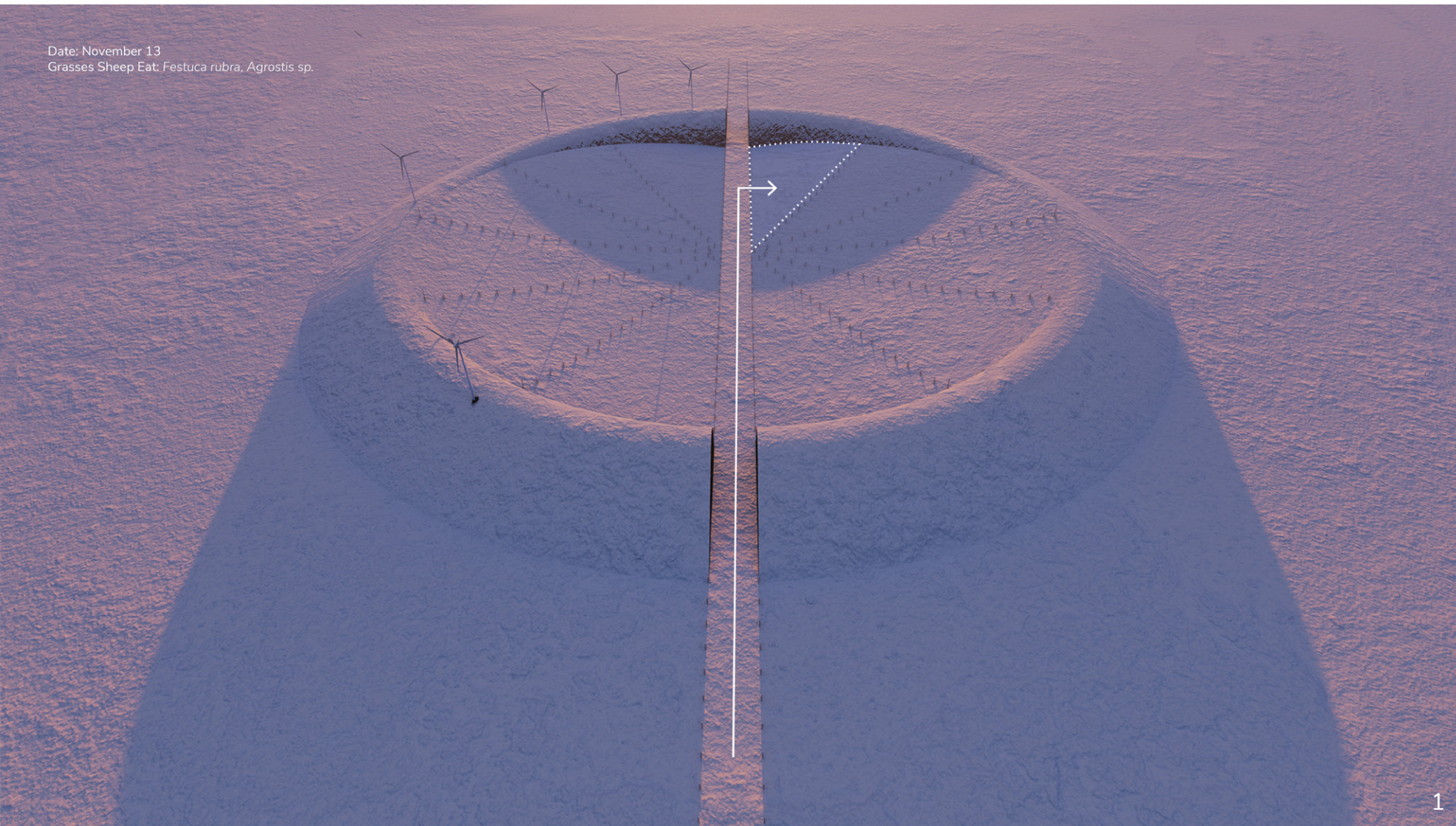


Solar Radiation Analysis

The curved surface allows continuous gradients of slopes and solar radiation.



In this initial planting plan, farmers plant an additional grass species in areas with a steeper slope.



1. The pastures are designed for responsive farming practices, and the rotation timing depends on the actual calculations of how much sheep graze. The images and dates shown here are just one example of possible usage. In November, the sheep are led to the first paddock.

2. And after ten days, they're led to the next paddock. The farmers maintain the grazed paddock and cover the area with fabric for protection. Based on observing the grasses, they recalculate the timing to rotate the sheep to the next paddock.

3. Farmers repeat the process until all the twelve paddocks are used.

4. At the end of winter, they lead the sheep out of the pasture and do the end-of-season assessment. They install tents, chairs, and equipment for microchip insertion, weight measurement, and ultrasound imaging.

Date: March 10
End-of-Season Assessment

Microchip insertion

Weight measurement

Ultrasound imaging

Record information on microchip

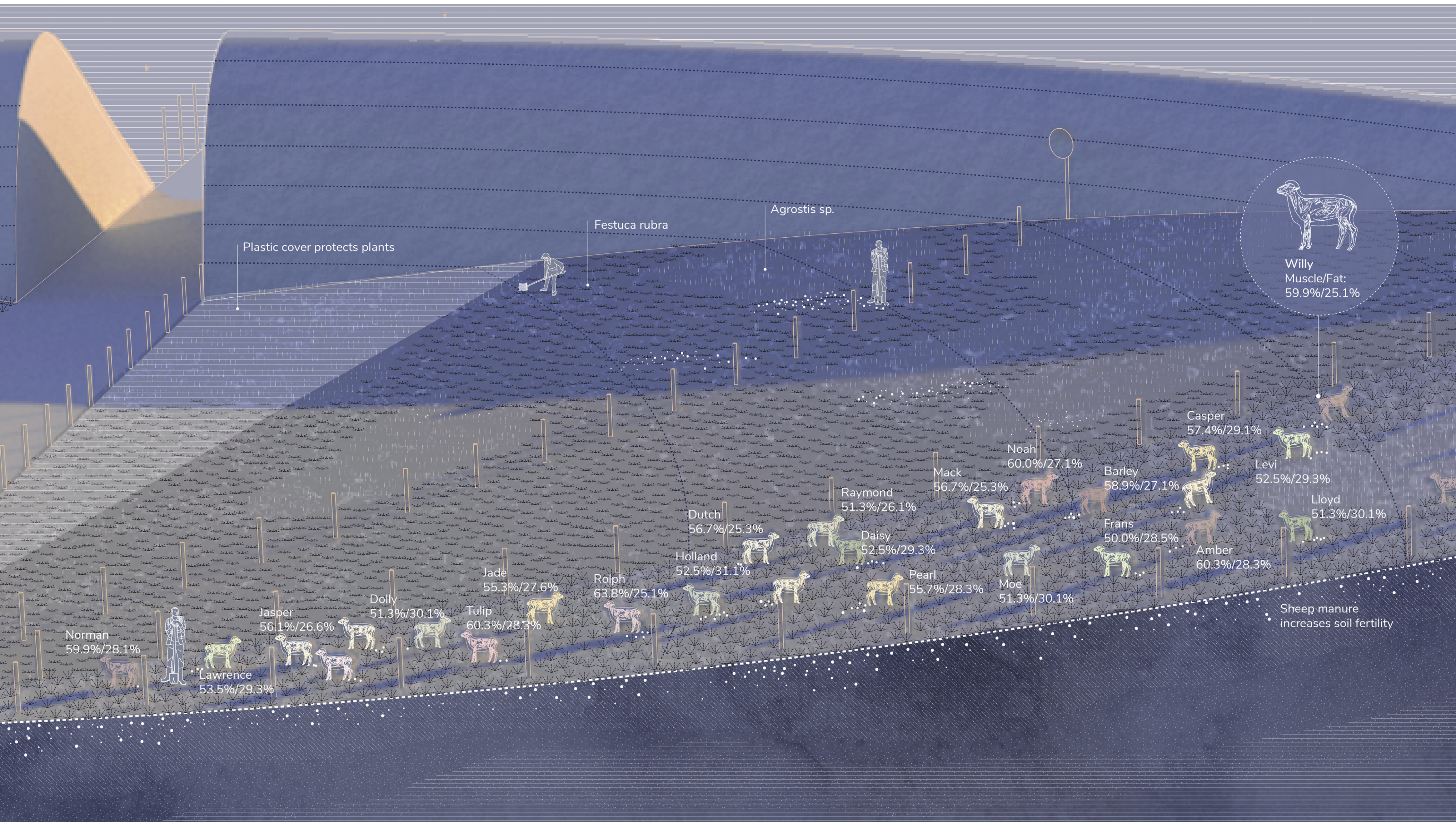
Ultrasound imaging for
measuring fat and muscle ratio

Weight measurement
for measuring growth rate

Sort sheep for assessment

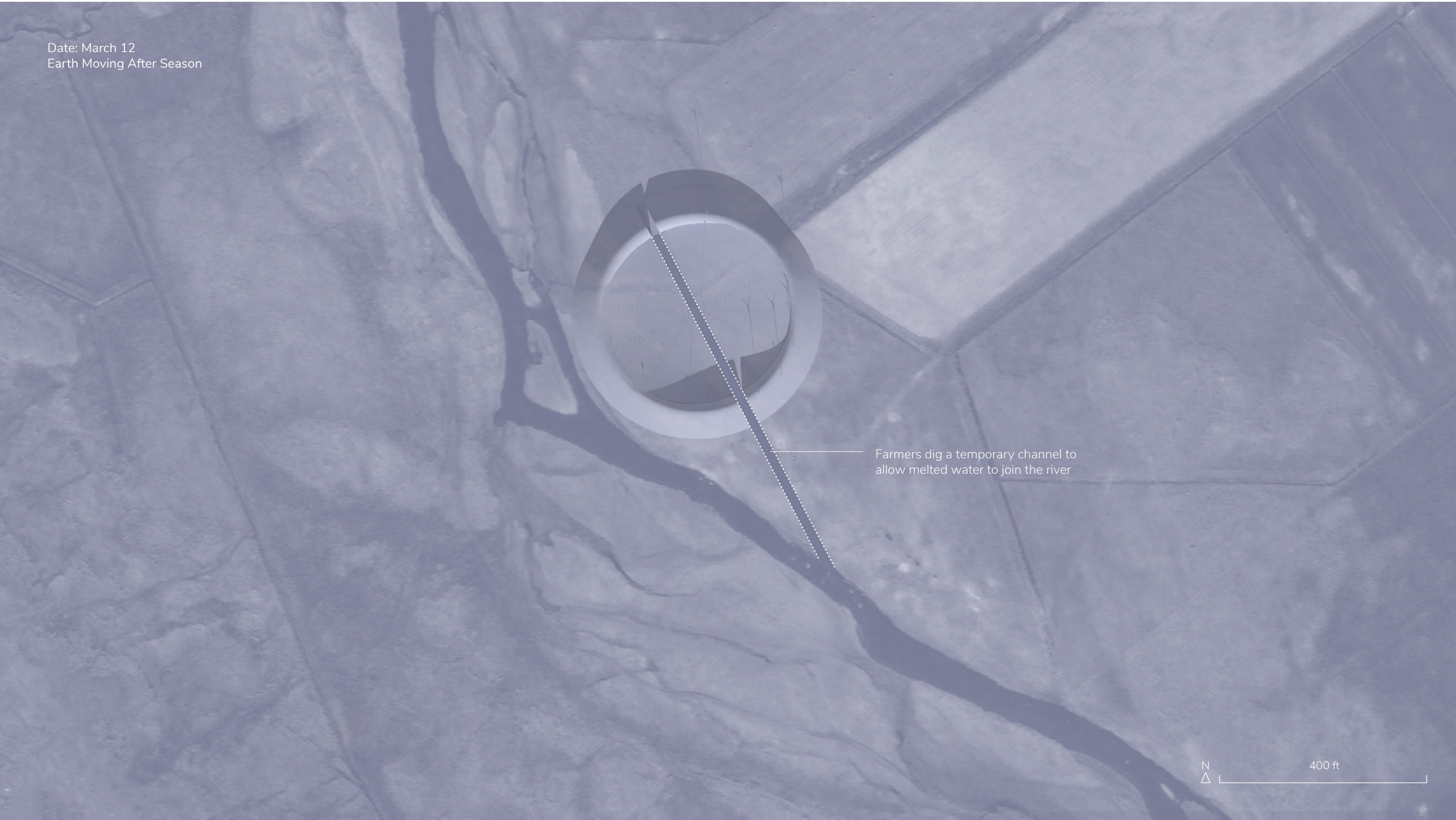
Microchip insertion for
recording information





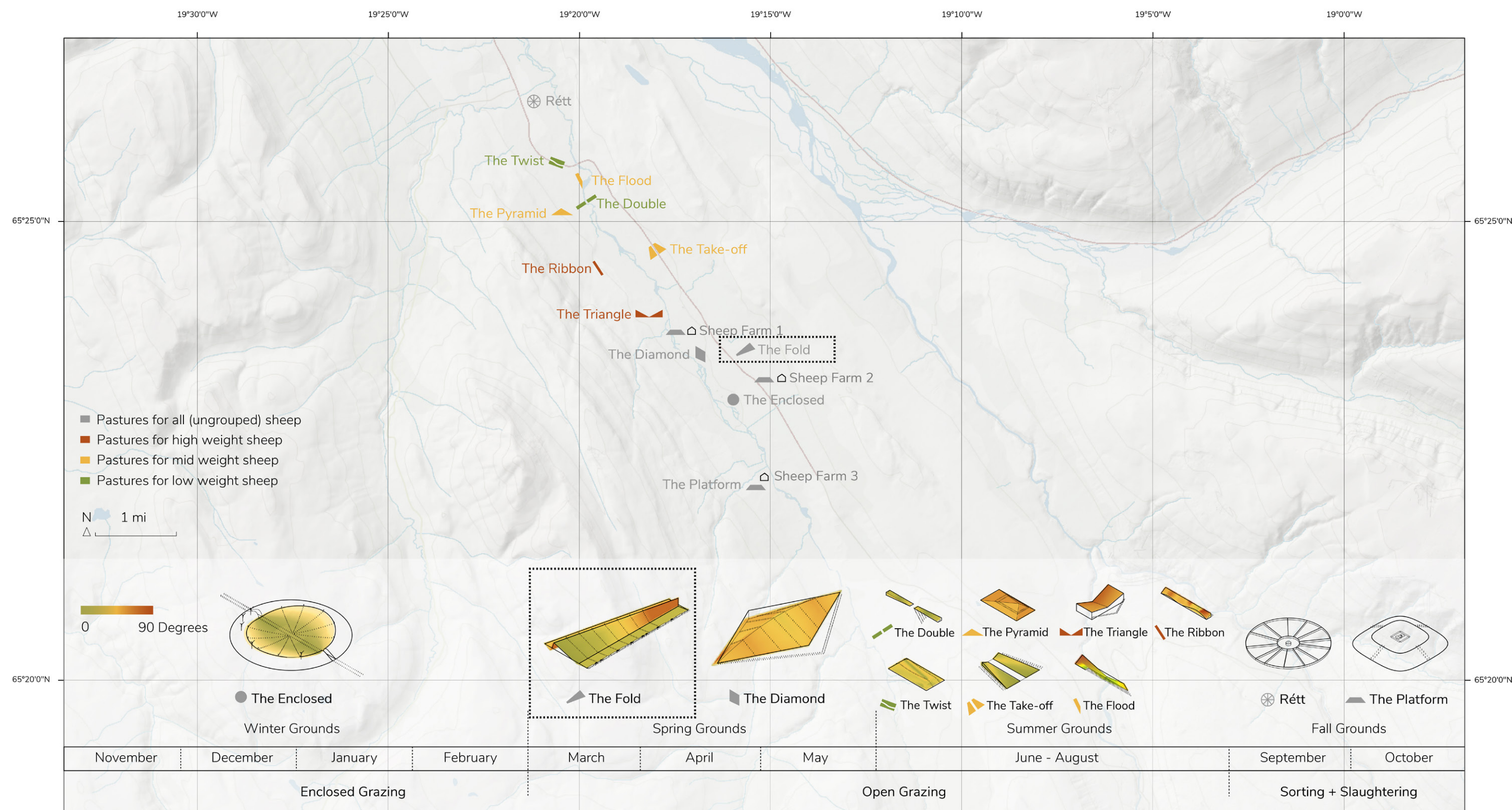
As sheep graze, the individuals that can climb a steeper slope will get more rewards: they can eat more species of grasses. As sheep walk on different slopes and eat different grasses, they start to develop different muscle tones.

Date: March 12
Earth Moving After Season



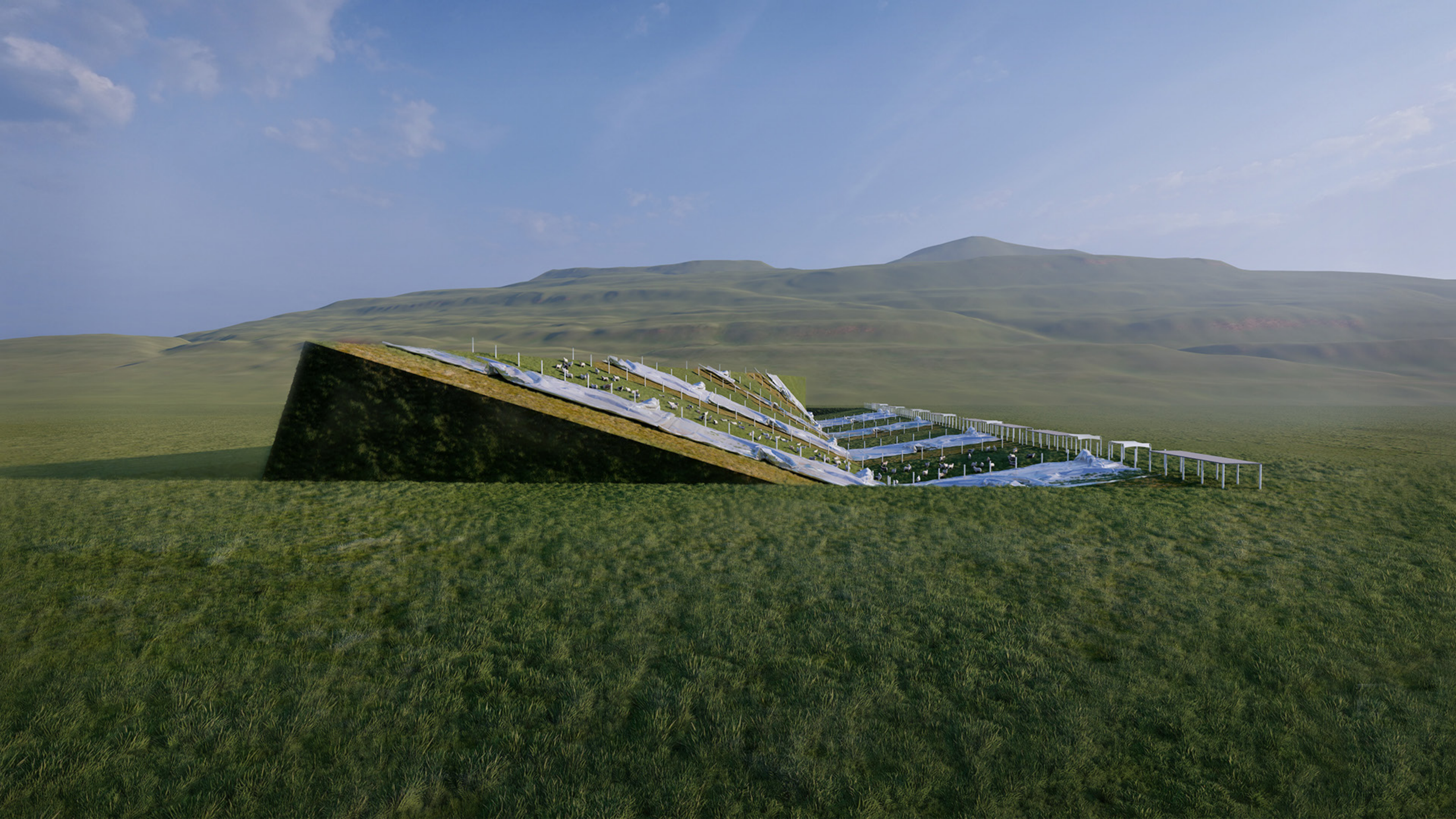
Farmers dig a temporary channel to allow melted water to join the river

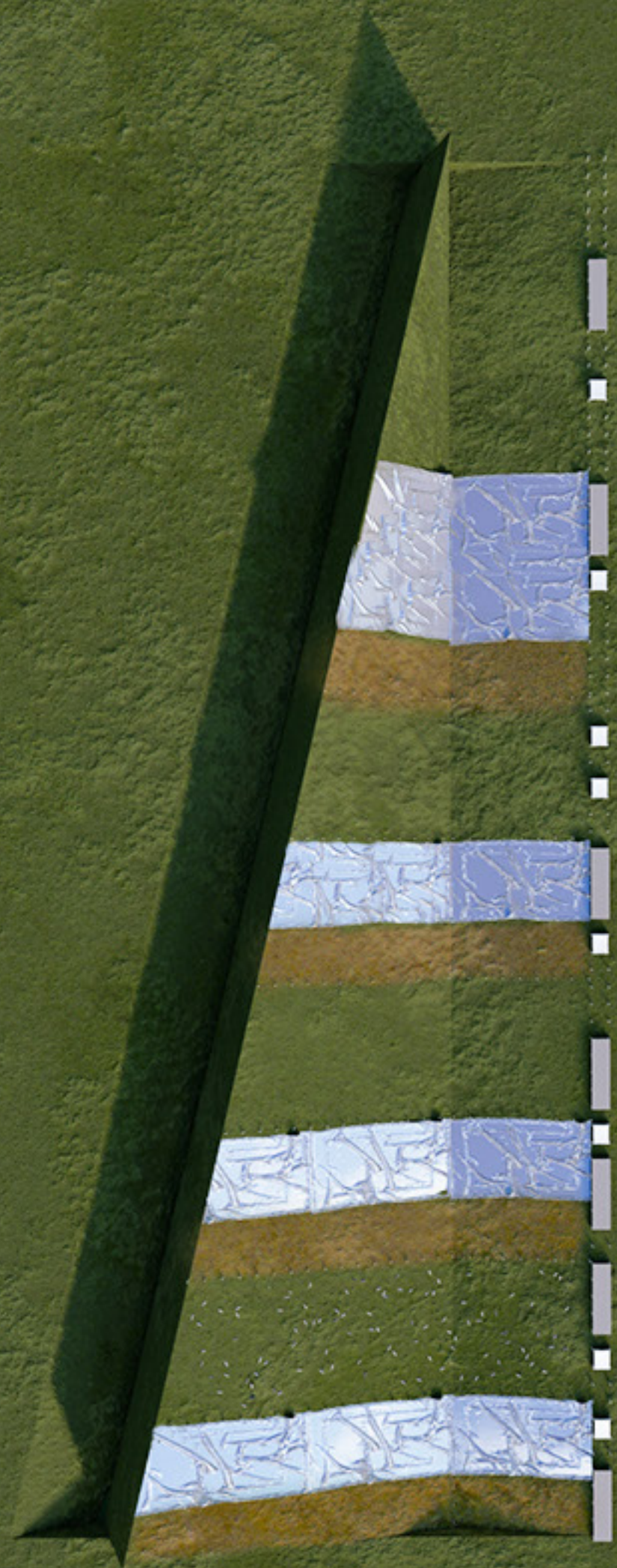
After the sheep are moved to the next pasture, the farmers dig a channel to allow snow melt to flow into the river.



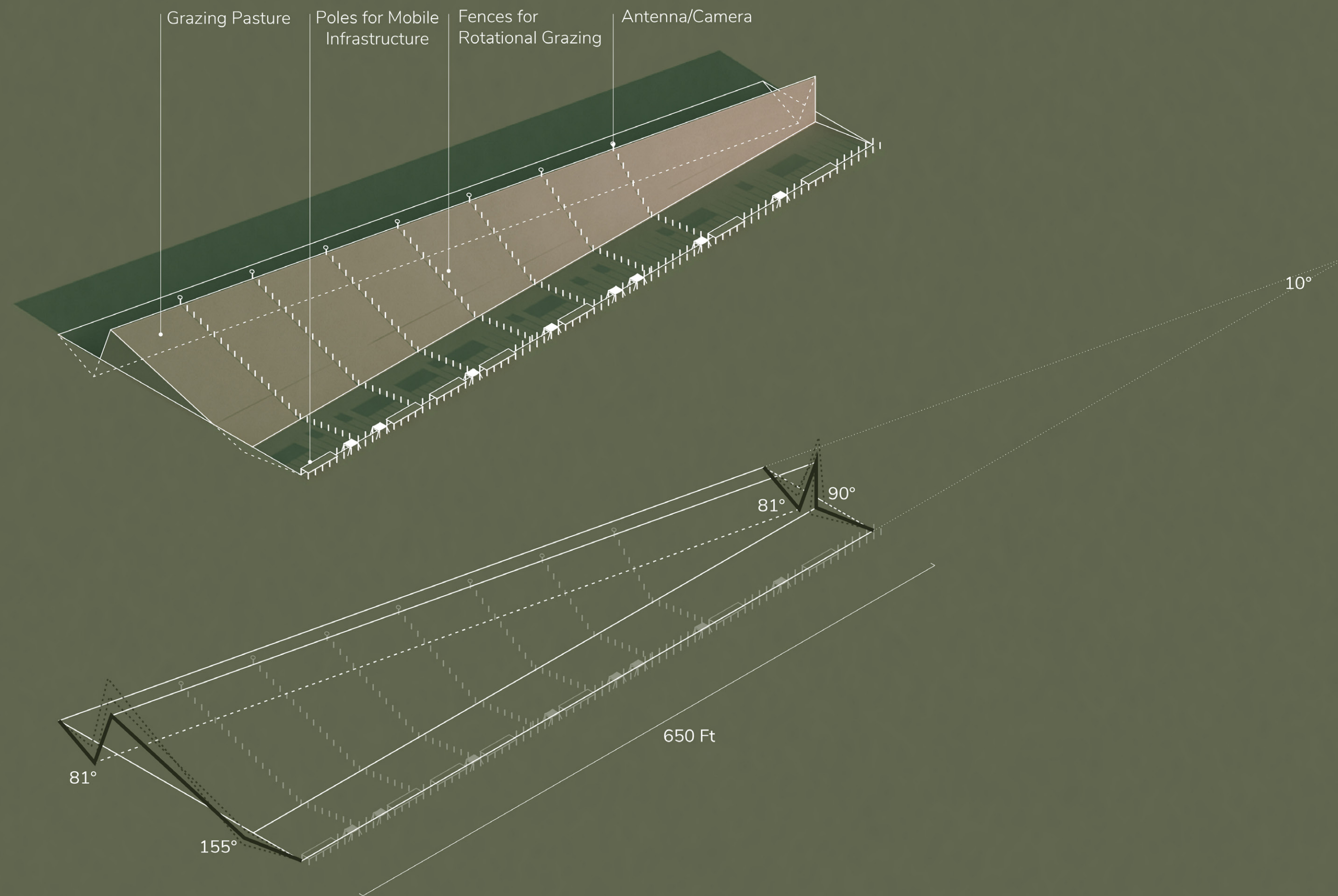
THE FOLD

“The Fold” will be used in spring. It is located on the north side of “The Enclosed” and next to the road. It has two folds for the sheep to graze on, one facing the sun and the other below the ground. As the visitors observe the pasture from the west, the sunlight from the south accentuates the shadow. The geometric shape forms a stark contrast with the mountain at the back. The fabric for protecting the plants is laid out among the strips of grazed paddocks.



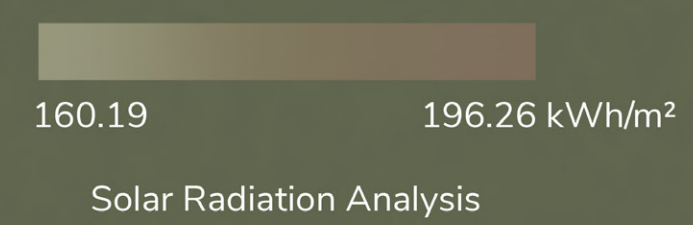
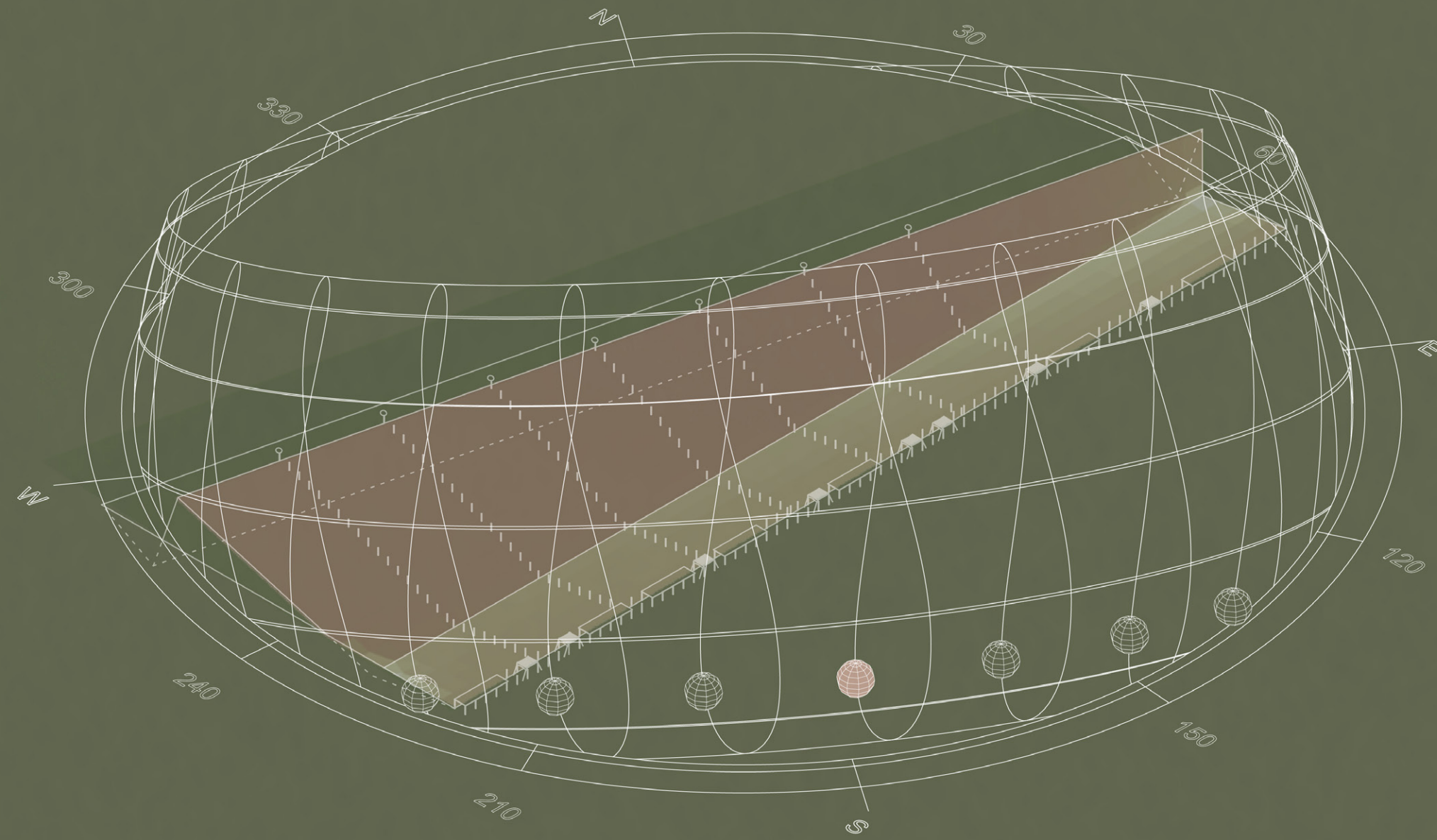
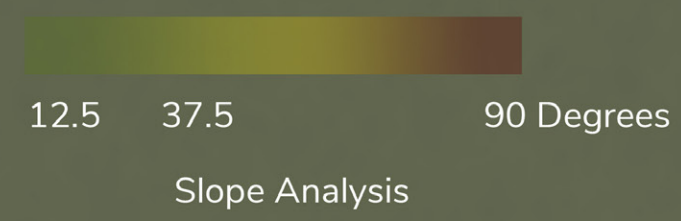
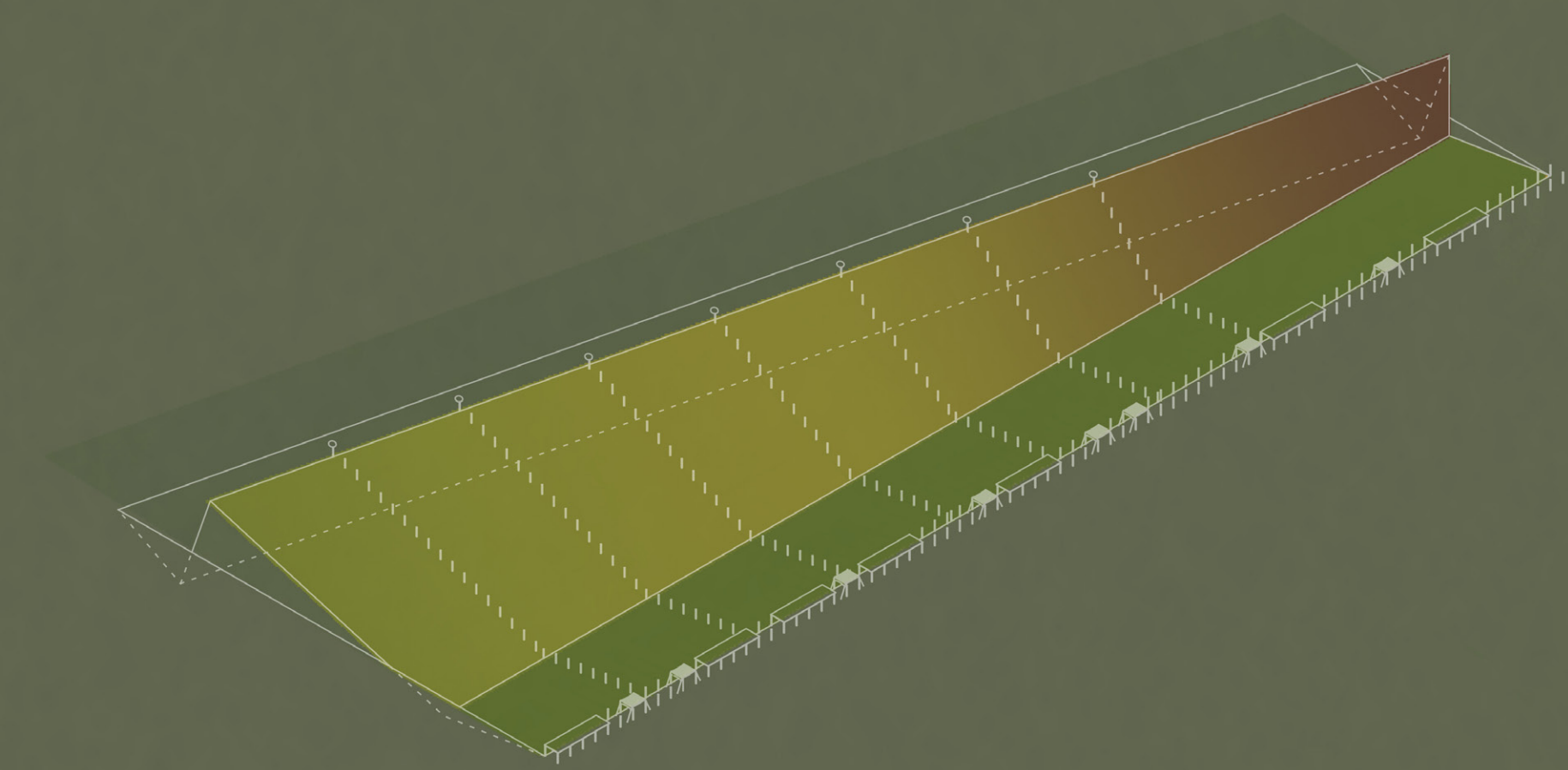




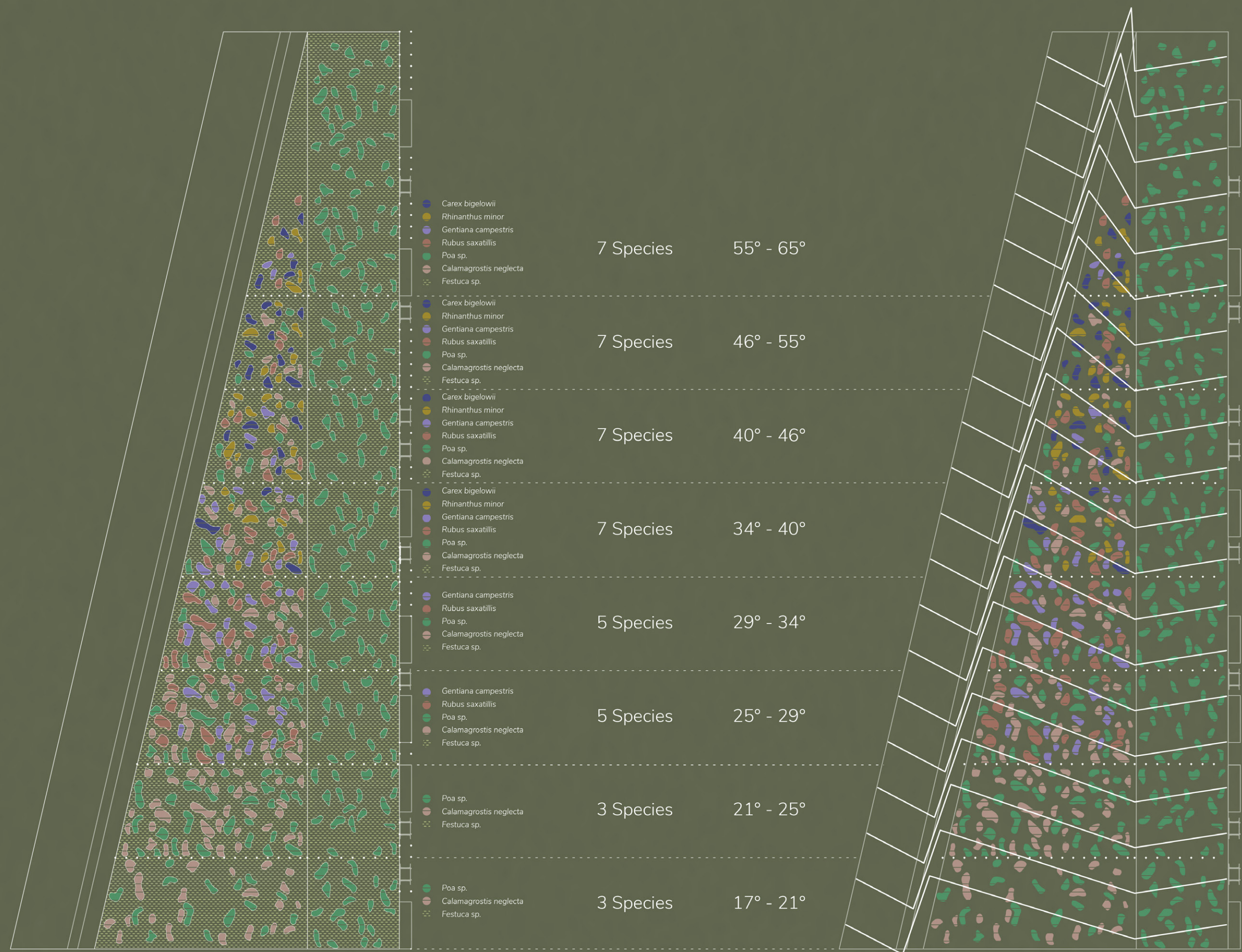


The geometry is designed through balancing between slope range, pasture size, and aesthetic experience

For "The Fold," the two curves that form the curved surface, as highlighted in green, are parallel. One curve is truncated and the end extensions meet at a 10-degree angle.

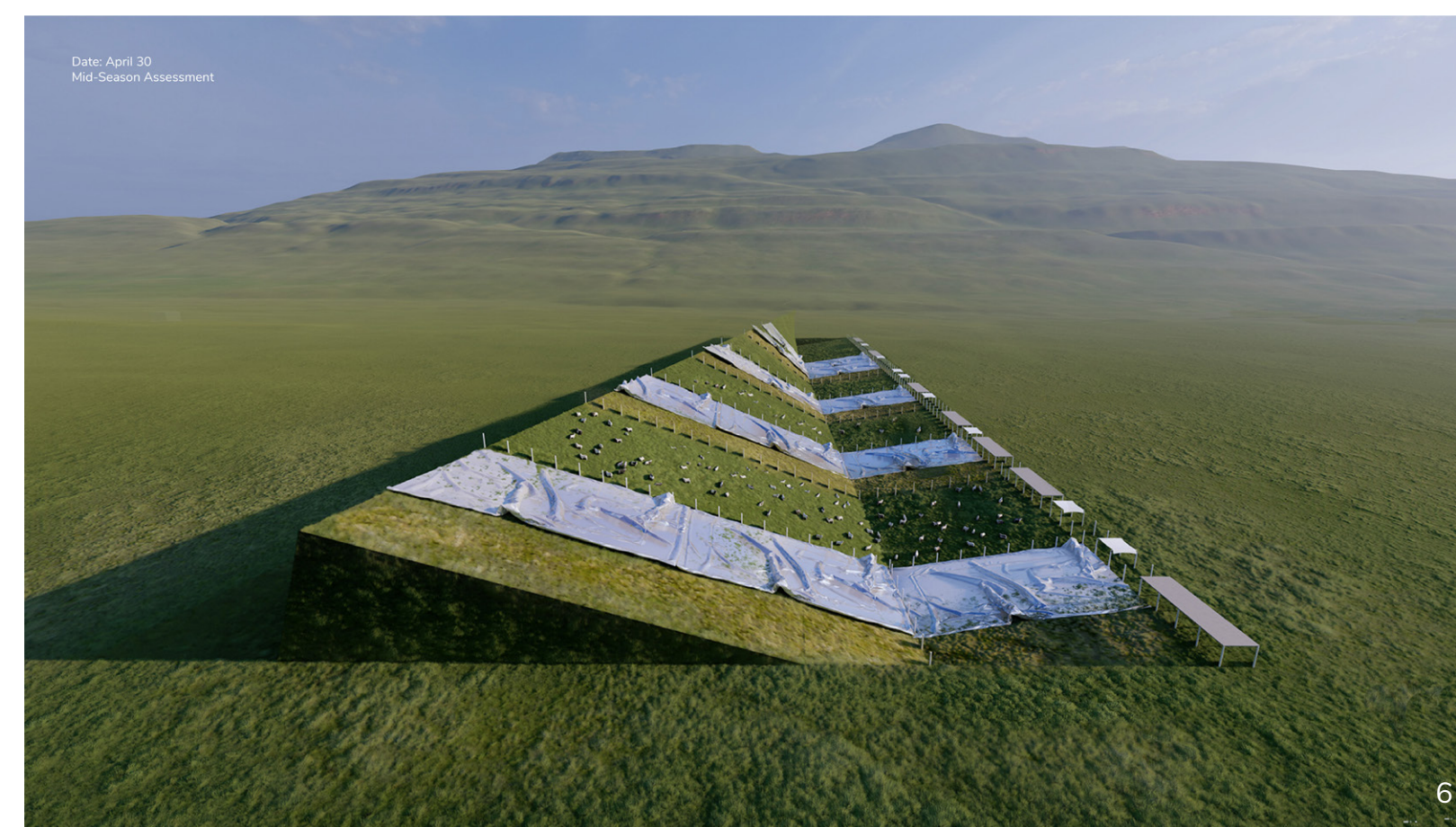
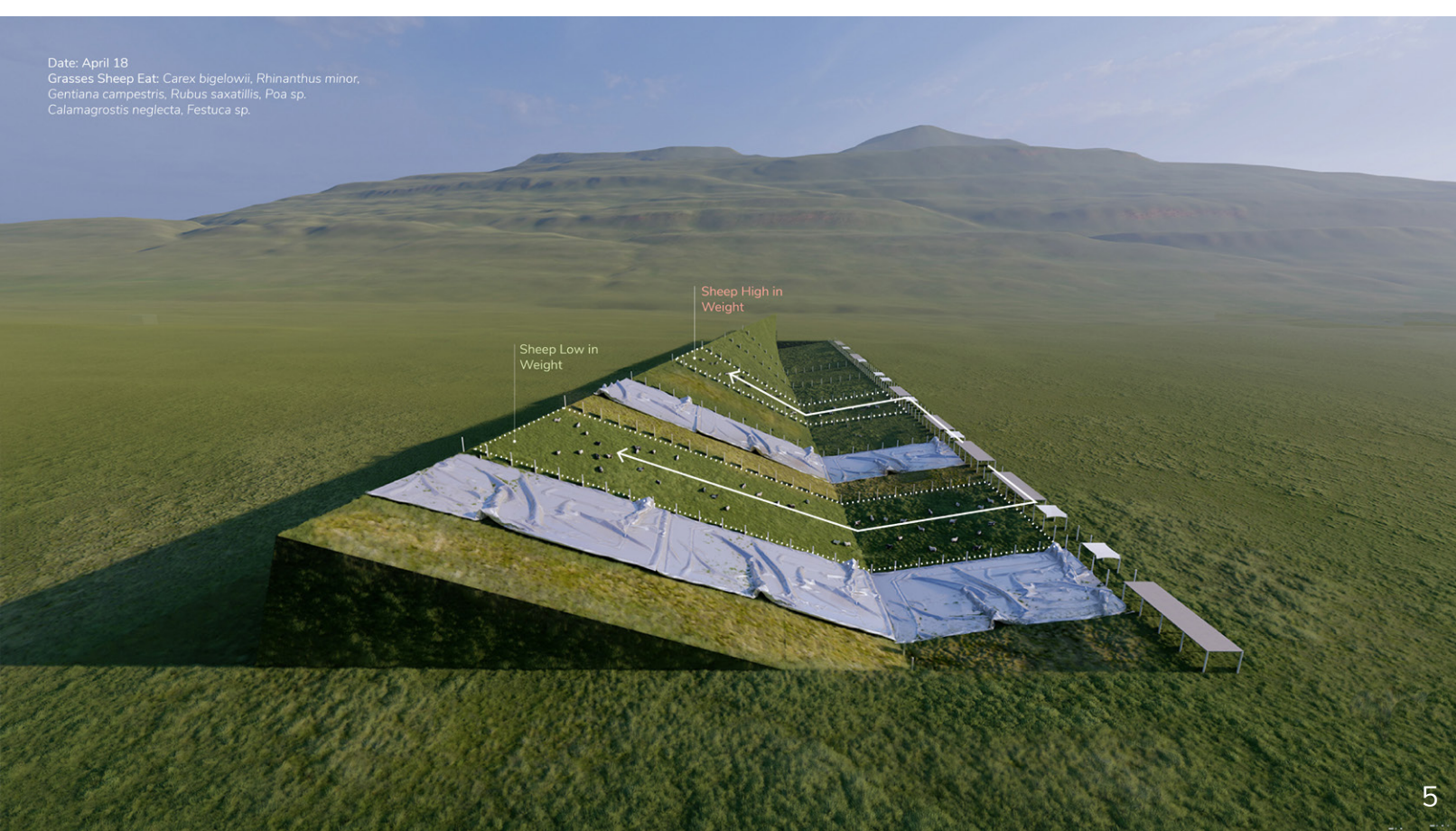
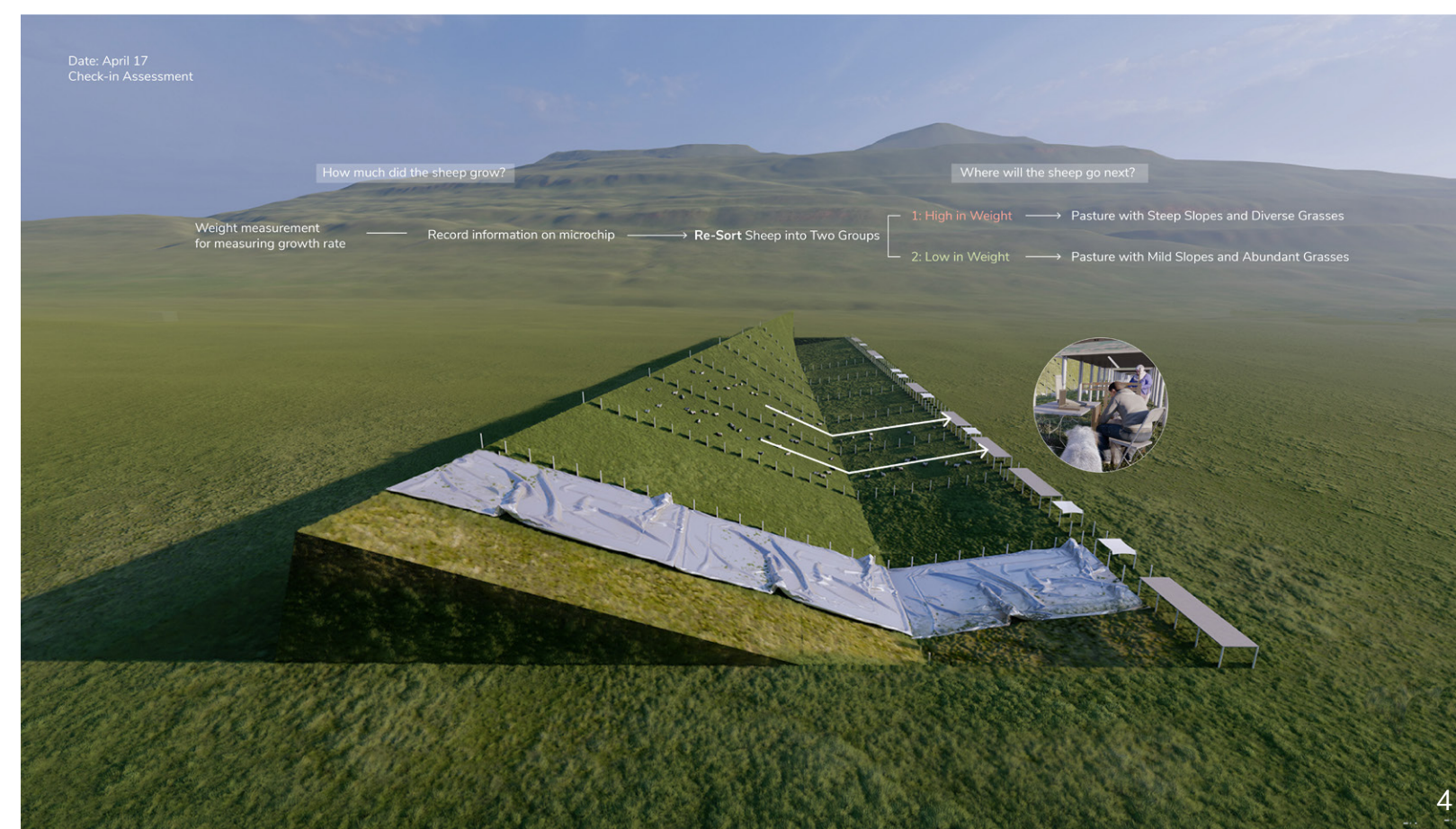
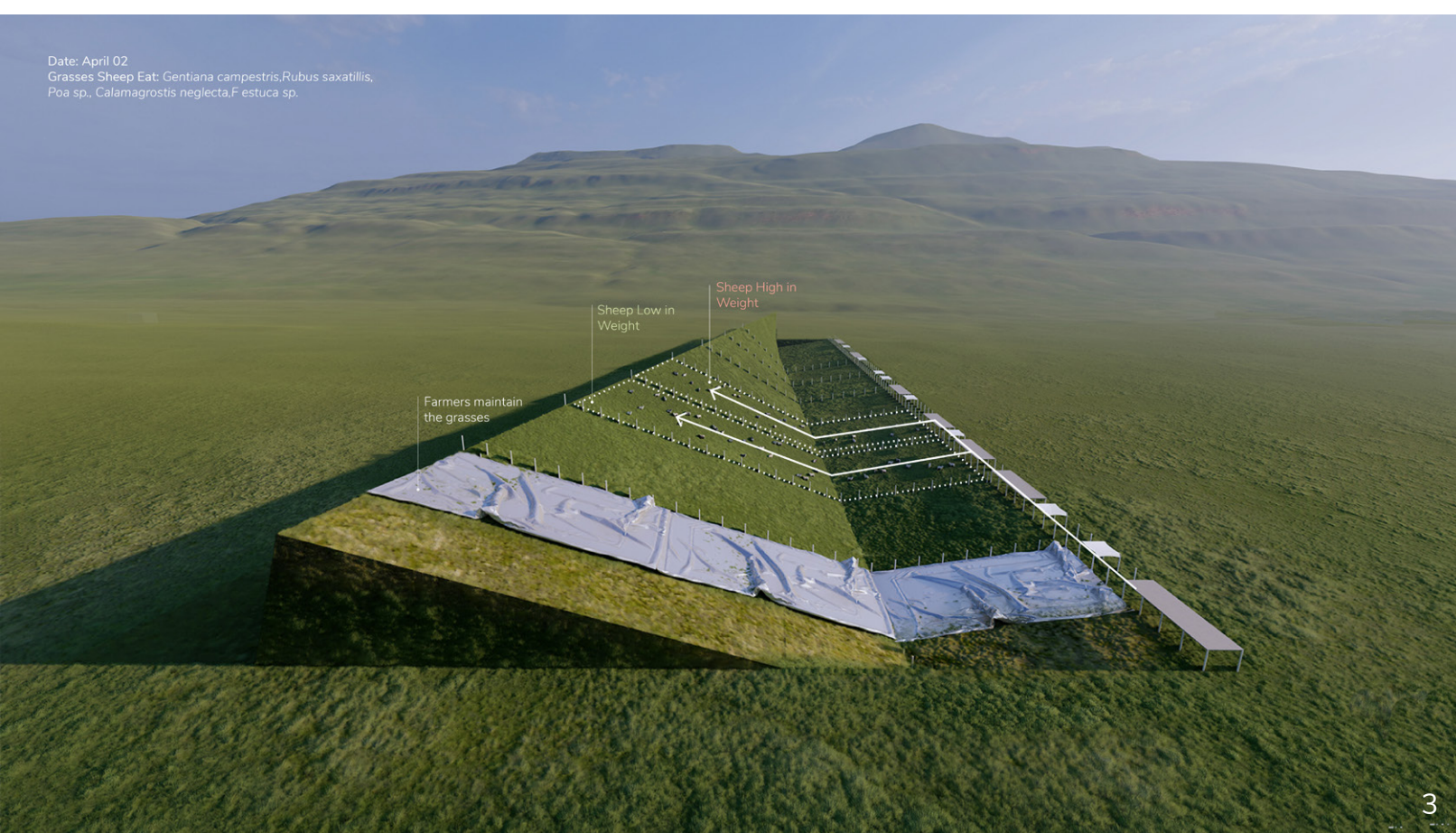
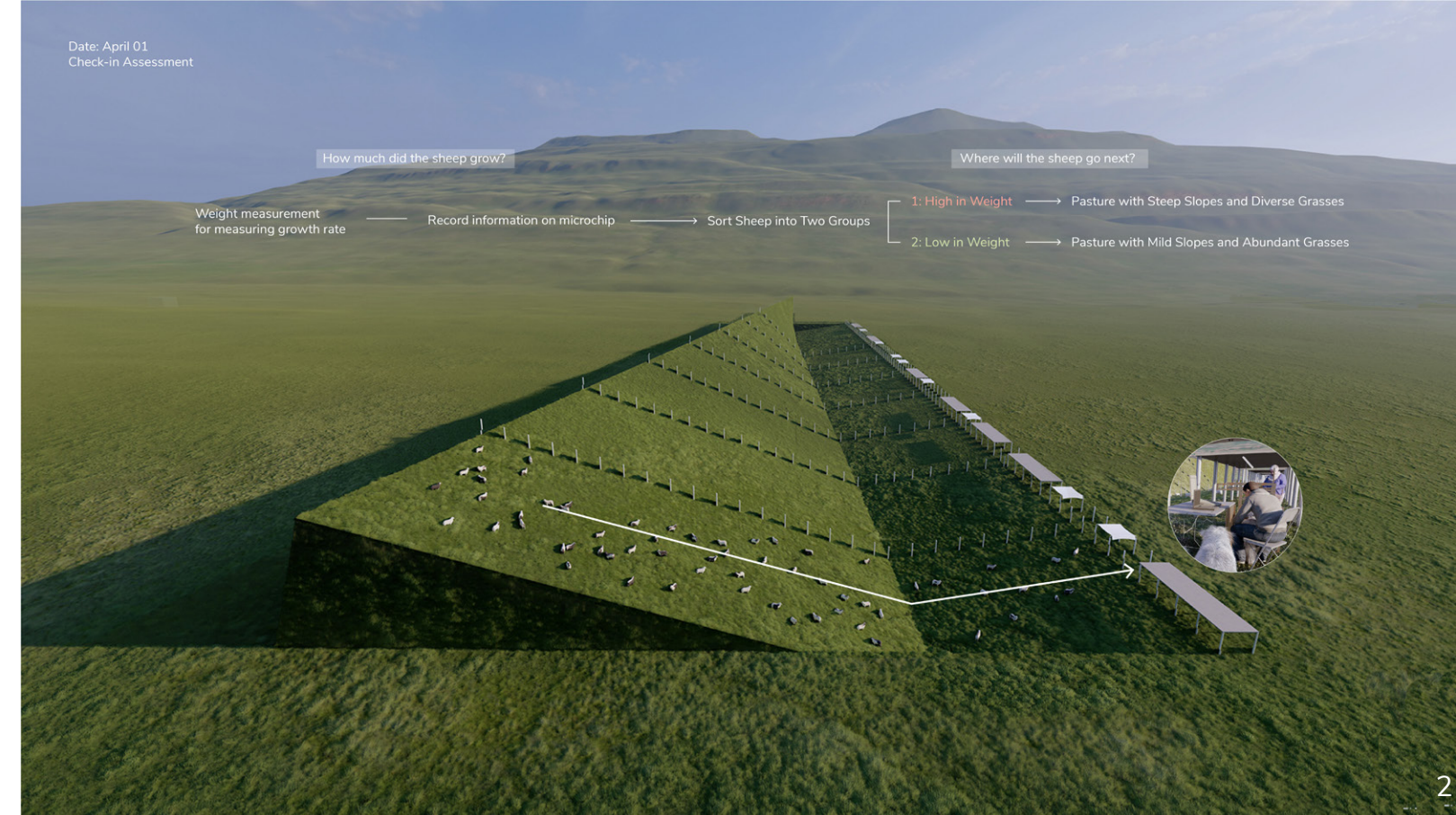
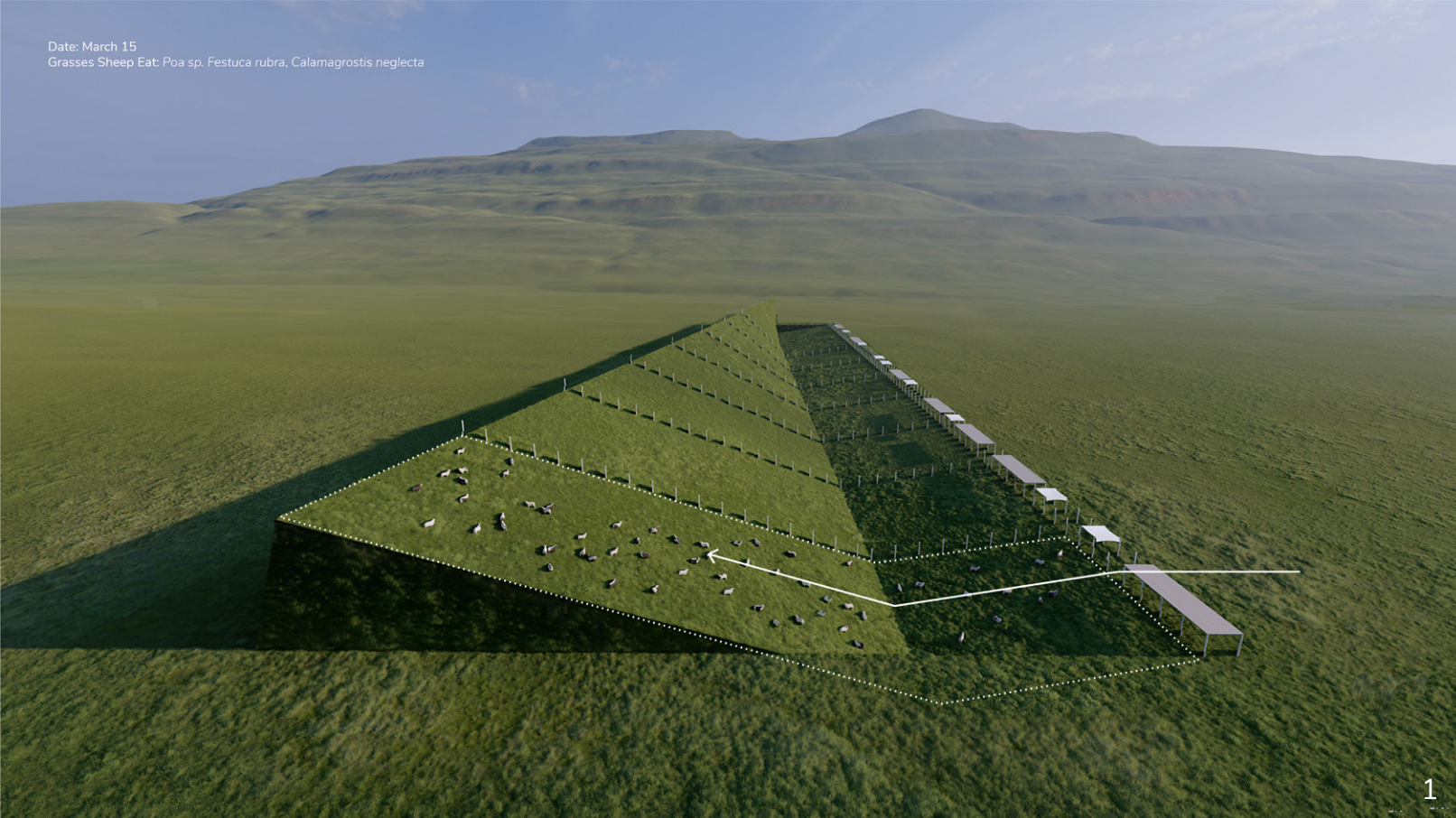


The two curves create a surface that has continuous gradients of slopes and solar radiation. This forms an unlimited array of microclimates for vegetation growth.



In this initial planting plan, farmers plant more species in areas with a steeper slope.

This is for two purposes: one is that, areas with a greater slope range generate more microclimates, which allow experiments with growing more diverse grass species. The other purpose is to reward the sheep that can go onto steeper slopes with more species of grasses, including the ones that are highly favored by Icelandic sheep, like a buffet. This can increase their fitness level and their muscle fat ratio, as the market demands.



1. In March, farmers lead sheep onto the first paddock.

2. After two weeks, the farmers lead the sheep down to do an assessment. They record sheep's weight on microchips.

3. Based on the data, they sort the sheep into two groups, one group relatively high in weight, and the other group low in weight. The sheep in the first group will graze on a paddock with steeper slopes and more grass variety, whereas the second group will graze on a mild paddock. The farmers maintain the grasses, monitor the sheep health, and offer individualized care. Based on observations, they recalculate rotation timing.

4. After two weeks, the sheep are gathered for another assessment.

5. After weight measurement, the sheep are re-sorted into two groups and graze on different paddocks.

6. After all the paddocks are used, this image shows one possible arrangement of the protective fabric and the grazed paddocks. The sheep are gathered for a mid-season assessment.

How much did the sheep grow?

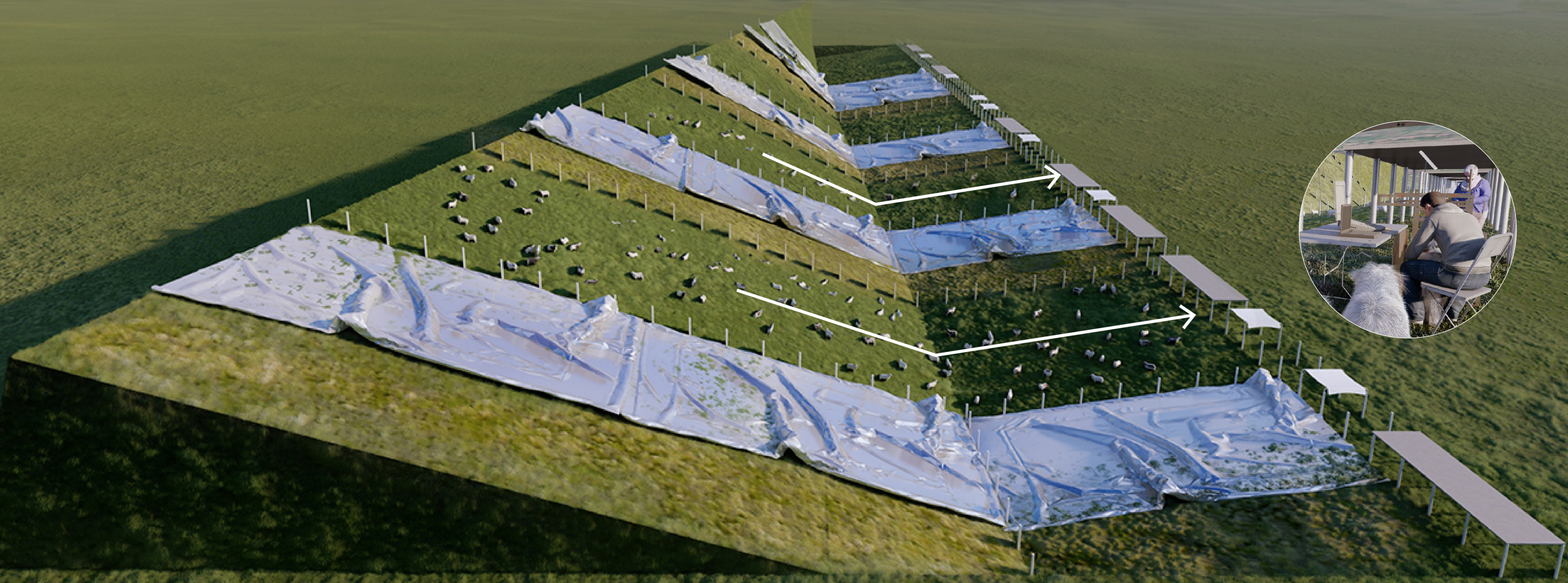
Weight measurement
for measuring growth rate

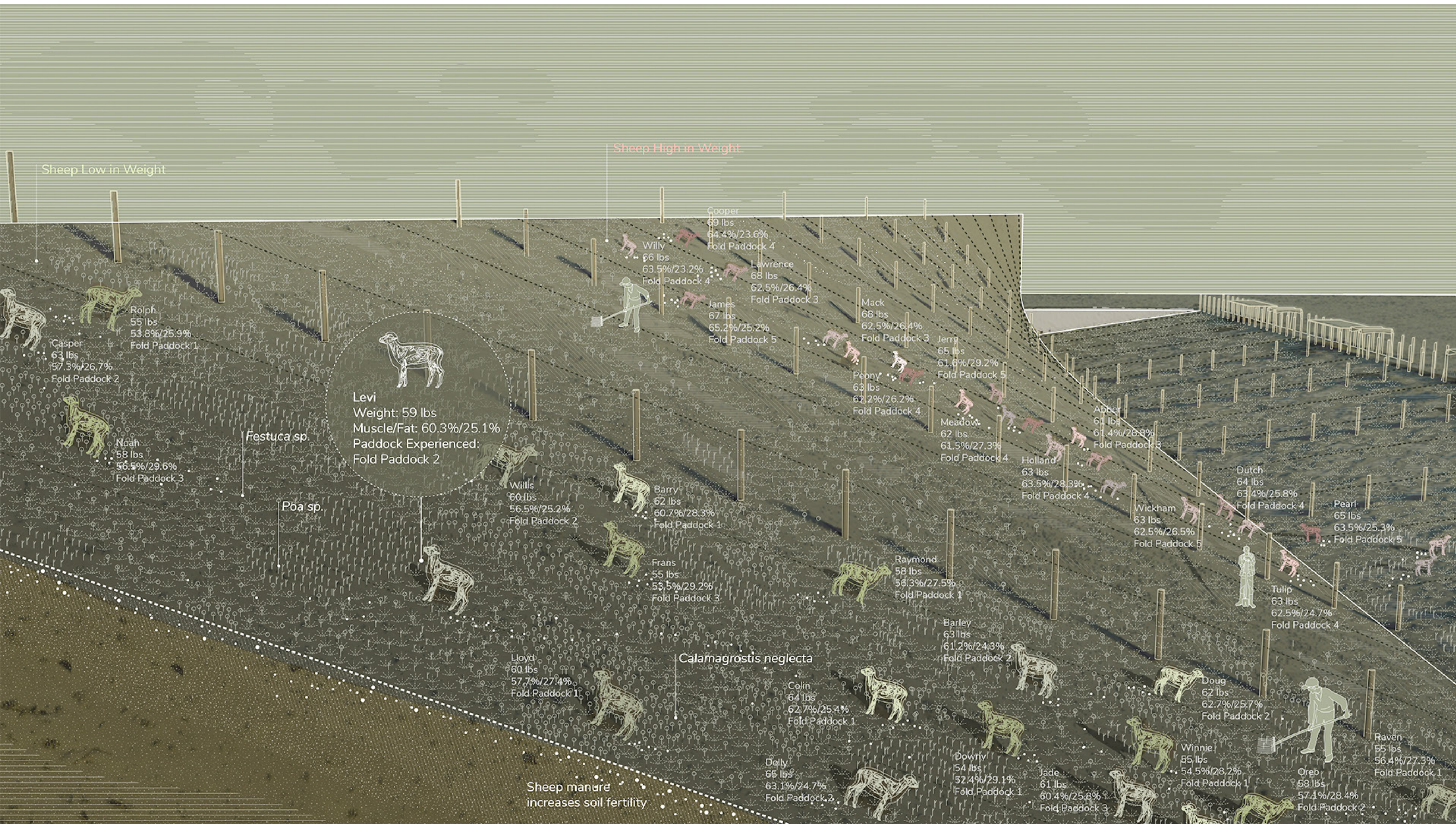
Ultrasound imaging for
measuring muscle fat ratio

Record information on microchip → Re-Sort Sheep into Three Groups

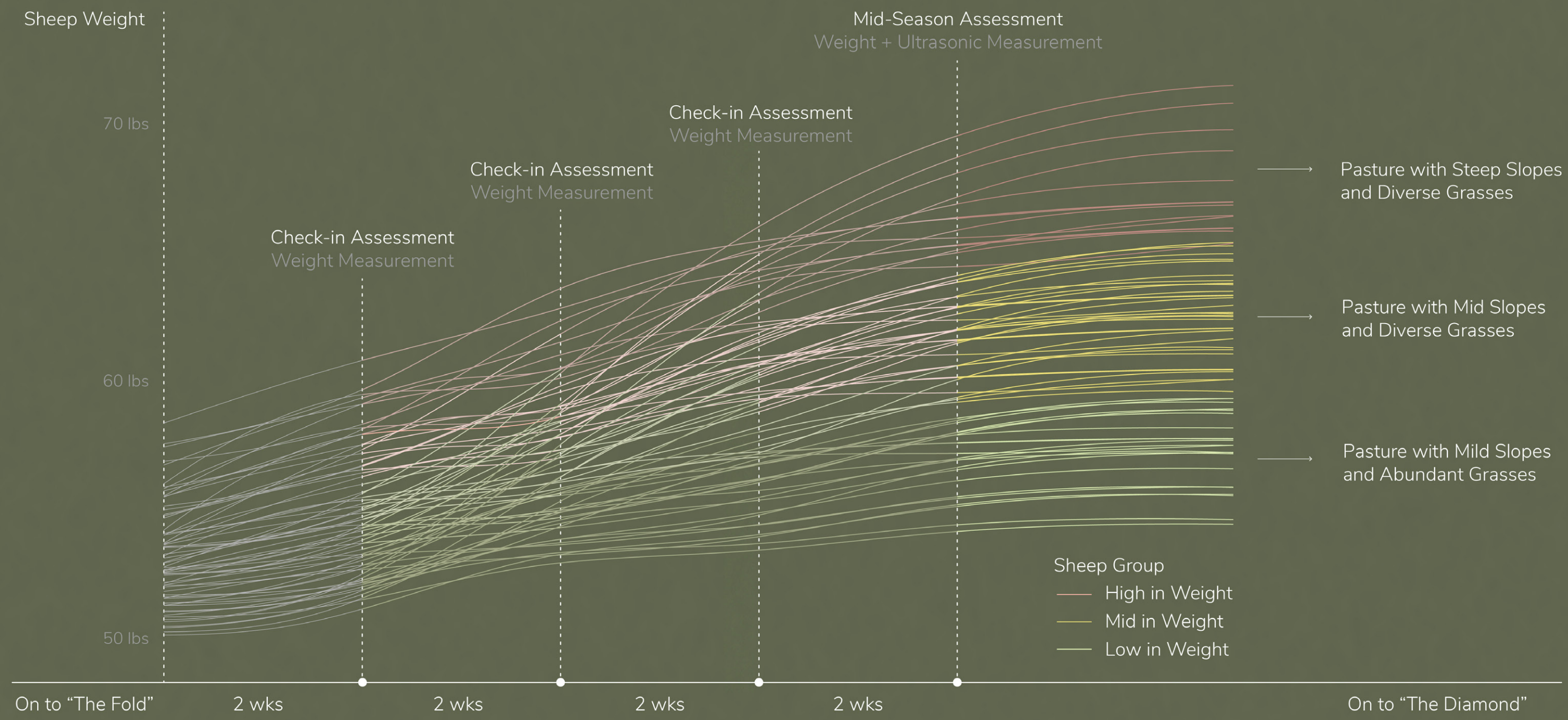
Where will the sheep go next?

- 1: High in Weight / High Muscle Fat Ratio → Pasture with Steep Slopes and Diverse Grasses
- 2: Mid in Weight / Mid Muscle Fat Ratio → Pasture with Mid Slopes and Diverse Grasses
- 3: Low in Weight / Low Muscle Fat Ratio → Pasture with Mild Slopes and Abundant Grasses

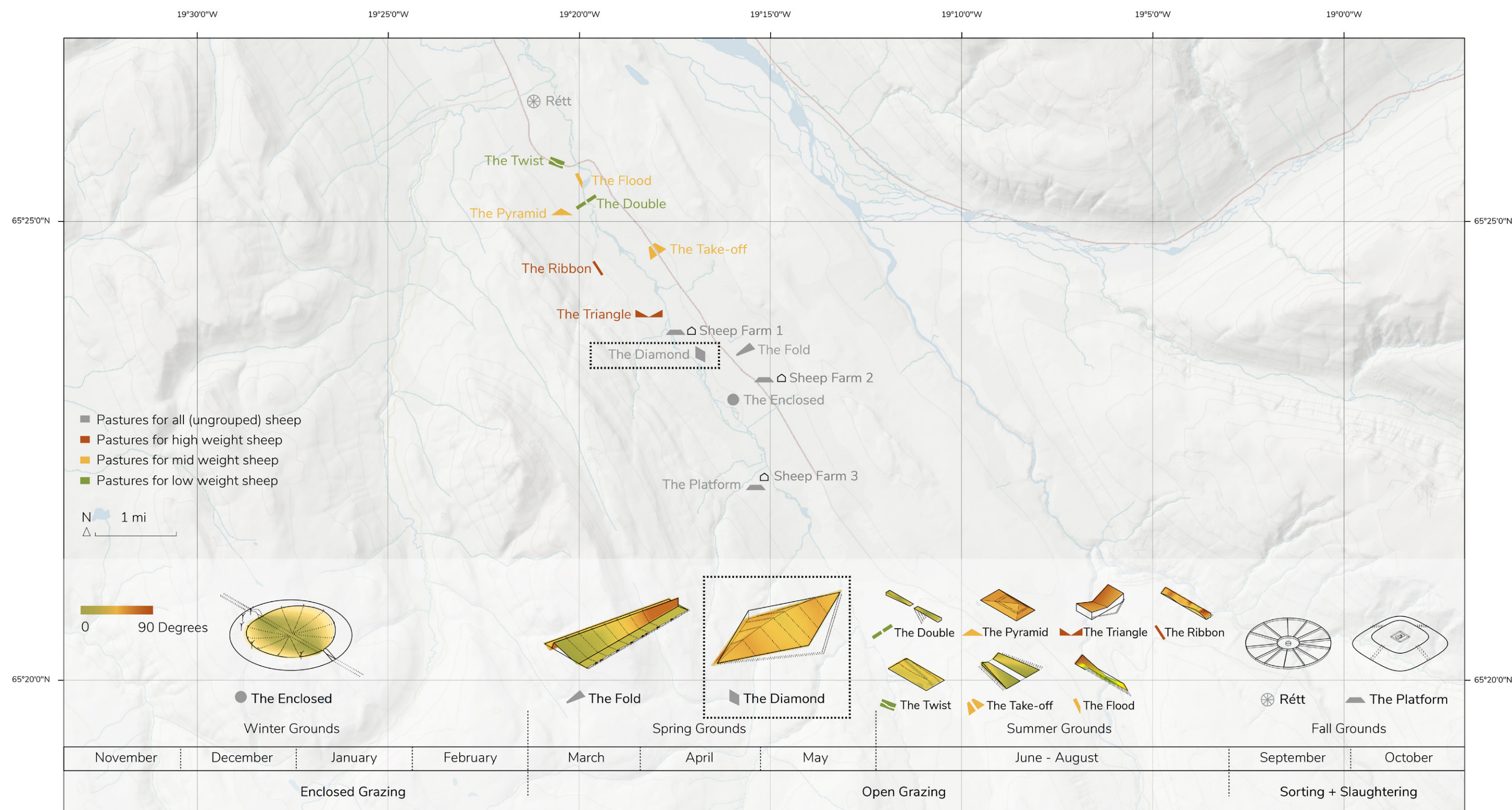




As sheep graze, the individuals that are able to get onto a steeper slope will get a higher reward: they get to eat more species of grasses. However, although the geometry of the pasture is the design factor of certainty, including the slope ranges, it cannot be predicted which individual grazes on the higher slope and which develops higher muscle fat ratio. Therefore, the gradient of slopes allows for maximum grazing need accommodation, and the assessments monitor the efficiency of the pasture in creating sheep with better fitness.



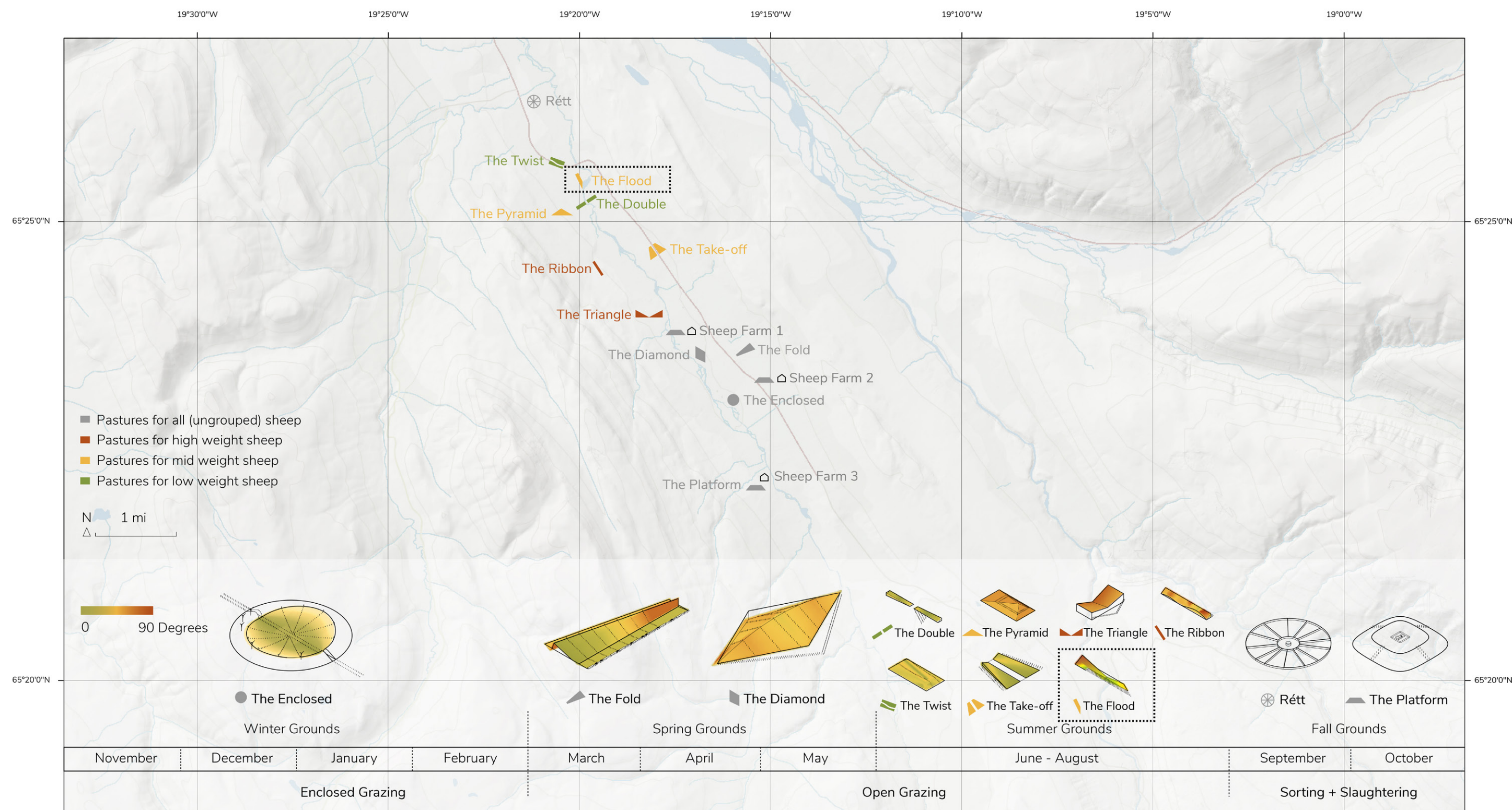
This graph explains the grouping and assessment mechanism. As sheep grow, their grazing needs are monitored and analyzed, and the result is used for sorting them into the most suitable paddock.



THE DIAMOND

“The Diamond” is used in spring after “The Fold.” The arch generates a surface of a gradient of facings, allowing different reflections from the sun. As visitors stand in front of it, the surface always reflect different shades of green.



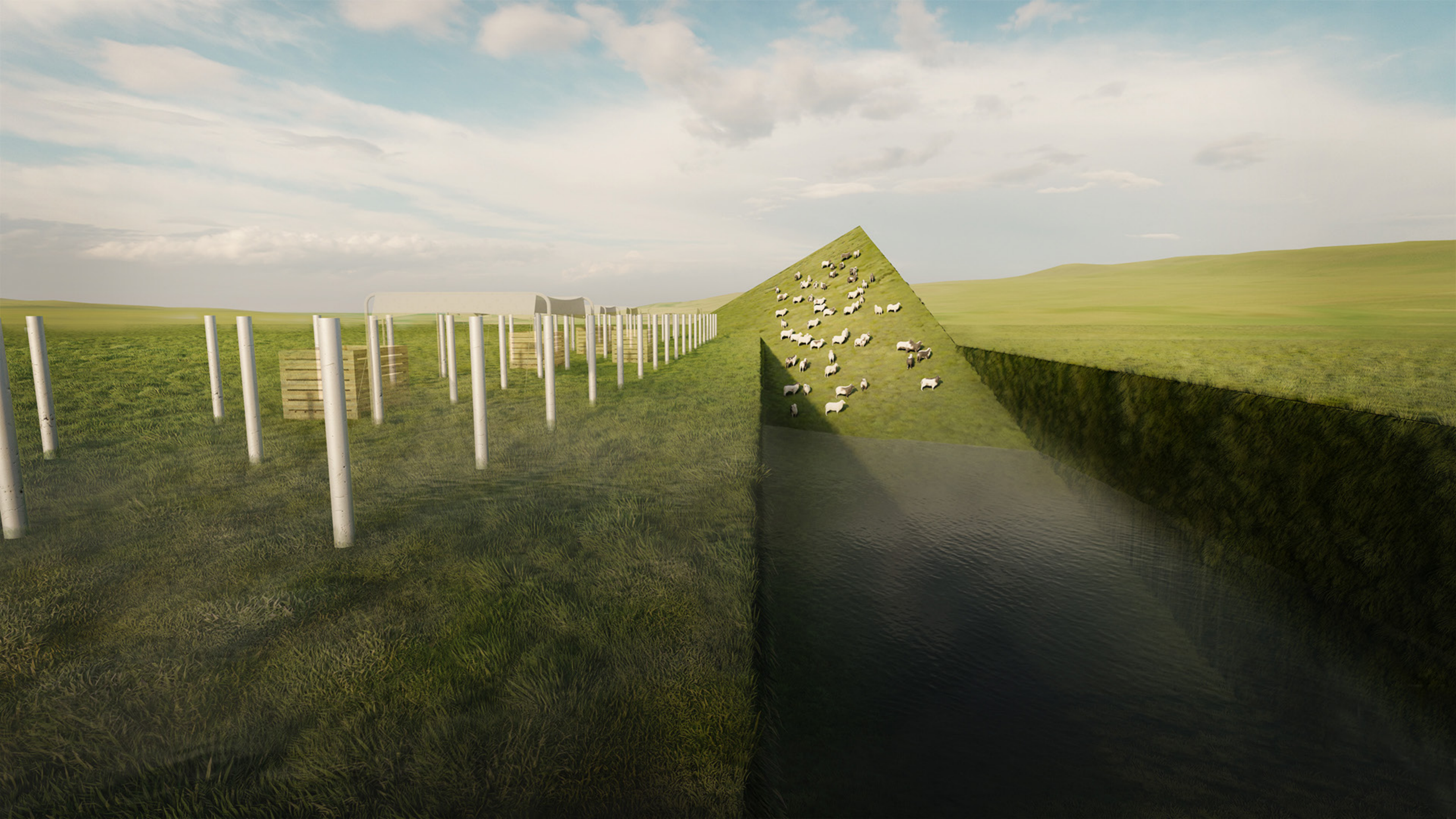


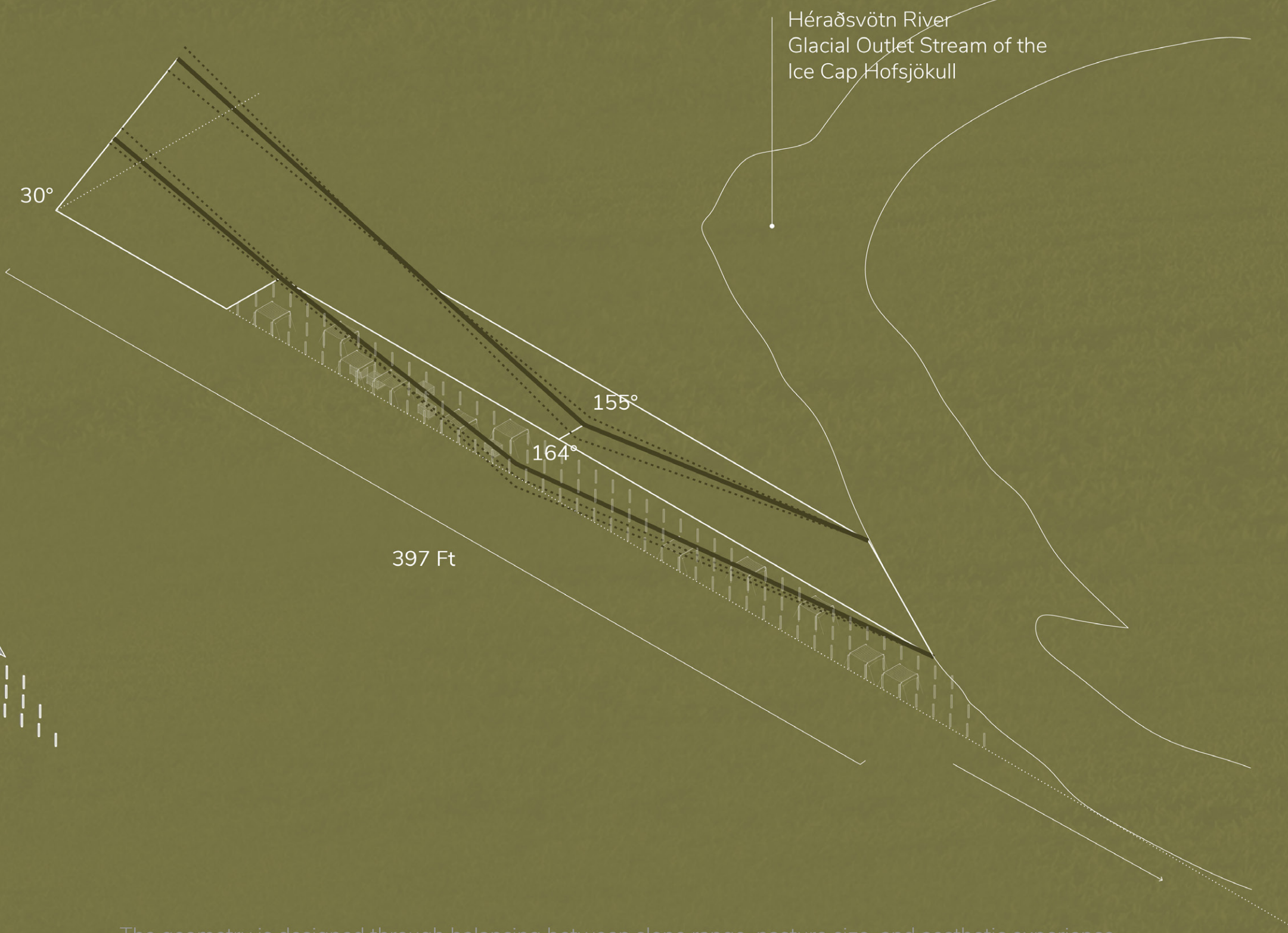
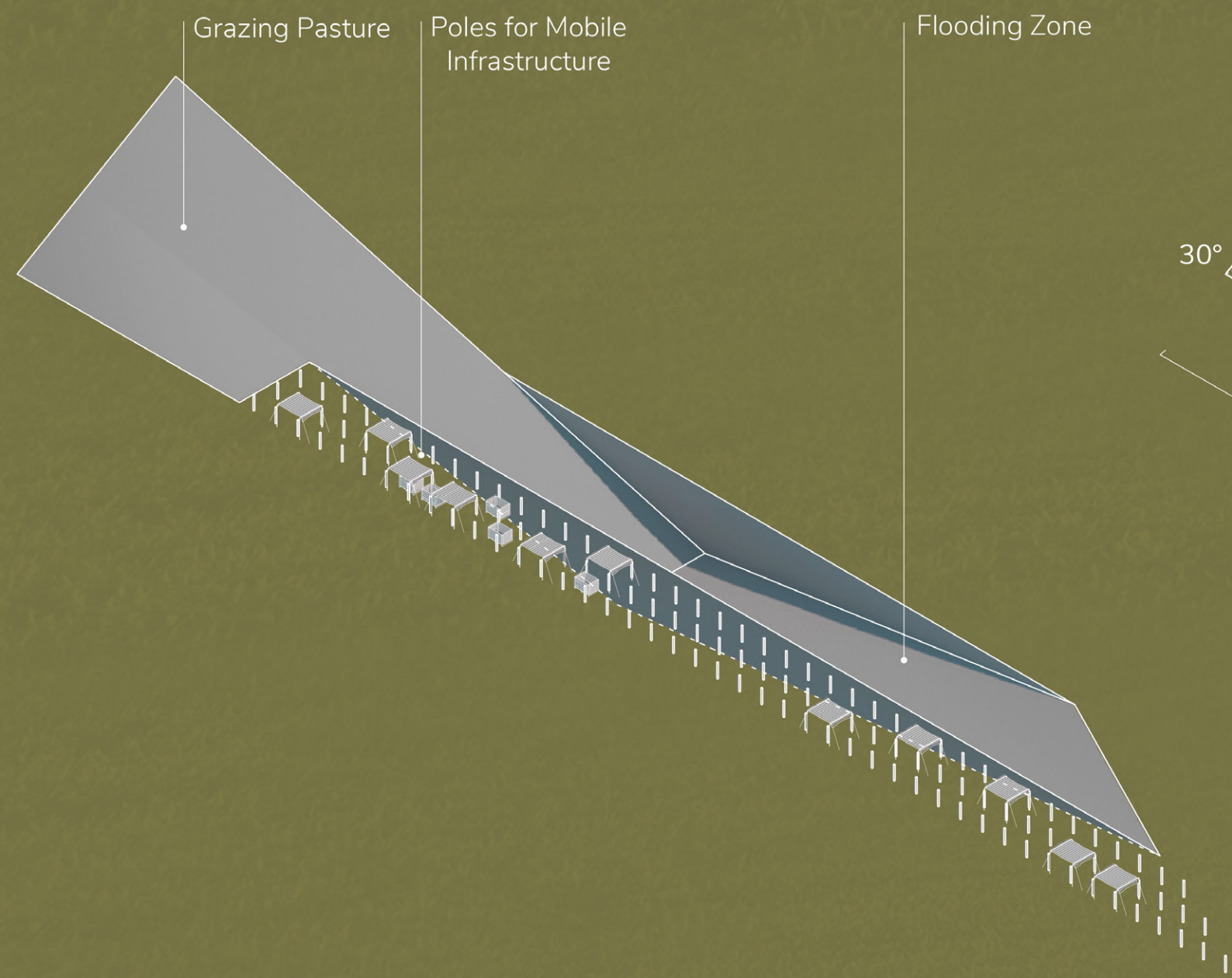
THE FLOOD

“The Flood” will be used in summer. This is one of the seven summer pastures that will be occupied simultaneously. It touches the bank of the river and cuts into the earth. The river is the glacial outlet of the ice cap Hofsjökull. During the summer, when the melted glacial water overflows the river, the water floods into the cut, which appears as a geometric shape etching into the earth. This shape forms a stark contrast with the naturalistic river. As visitors enter this pasture, they see geometric landforms popping out of the flooded landscape.



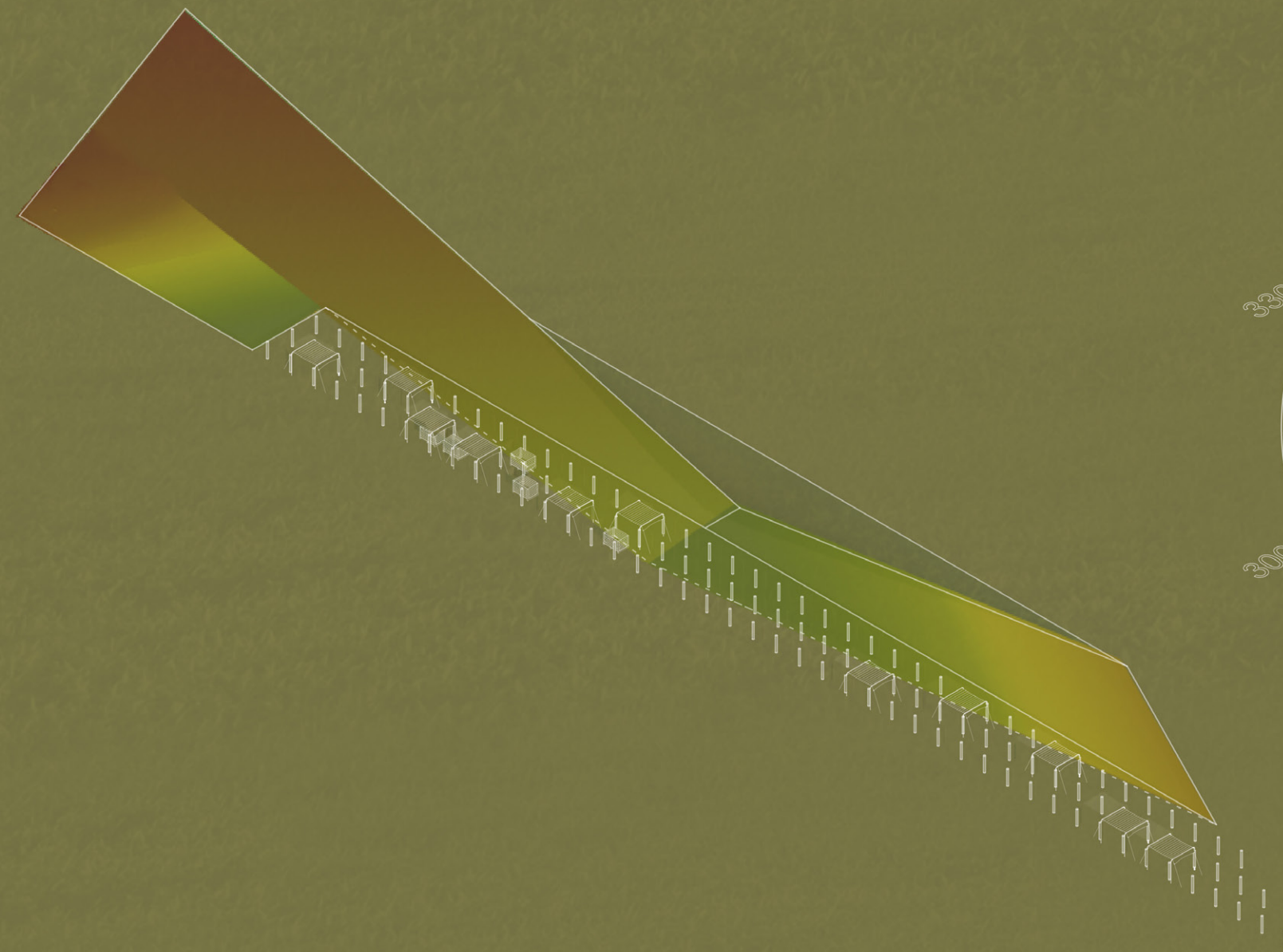




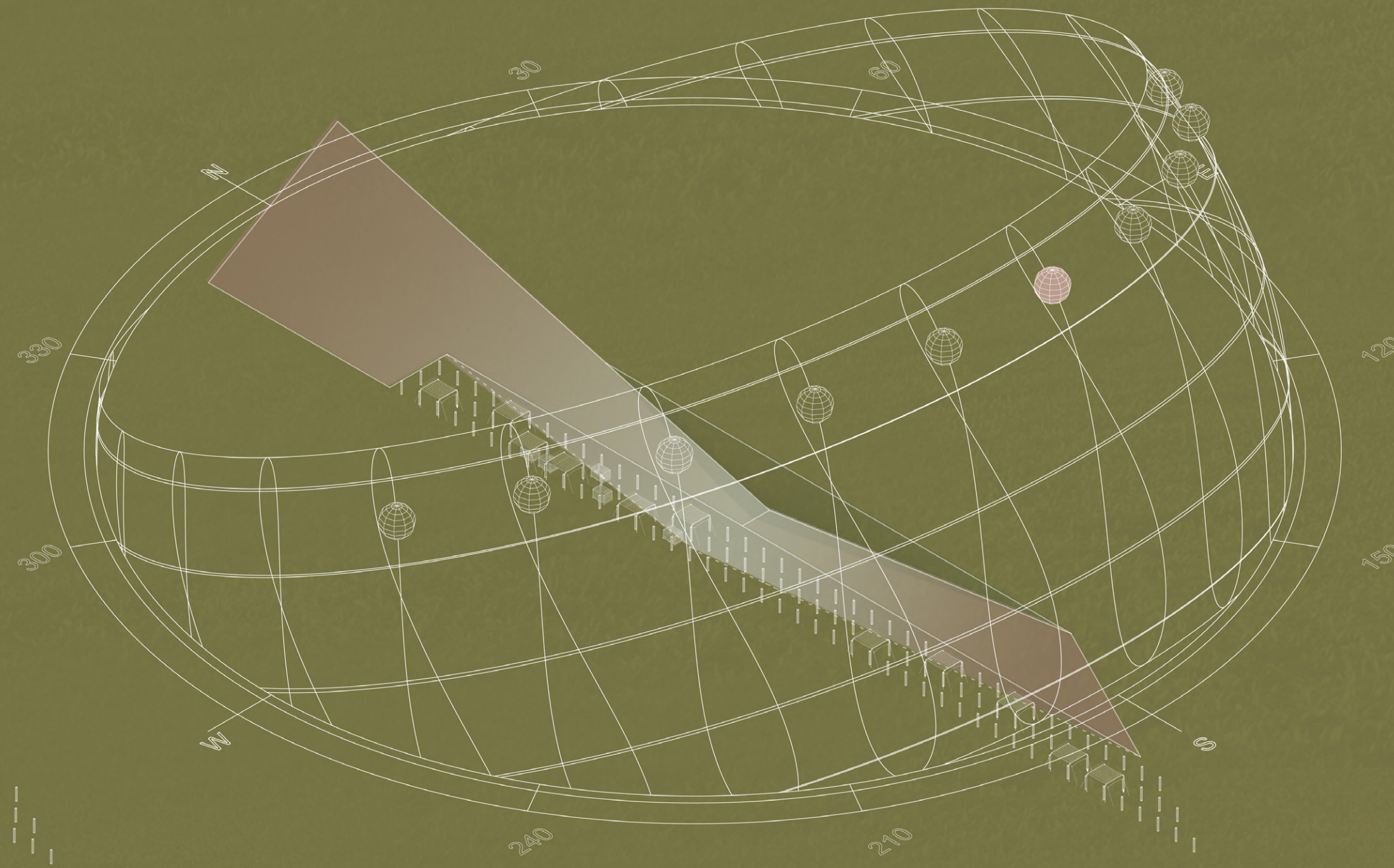


The geometry is designed through balancing between slope range, pasture size, and aesthetic experience

For "the Flood," the two curves that form the curved surface, as highlighted in green, are parallel and they vary in one angle.

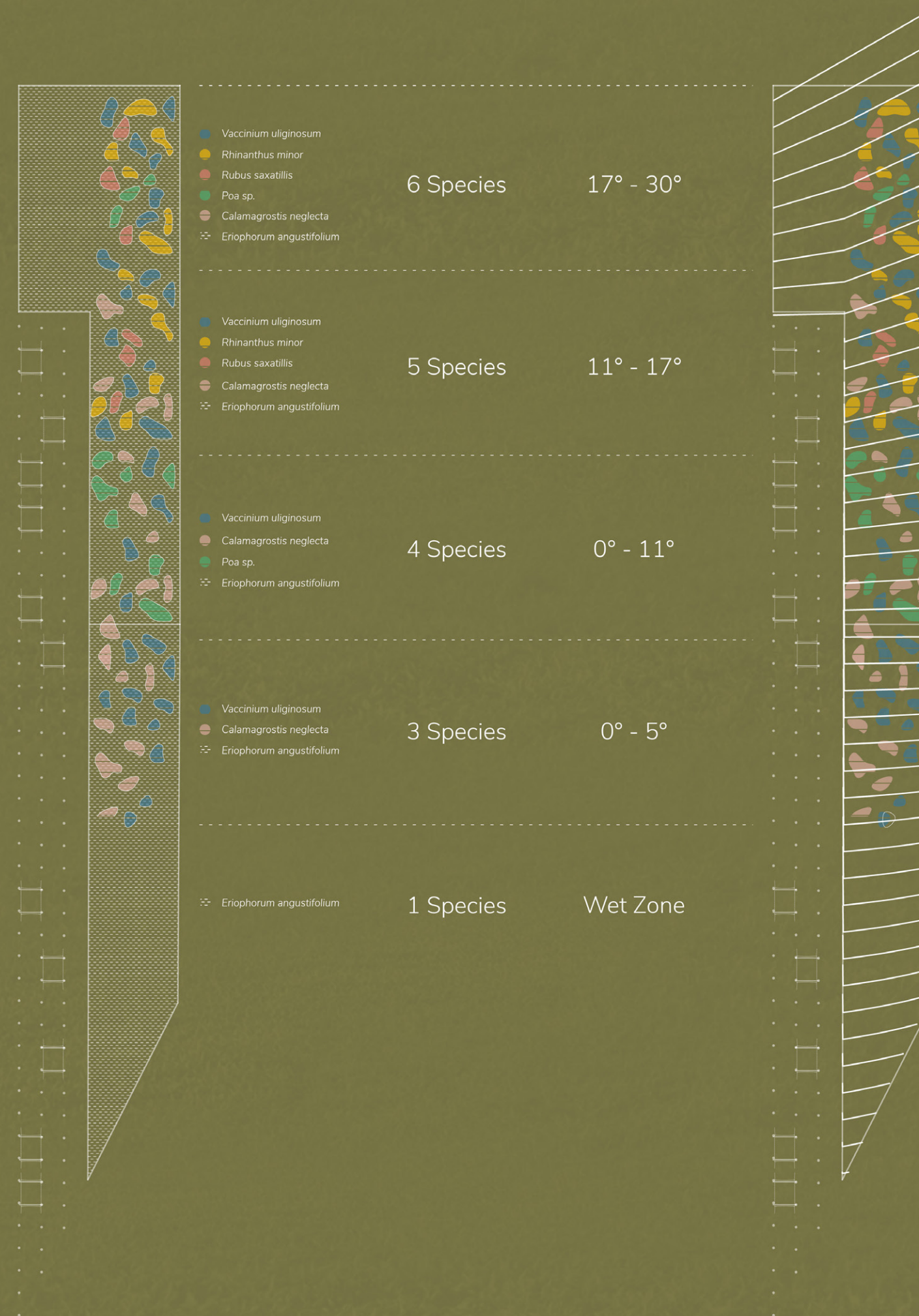


12.5 30 Degrees
Slope Analysis



82.07 177.00 kWh/m²
Solar Radiation Analysis

The two curves create a surface that has continuous gradients of slopes and solar radiation.



In this initial planting plan, farmers plant more additional species of grasses in areas with a steeper slope.

Date: May 02
Grasses Sheep Eat: Calamagrostis neglecta, Poa sp. Eriophorum
angustifolium, Rhinanthus minor, Vaccinium uliginosum, Rubus saxatilis

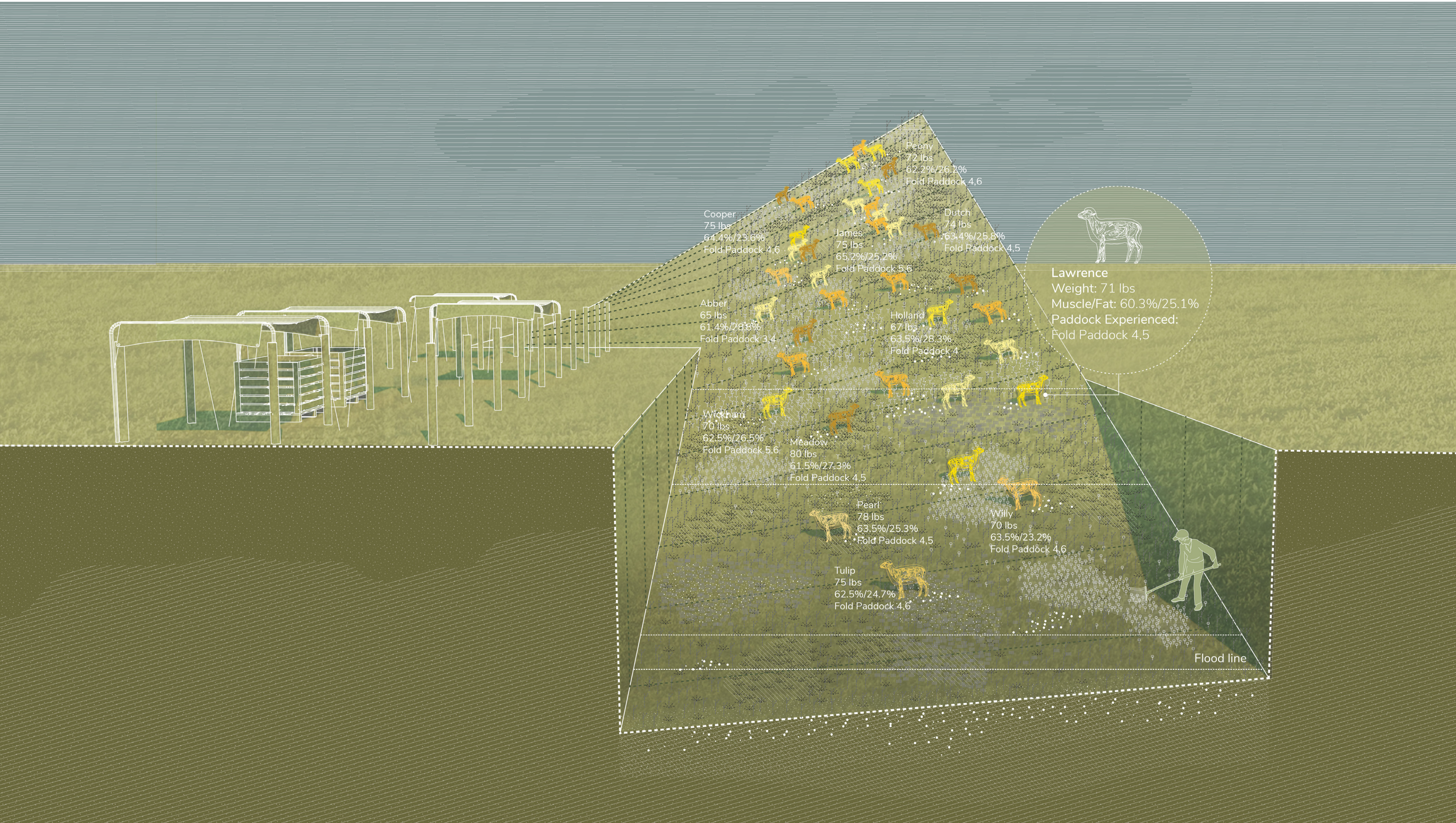


Date: May 16
Mid-Season Assessment

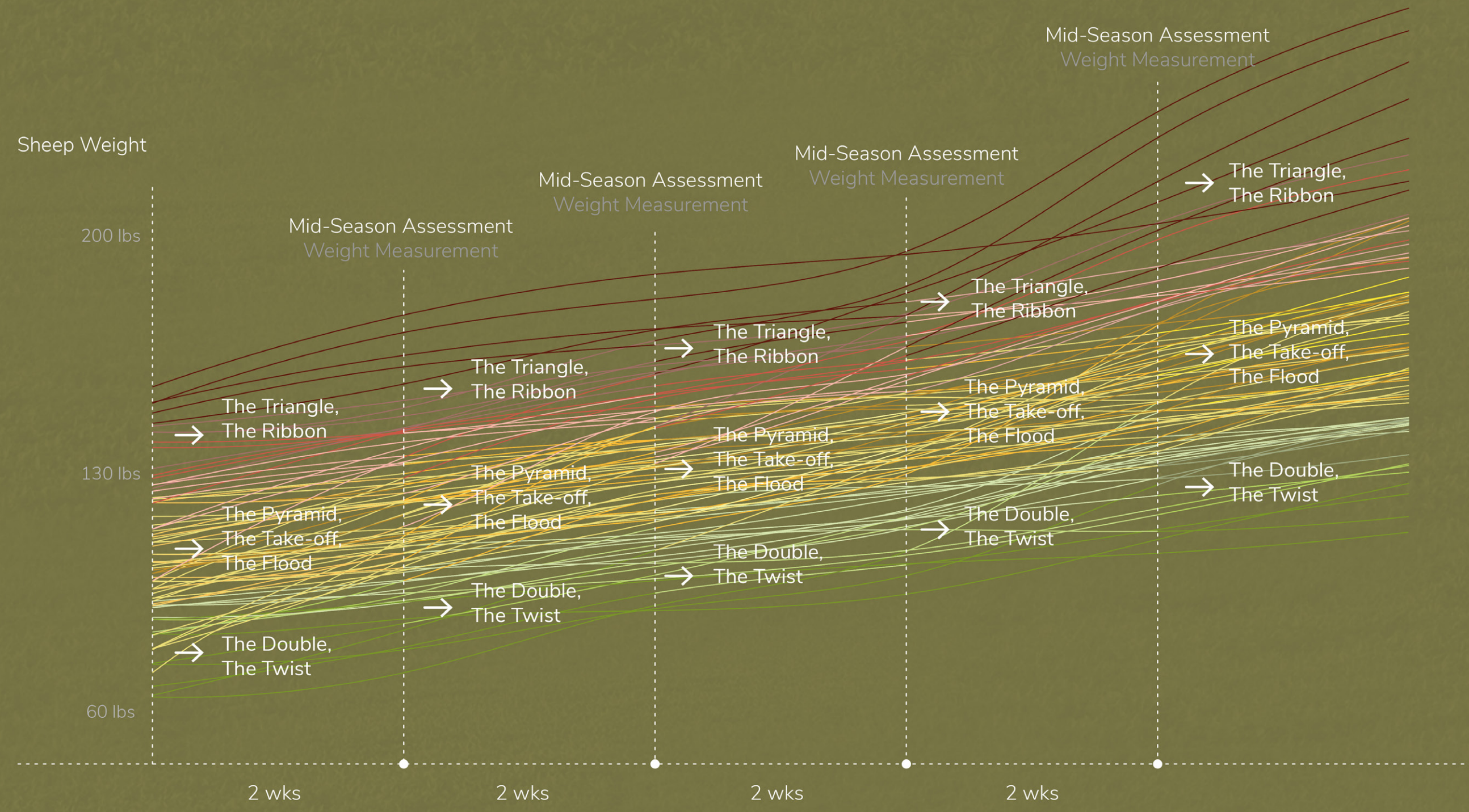


1. This pasture has a mid-range slope. Sheep that are in the yellow group will graze here. Sheep in the red and green groups will graze on other pastures.

2. After two weeks, sheep are assessed. Their microchip records are updated before farmers re-sort them again into three groups for pastures with different slope ranges.



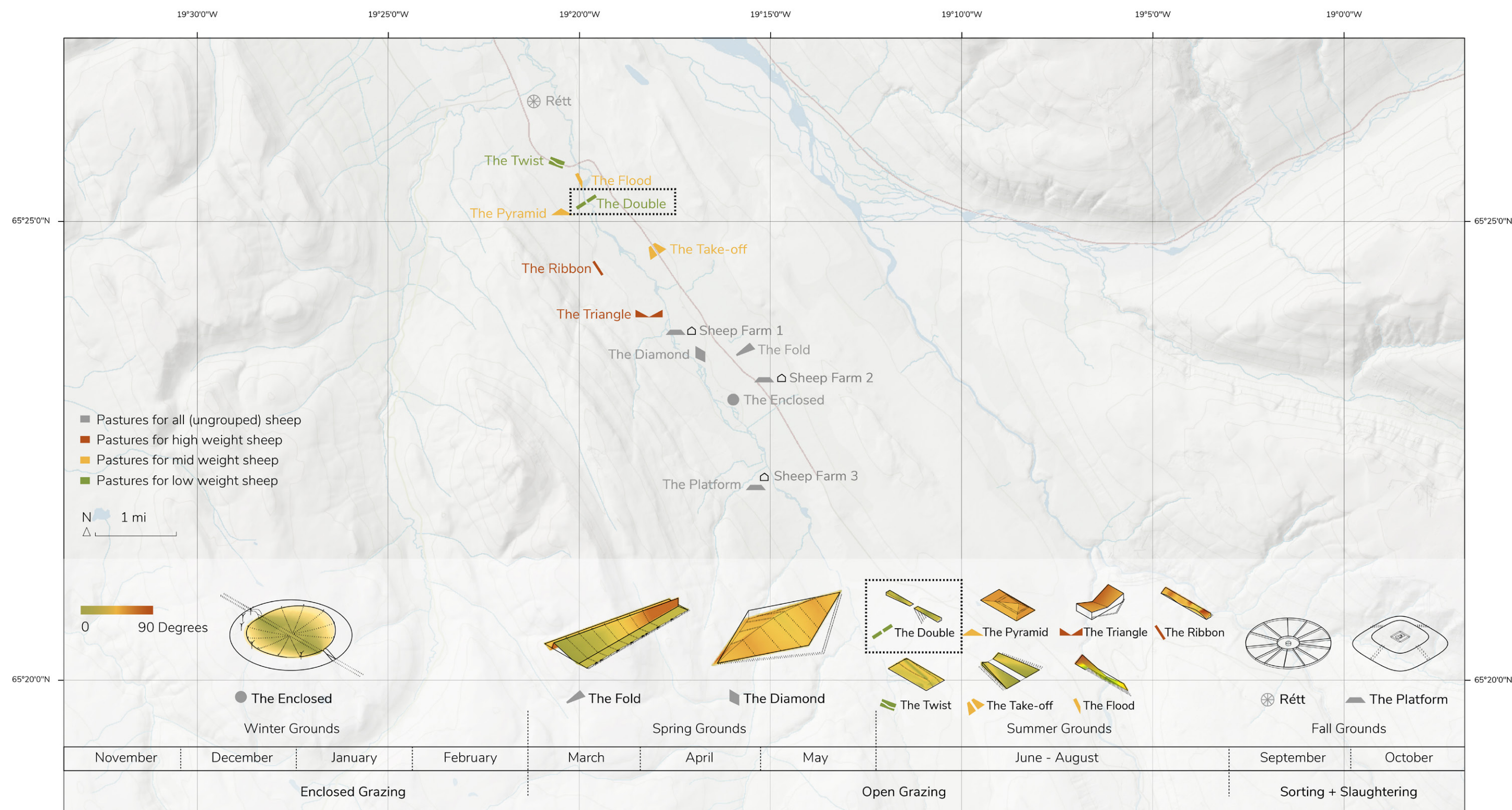
Slope gradients with diverse grasses accommodate the grazing needs of all the individuals in the yellow group. Sheep that climb high and get the most grass, are more likely to possess genes for a high muscle fat ratio. Constant assessments ensure that these individuals are recognized and sorted into more rewarding pastures.



This graph shows how the sheep are re-sorted and led to different pastures.



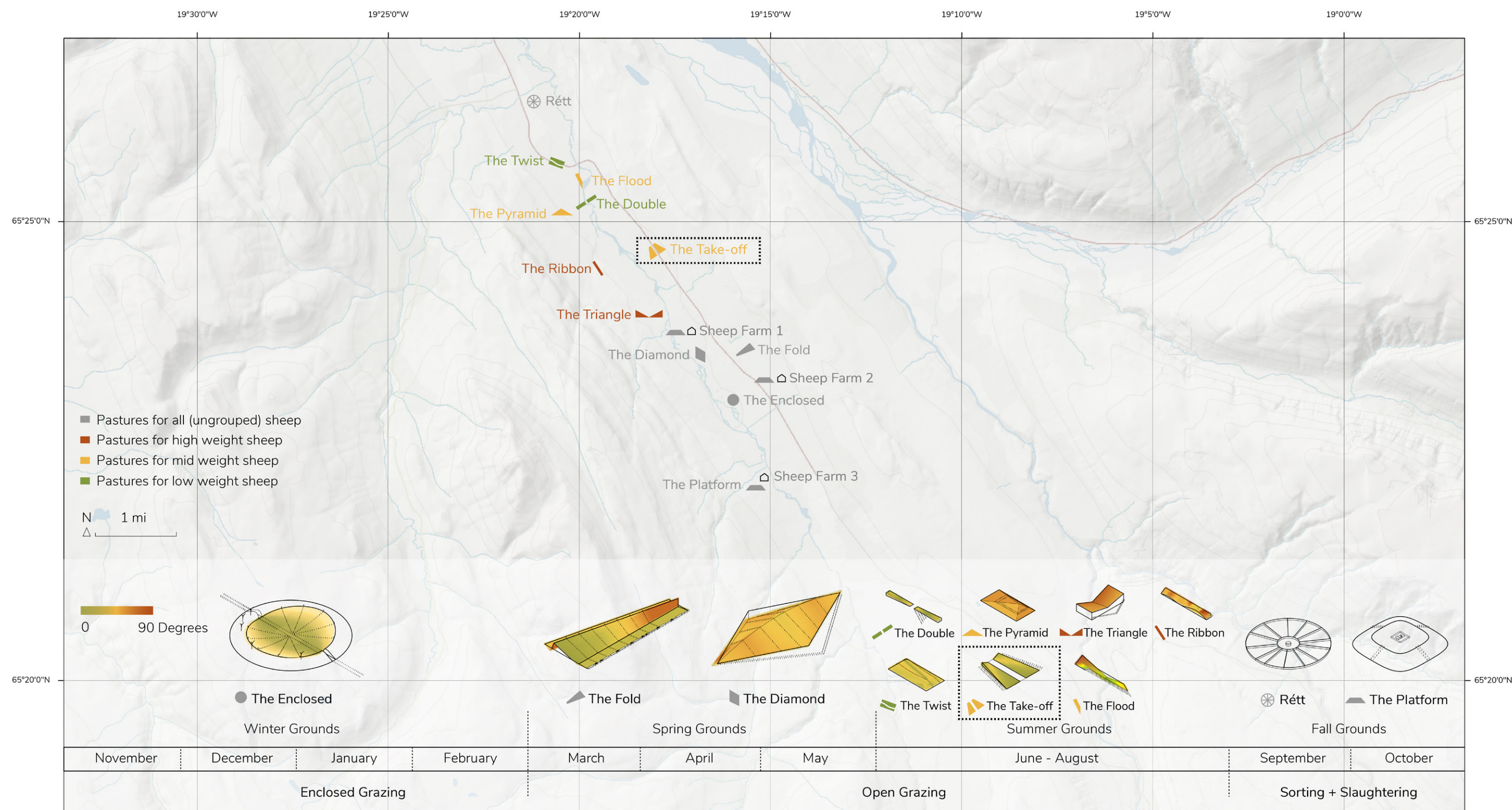
As the sheep continue to evolve year after year, farmers modify the slope angles and the planting palette through earthmoving to accommodate changing grazing needs.



THE DOUBLE

It is situated on the sides of the road for aesthetic experiences for people driving in cars. The geometries are parallel with the horizon line and create a discontinuity in the scenery of the naturalistic landscape.

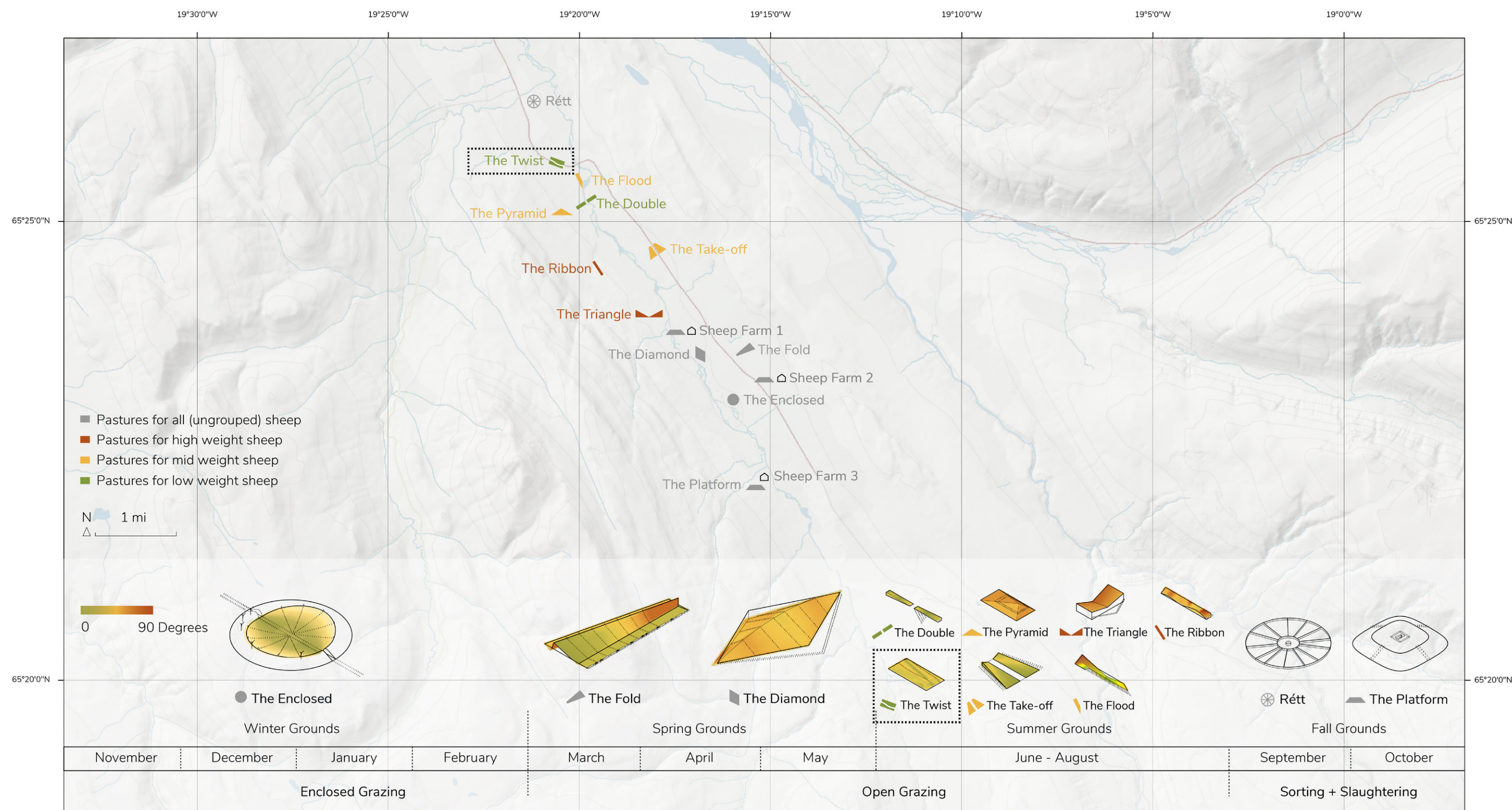




THE TAKE-OFF

It is situated on the sides of the road for aesthetic experiences for people driving in cars. The narrowed ends distort the extension line of the vanishing point in the perspective view. When drivers are driving, the landform creates an illusion of a distorted field and makes drivers feel they are about to take off.

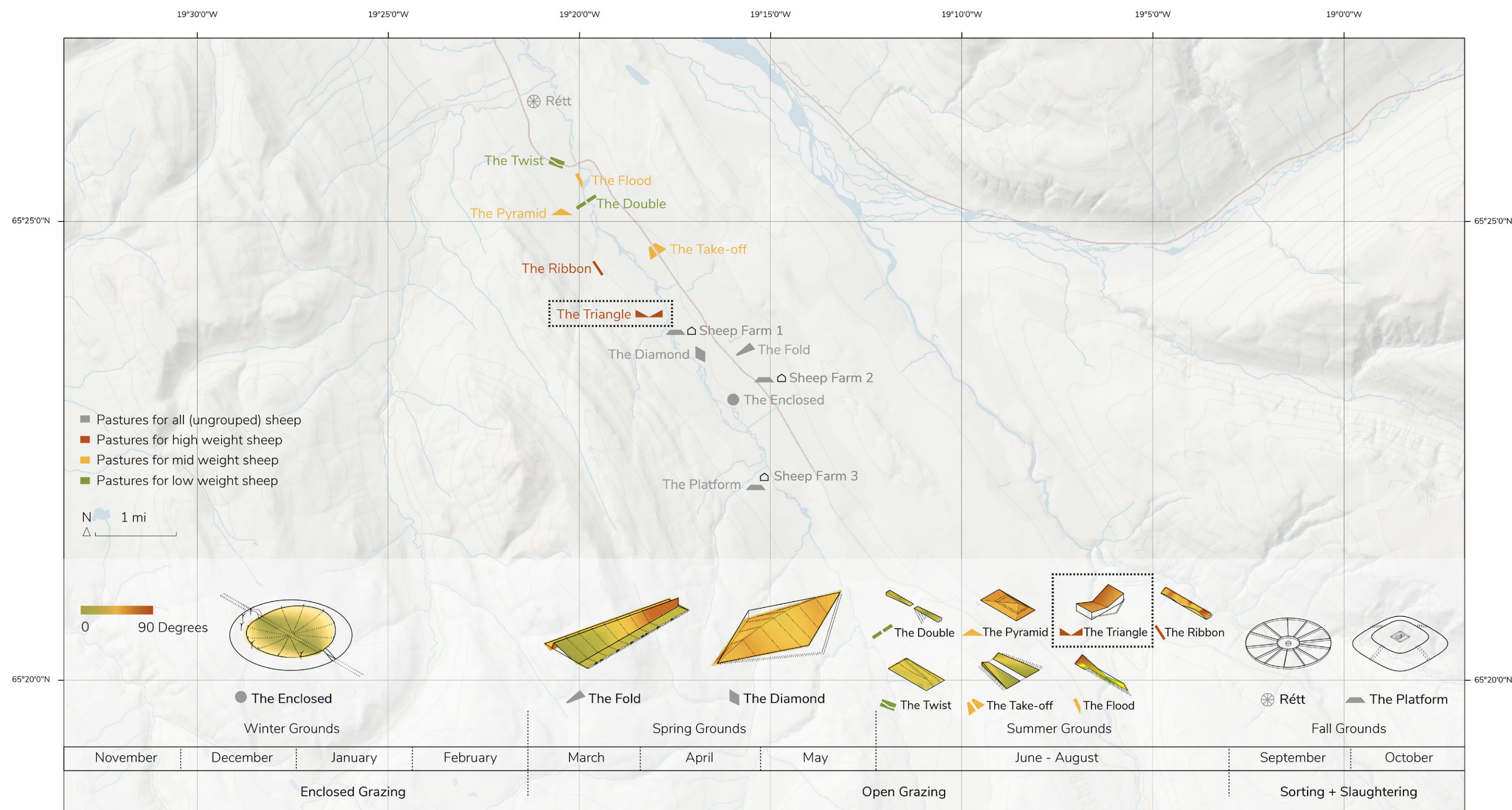




THE TWIST

It is situated in the middle of the road for aesthetic experiences for people driving in cars. The fences are the extensions of the blocked path. Drivers can stop in front of the pasture to observe the landform closely.

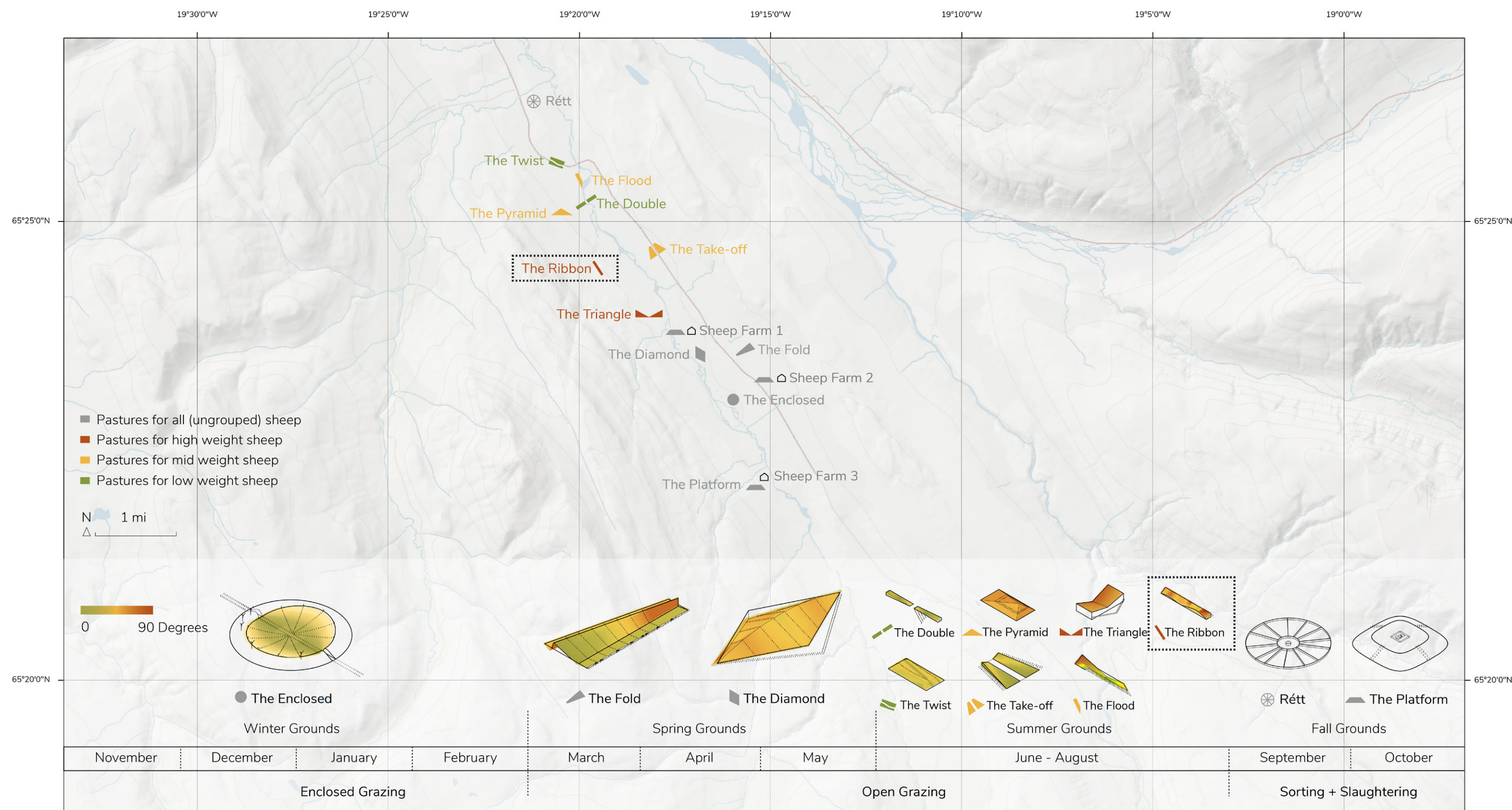




THE TRIANGLE

The geometry creates a frame for the valley in the background. It is situated in front of the river. The reflection of the sky creates an illusion that the landform is floating in the air. There is a specific viewing angle for this pasture. Visitors should stand align with the low point at the middle of the geometry.

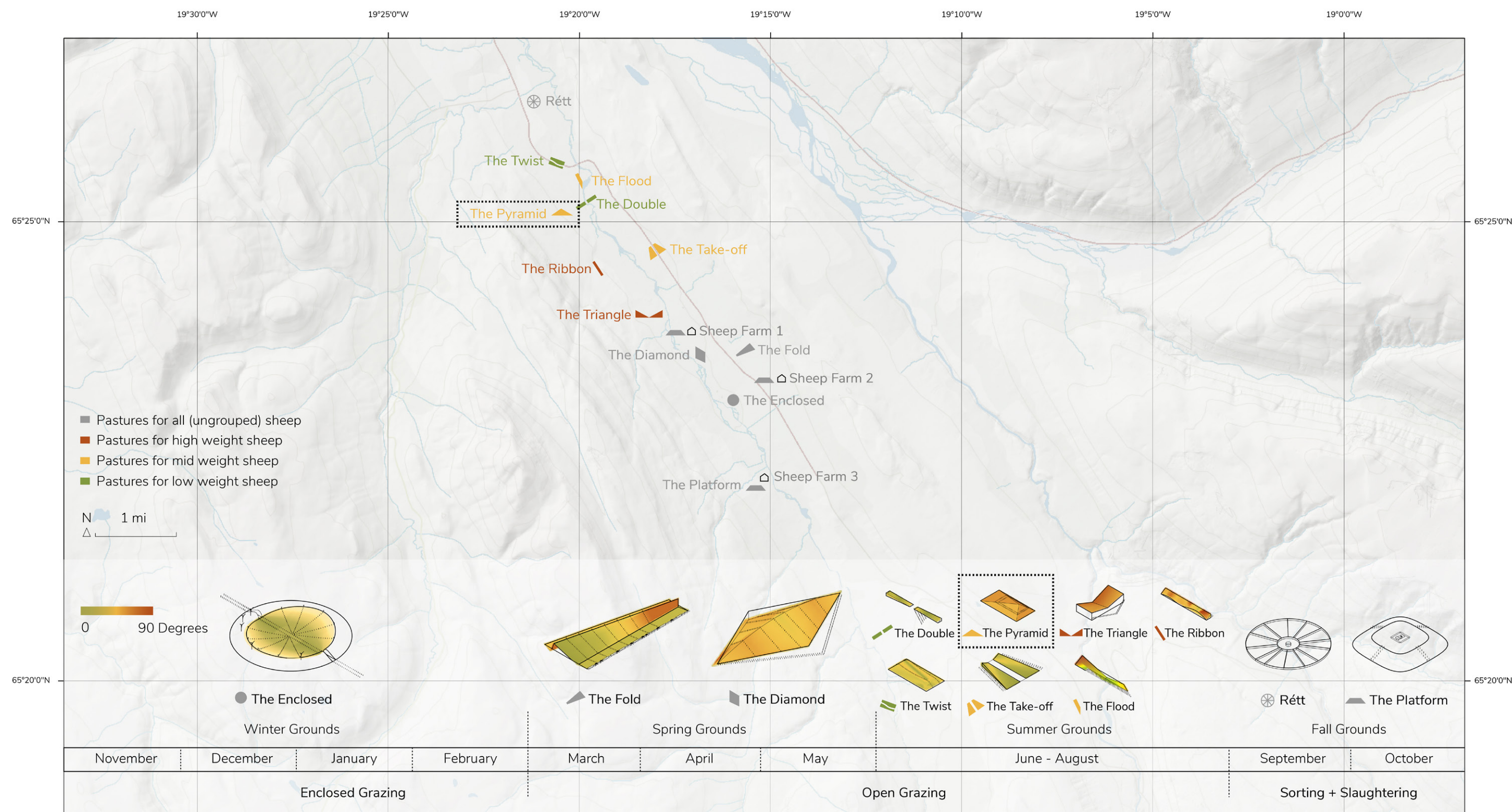




THE RIBBON

The strip form of the pasture follows the horizontal mountain line in the background.

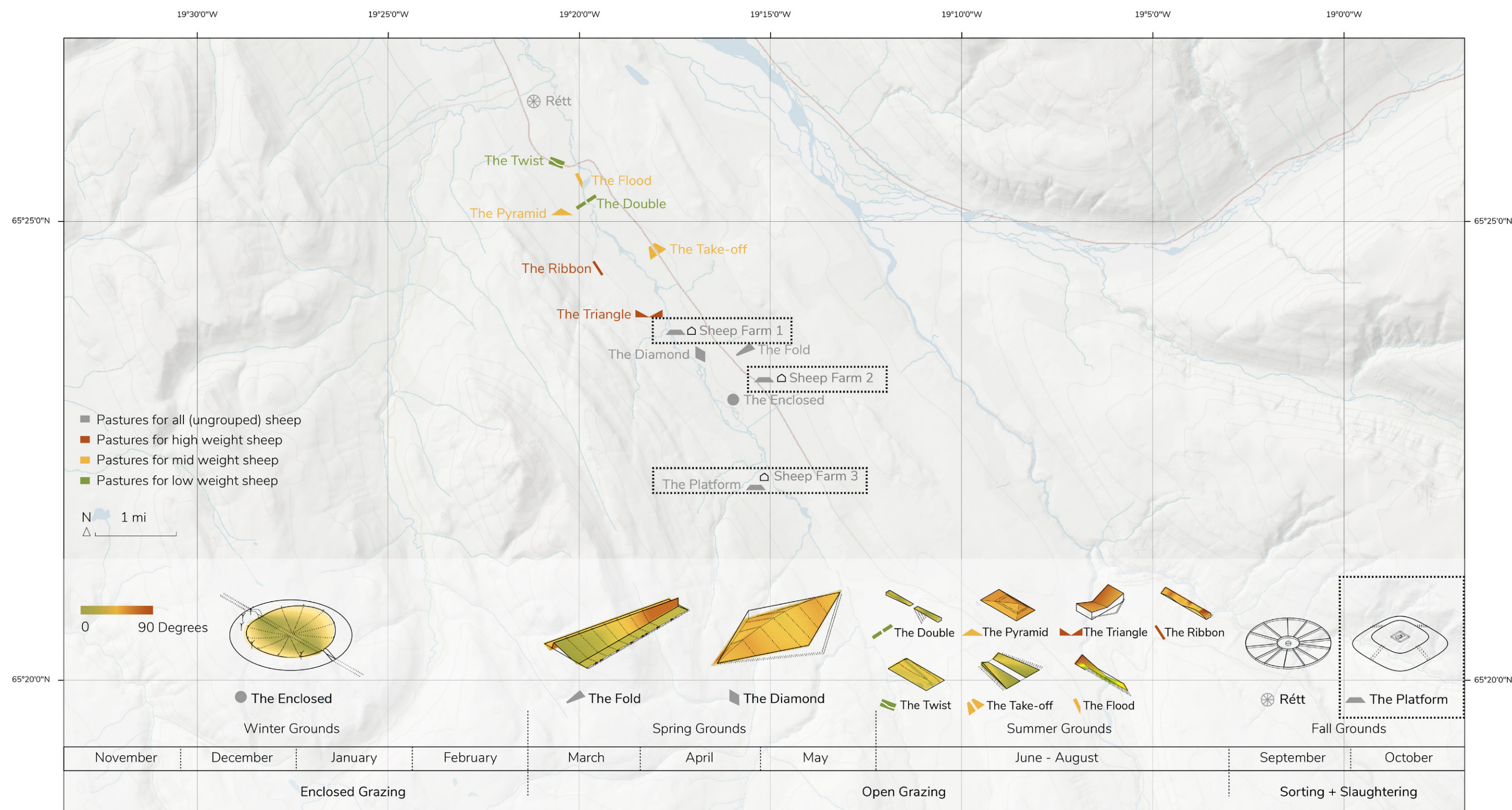




THE PYRAMID

The form of the pasture mirrors the tip of the mountain in the background.





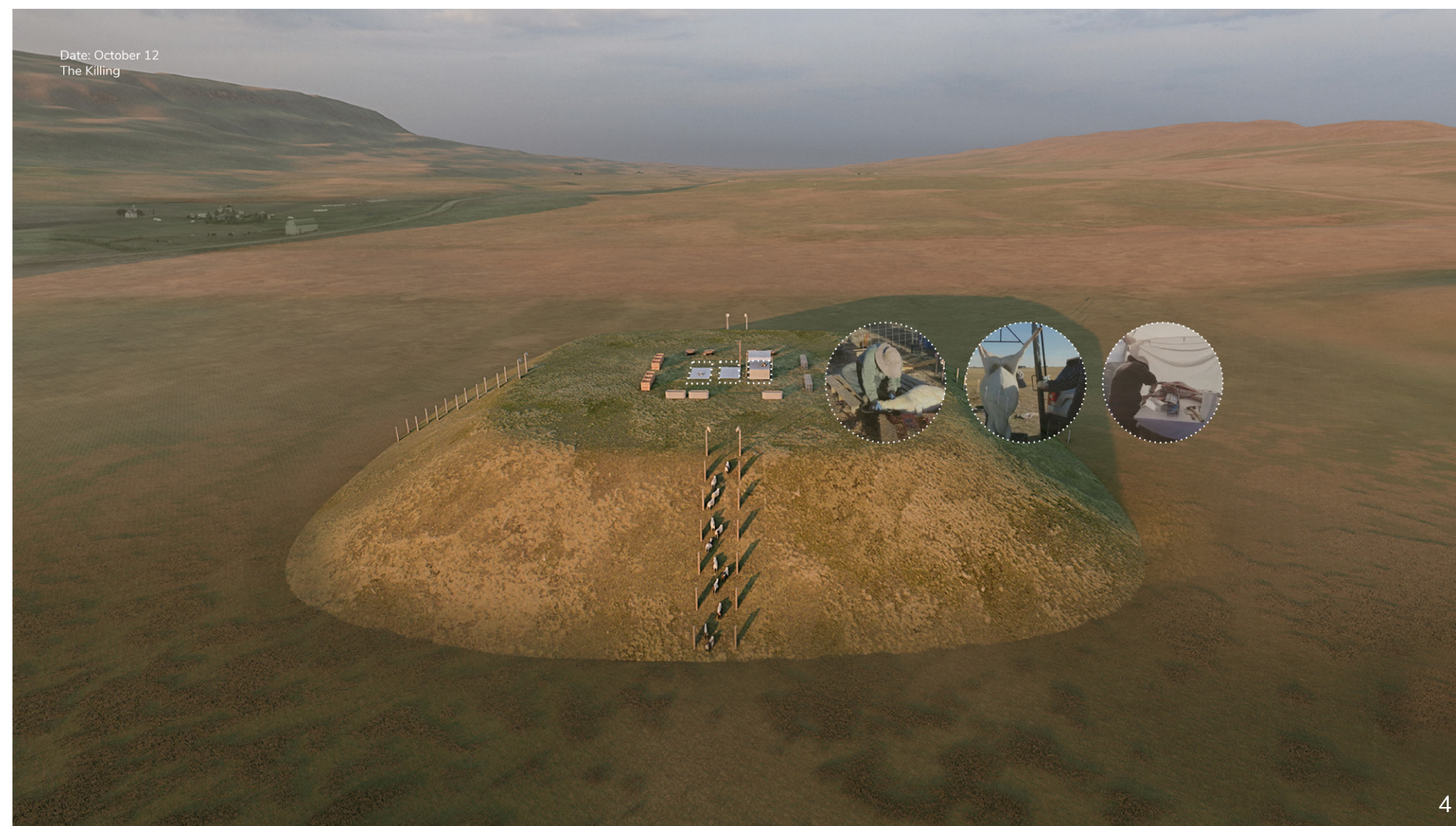
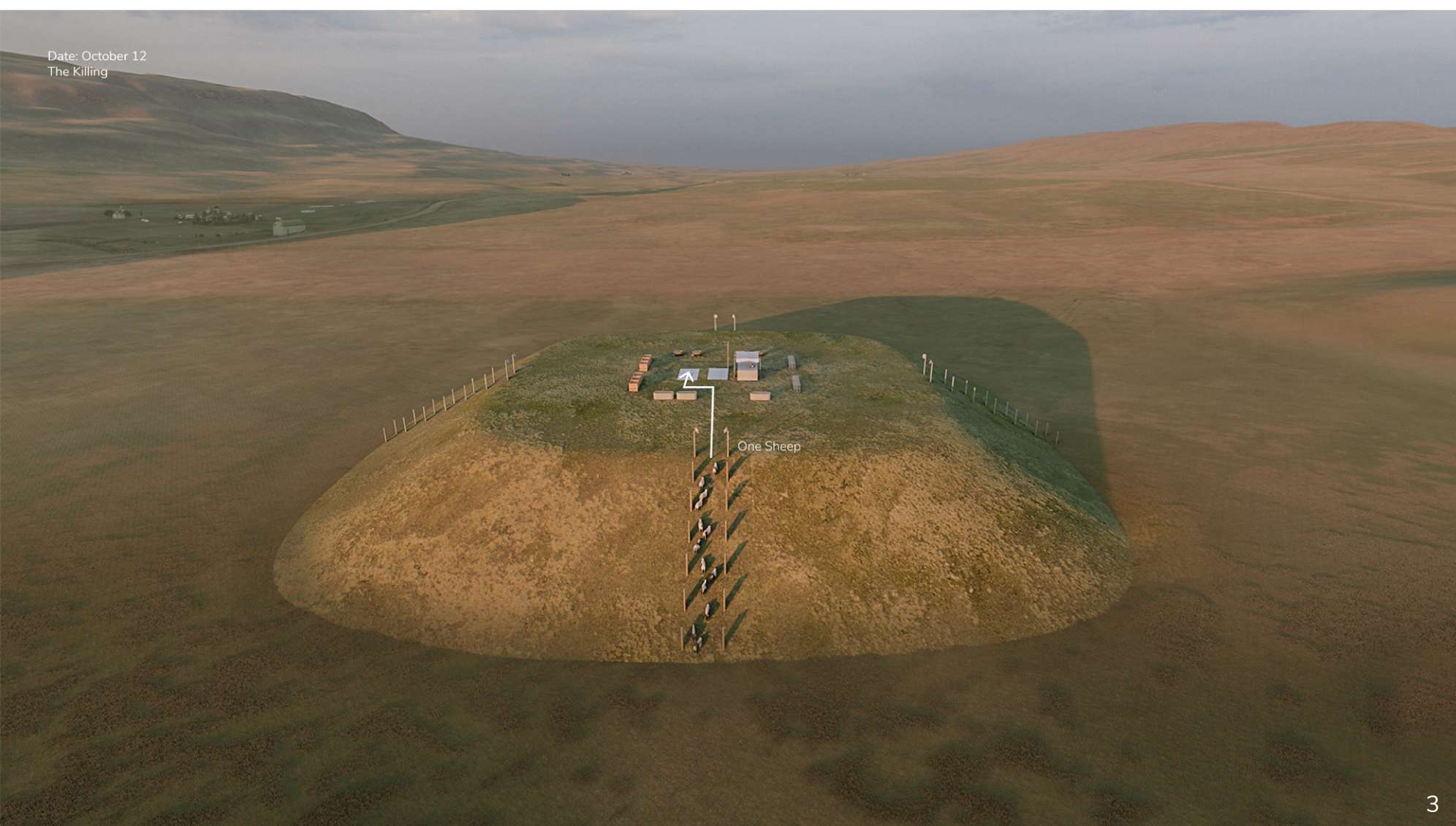
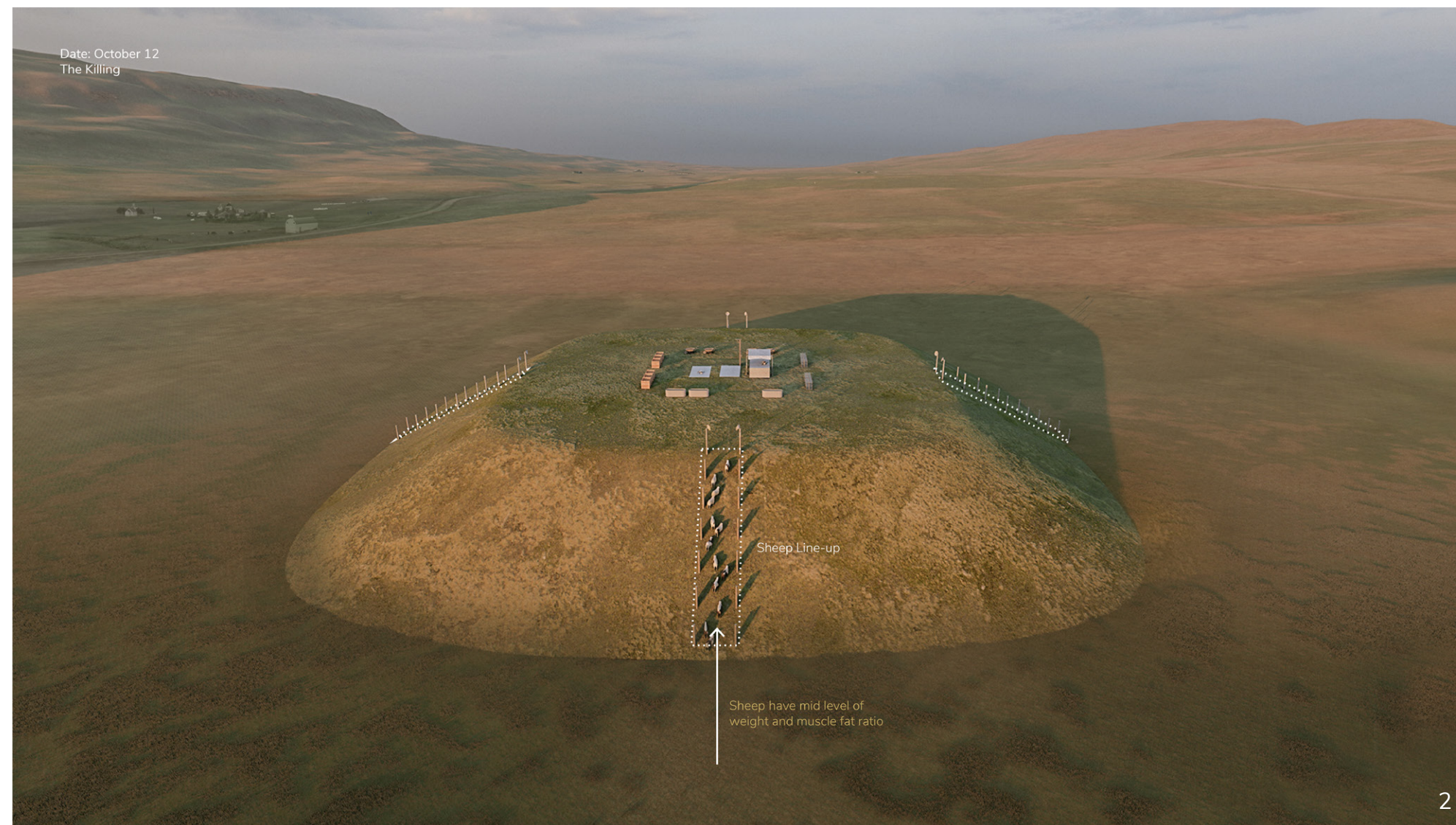
THE PLATFORM

It will be used in the fall for killing sheep. There is one near each farm base for farmers to kill the sheep they breed. "The Platform" is an elevated surface with fences installed in two rows on the four slopes. On the top of the surface, there are farm devices organized in a symmetrical way, including water tanks, waste bins, metal shelves, and wheelbarrows. Three platforms at the center are for killing and processing the sheep.







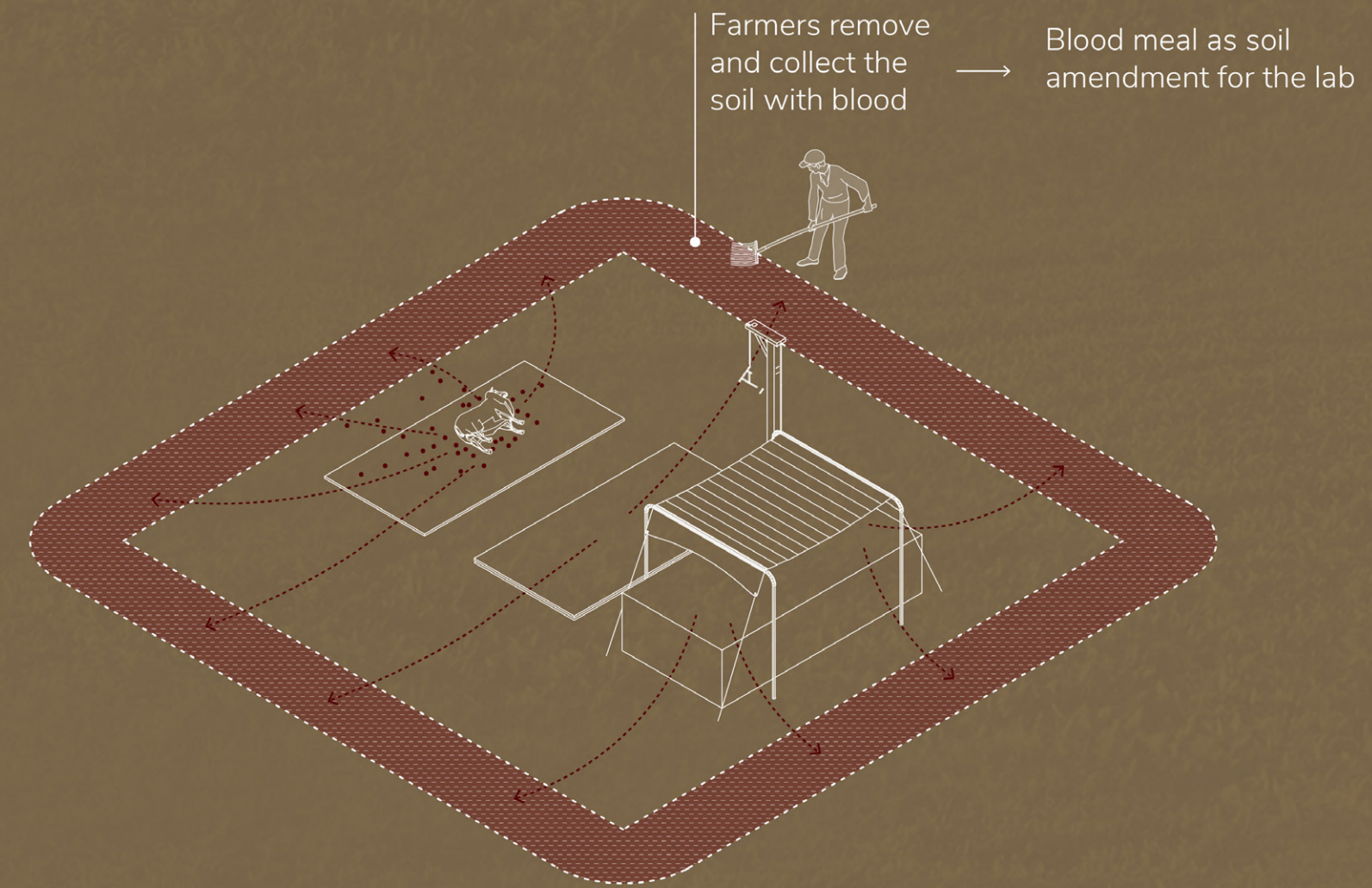
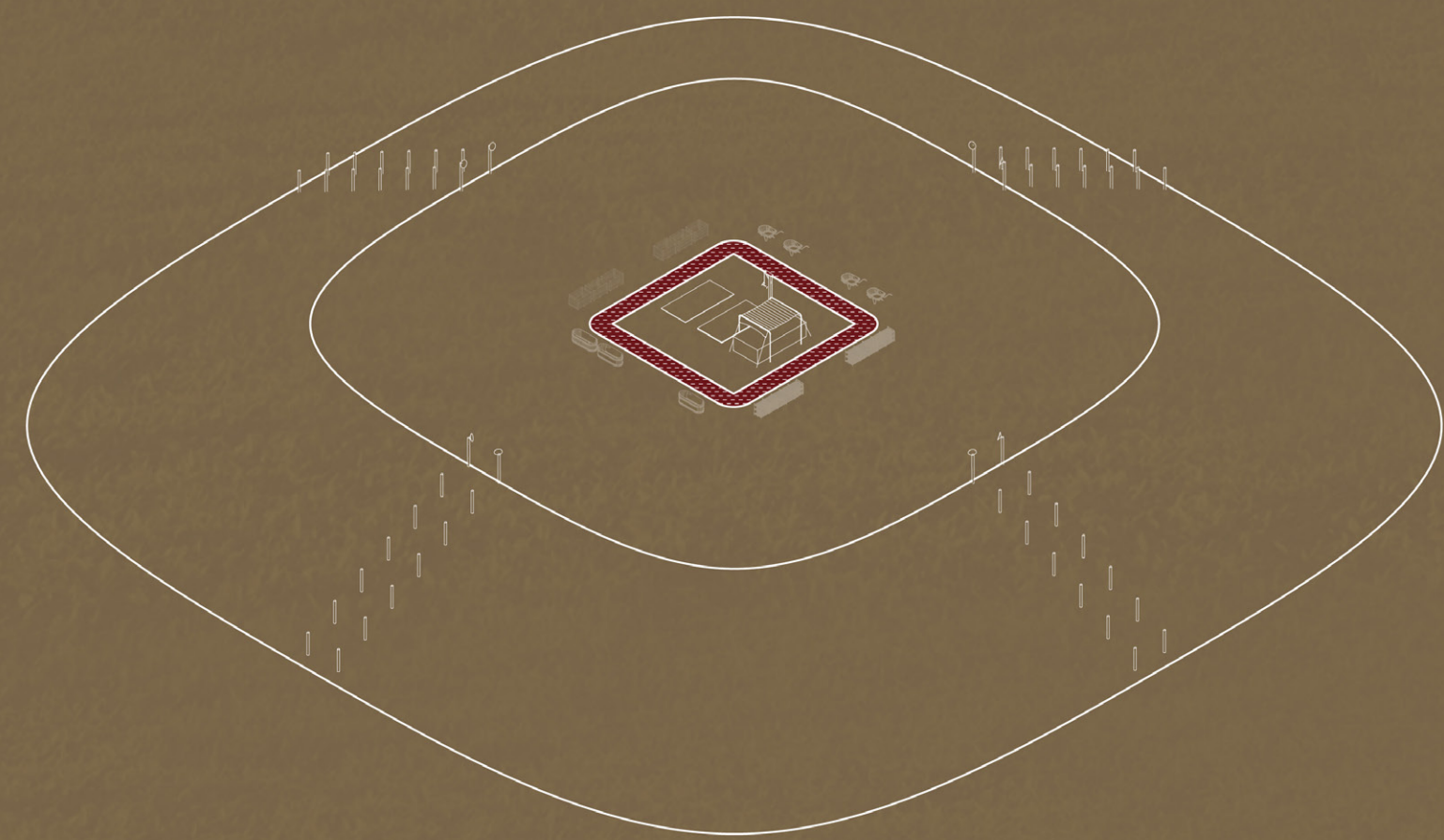


1. In September, farmers gather all the sheep from the summer pasture to the Rétt, which is the sorting ring. The sorting ring is currently used for sorting the sheep based on their ownership. In my thesis, the sorting ring is used for annual assessment and sheep sorting based on results. Similar to the assessment I explained previously, the sheep will be sorted into three groups. The first group will be for breeding, the second group will be for killing, and the third group will be for wool production. The reason is that after a year of assessments, the first group of sheep is most likely to possess the genes for developing high weight and muscle fat ratio, so they are likely to pass on good genes to their offspring. The second group has a good weight to sell in the market. As the market does not have high standards in wool quality, the third group may not have the best meat quality, but their wool is of great value.

2. The farmers bring the sheep home, and the second group of sheep are led onto "the Platform." The sheep line up between the fences, unaware of the procedures at the top.

3. Farmers lead one sheep to the first platform.

4. And perform the killing and processing on the second and third platforms. The killing procedure returns to the basics--one farmer kills one sheep at a time and lets the blood flow into the earth.



There is a curved ditch around the three platforms. As the sheep blood flows, it gathers in the ditch, forming a deep red ring. After the killing season, farmers remove and collect the soil with blood here to produce blood meal as a soil amendment for the lab.

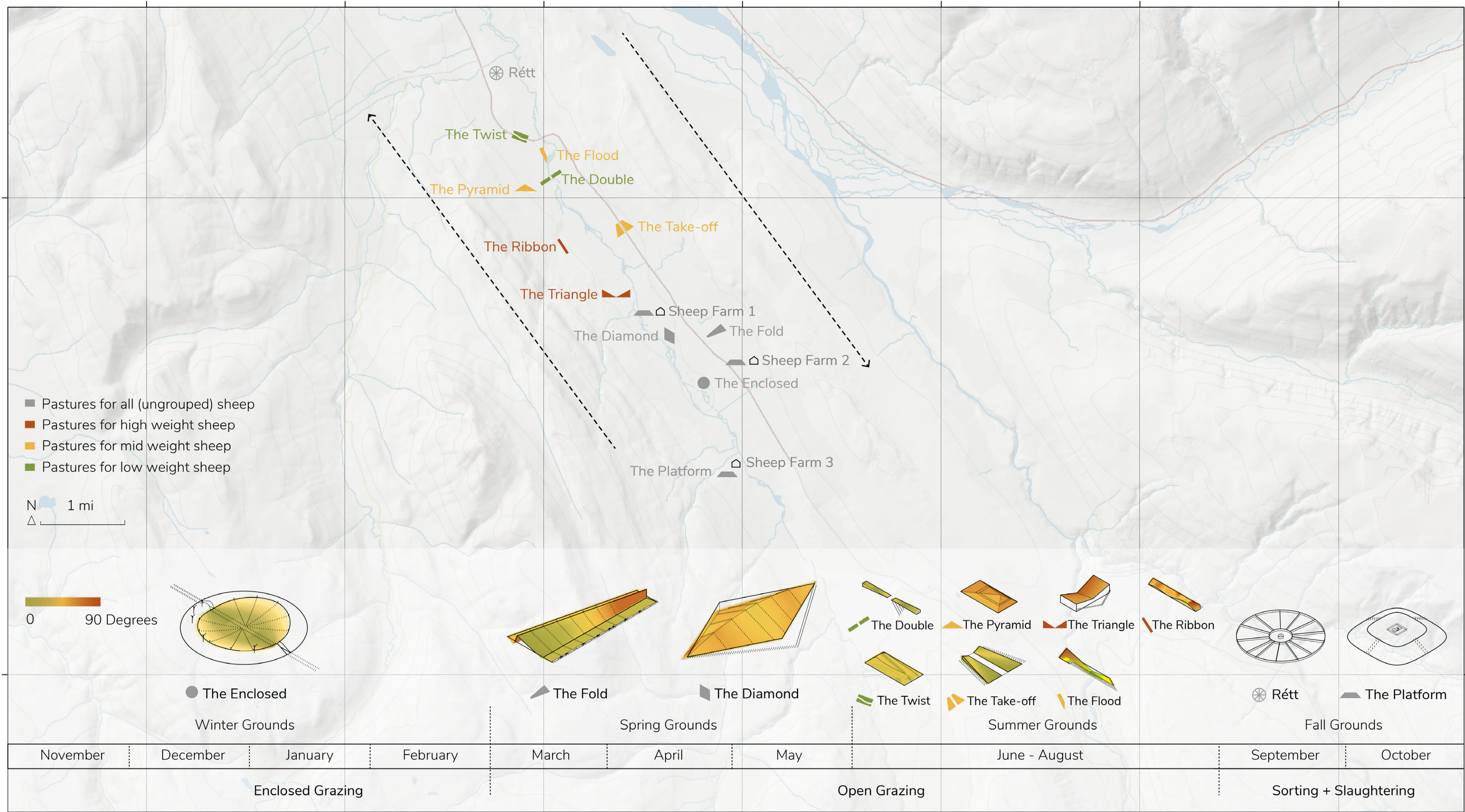
19°30'0"W 19°25'0"W 19°20'0"W 19°15'0"W 19°10'0"W 19°5'0"W 19°0'0"W

65°25'0"N

65°25'0"N

65°20'0"N

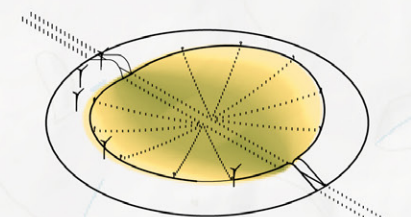
65°20'0"N



- Pastures for all (ungrouped) sheep
- Pastures for high weight sheep
- Pastures for mid weight sheep
- Pastures for low weight sheep

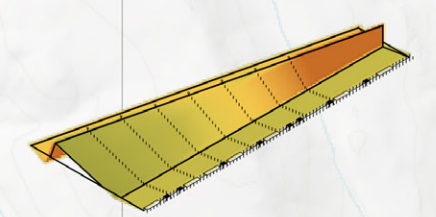
N 1 mi

0 90 Degrees



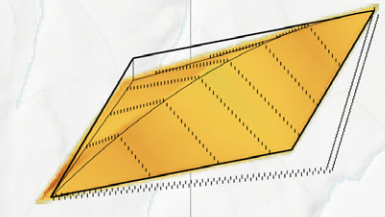
● The Enclosed

Winter Grounds



▲ The Fold

Spring Grounds



■ The Diamond



■ The Twist



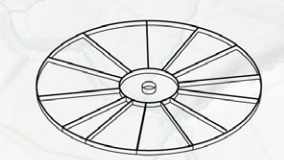
▲ The Take-off



▲ The Flood



▲ The Ribbon



⊗ Rétt



■ The Platform

November

December

January

February

March

April

May

June - August

September

October

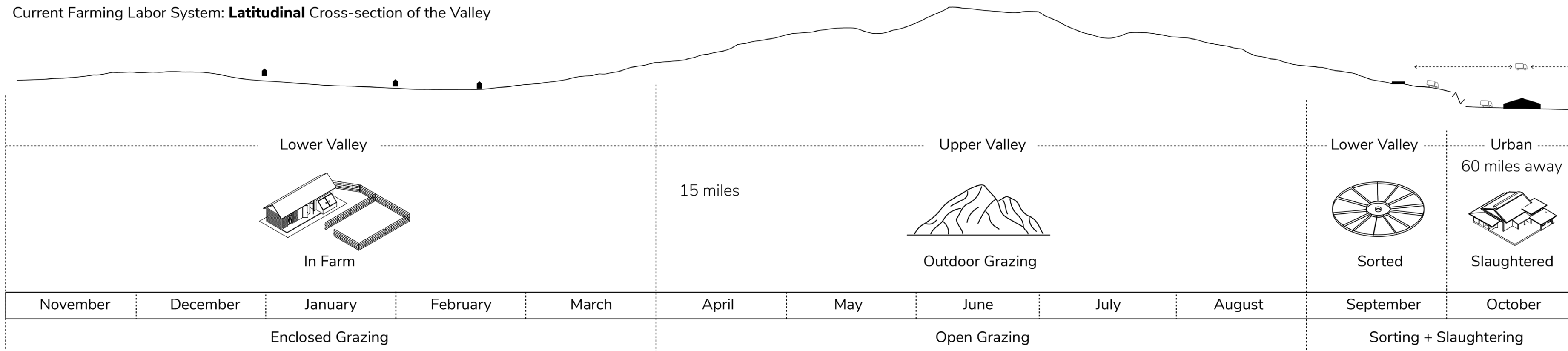
Enclosed Grazing

Open Grazing

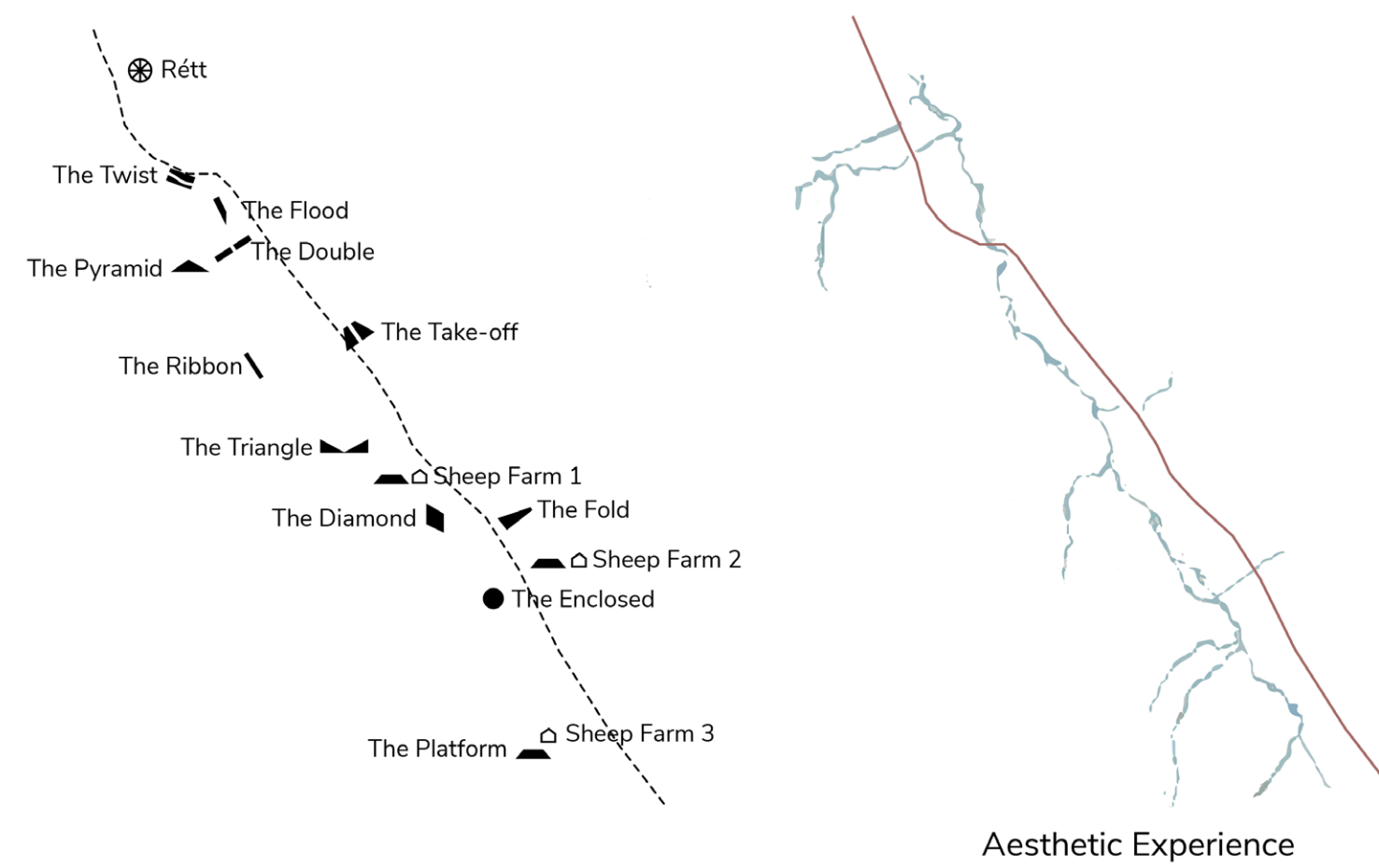
Sorting + Slaughtering

The process begins in winter, when farmers move the sheep to the winter grounds close to the farm base. When spring comes, farmers move the sheep to the spring grounds, and then up the river and roads to the summer grounds. Finally, they reach the Rétt at the far north for annual assessment and sorting. They bring the sheep back to the farm where the sheep were born, and kill them on the fall grounds.

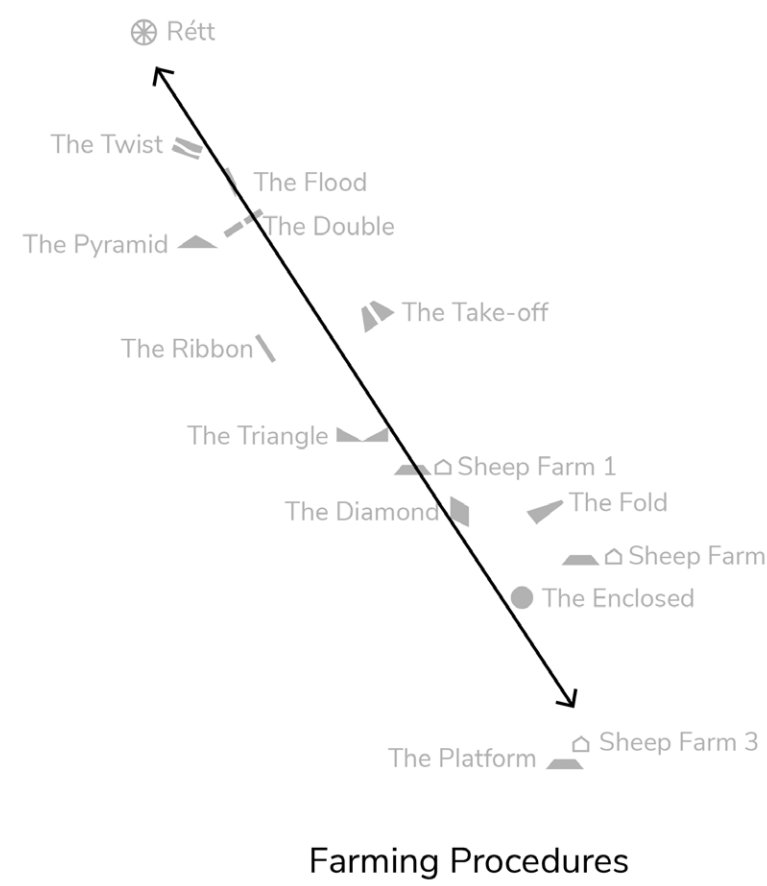
Current Farming Labor System: **Latitudinal** Cross-section of the Valley



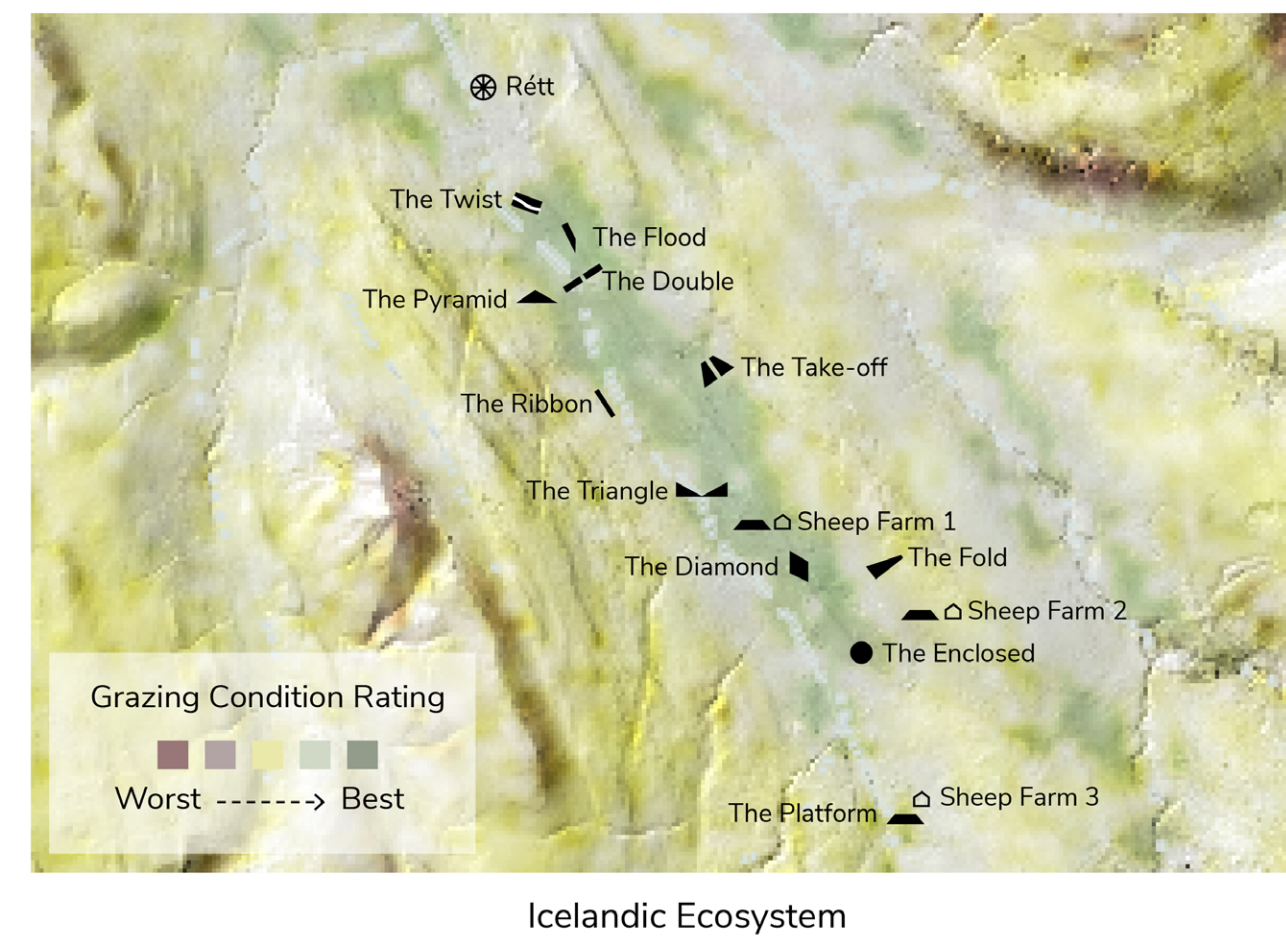
Ovis Versatilis: **Longitudinal** Cross-section of the Valley



Aesthetic Experience

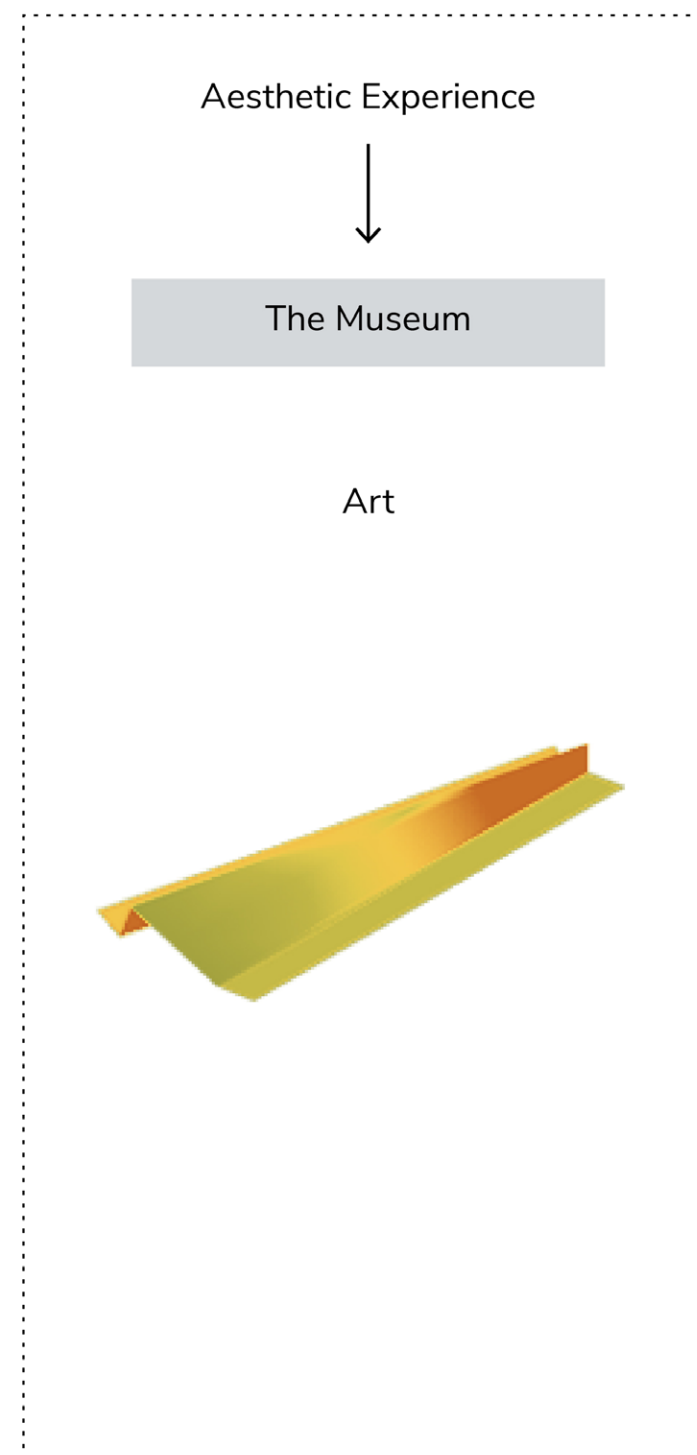


Farming Procedures



Icelandic Ecosystem

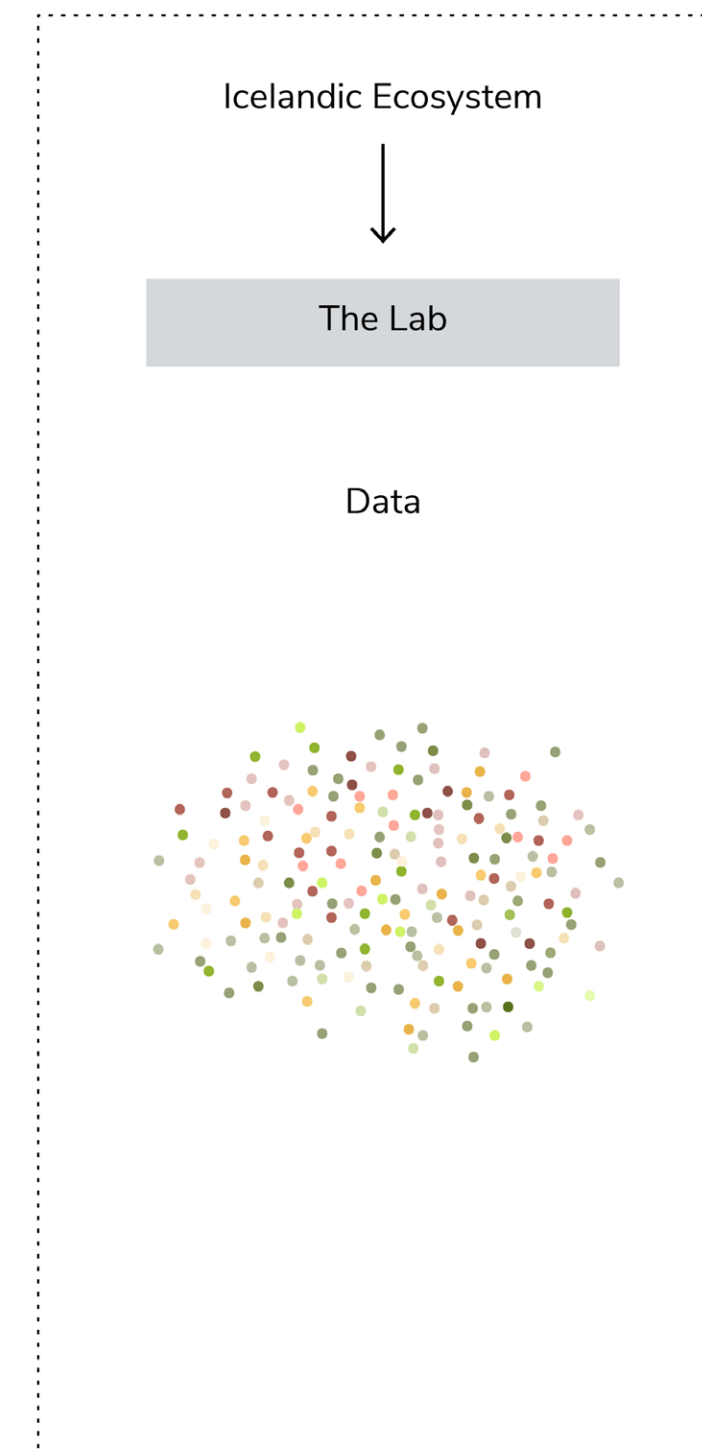
The current farming labor system is a latitudinal cross-section of the valley, with sheep grazing freely in the upper valley, and killing and processing in the lower valley. My thesis proposes a longitudinal cross-section that follows the river and the road. This geographic reorientation is for three reasons: aesthetic experience, farming procedures, and the Icelandic ecosystem. Visitors experience the Icelandic valley along the river and road. The farming season starts in winter near the farm base and ends in the Rétt in the north. Iceland has the most fragile ecosystem in the upper valley, so sheep grazing should be concentrated in the lower valley.



High Resolution of Landscape

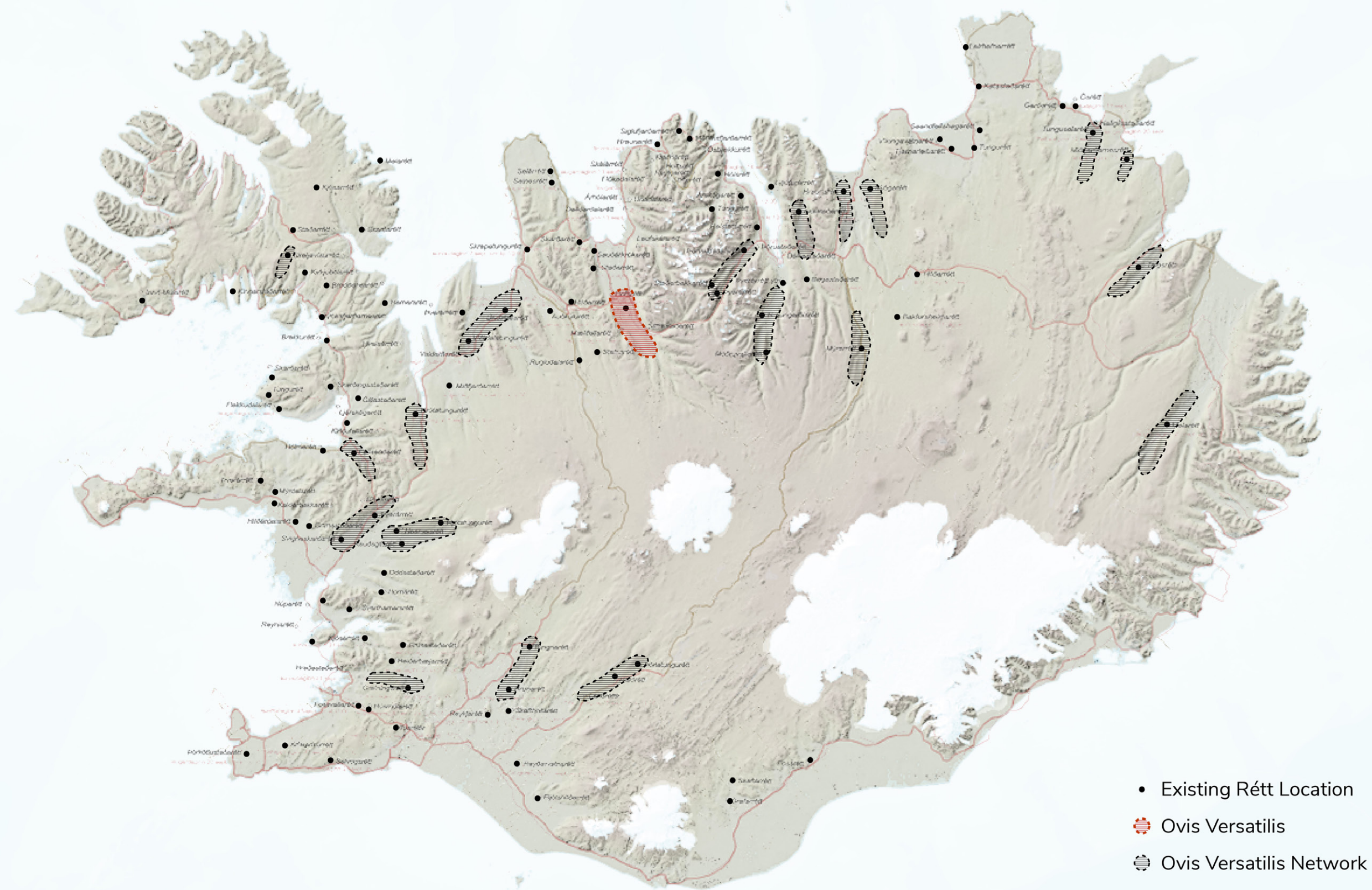


Low Resolution of Landscape

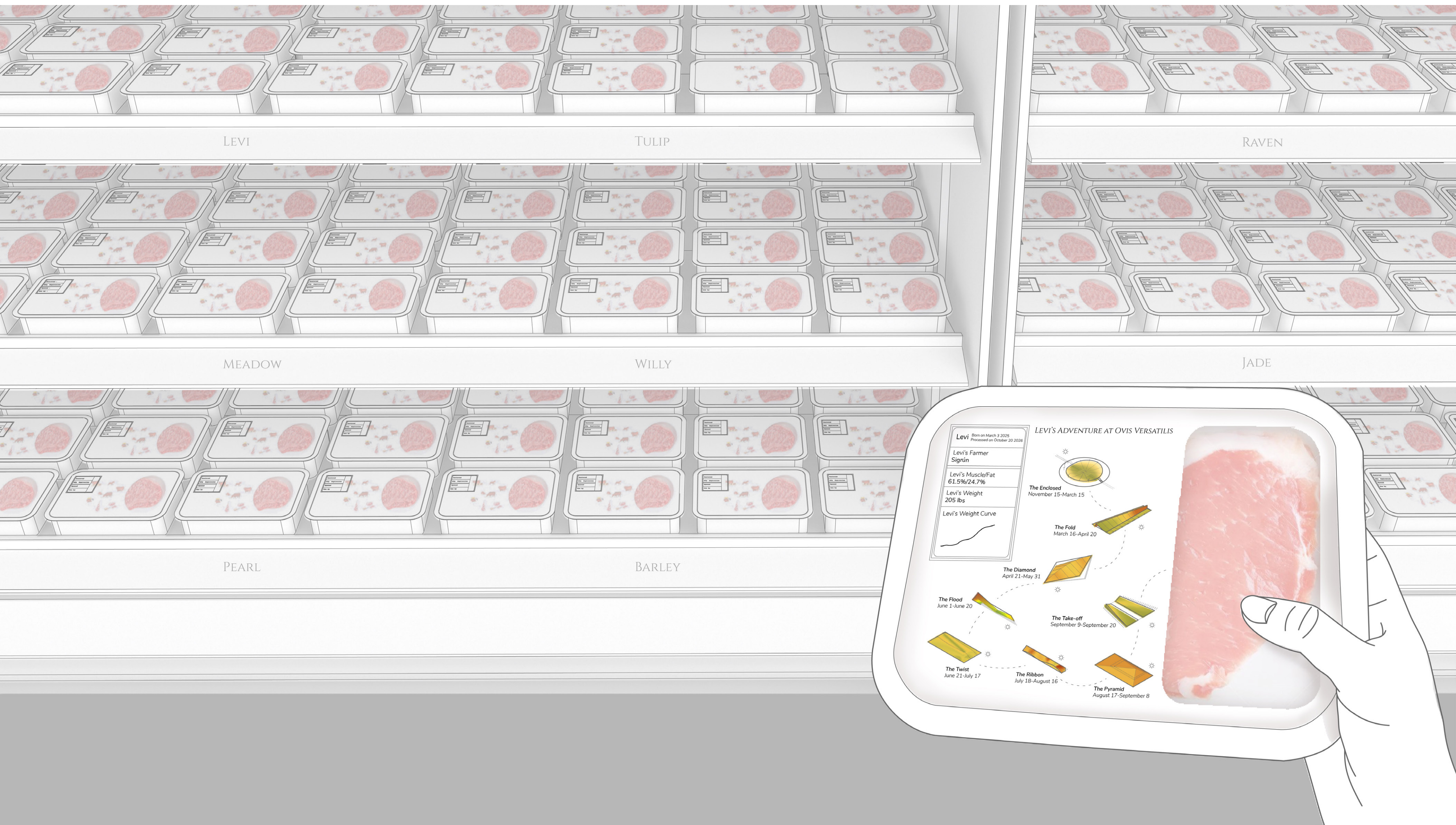


High Resolution of Landscape

These three reasons run parallel with the three programs: the museum, the farm, and the lab. In my thesis, both the museum and the lab are high resolution mechanism in the landscape and offer infinite possibilities. The aesthetically designed slopes provide a gradient that can accommodate the needs of all sheep individuals. The assessment system also has data for each individual. On the other hand, the farm is a low-resolution mechanism. The sheep always fit in two or three groups, rather than an infinite number of groups. This is because, at the end of the farming season, the sheep have to be sorted into groups to live or die. There is no gradient in life and death. The farm is placed between the other two programs, the museum and the lab, as a moderator between the programs of infinite possibilities.



My thesis proposes a farm network in the Icelandic valley and looks at one valley as a unit of the practice. This model can be applied nationally.



“For the domestic animal, the good life cannot be achieved apart from humans—apart from our farms and therefore from our meat eating.”

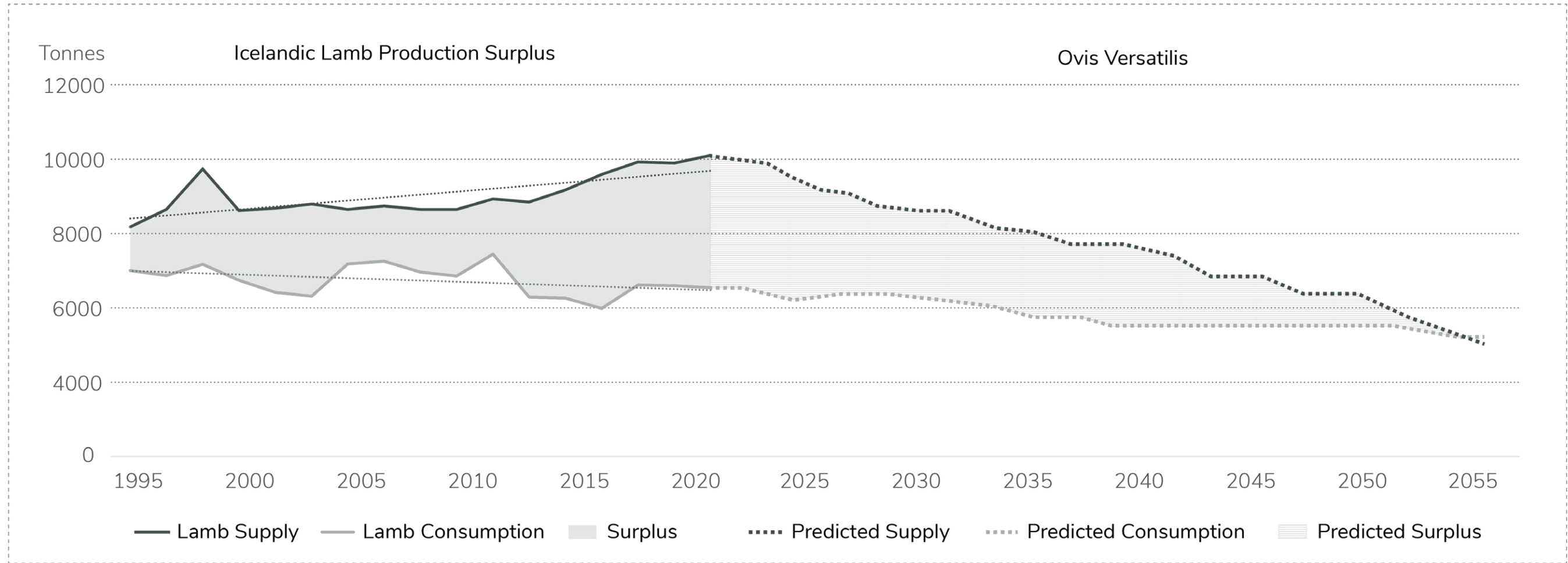
“From the point of view of the individual prey animal predation is a horror, but from the point of view of the group [the species] -- and of its gene pool -- it is indispensable.”

Michael Pollan, *The Omnivore's Dilemma*

Meat eating is the evolutionary reason why sheep exist in the first place and the reason why the species entered into its dependent relationship with humans, which produced its evolutionary success.

Ovis versatilis's Value

- Premium Meat and Niche Product
- Tourism
- Plant Ecology and Ecosystem Service
- Evolution Lab
- Human-sheep Relationship



Domestication is symbiosis between humans and sheep in nature. The problem is how we farm, and how we define the relationship between humans and sheep. Here, I propose an aesthetic landscape approach to farming. The value of *Ovis versatilis* creates not just a tasty lamb product, but also contributes to tourism, plant ecology, evolution lab, and emotional well-being. Ultimately, my thesis aims to decrease the current production surplus by decreasing the supply. As *Ovis versatilis* becomes a premium, niche product, there will be fewer incentives to breed a lot of them, but more motivation to care about each individual.

ACKNOWLEDGMENTS

This thesis would not have been possible without the kind support of many individuals.

I would like to first express my most sincere gratitude to my thesis adviser, Sergio Lopez-Pineiro, for his guidance and support since day one at Harvard GSD. I am immensely grateful for his encouragement, his wisdom, his patience, and his trust in me.

I would also like to thank David Haig for his extensive knowledge of evolution and his insightful feedback on my thesis throughout the semester. Thanks to Charles Waldheim and Min Yeo Seok for their help on the development of my project, and to Rosalea Monacella, Seth Denizen, Danielle Choi, Montserrat Bonvehi Rosich, Gary Hilderbrand, Jill Desimini, and Craig Douglas for their valuable comments on my thesis. Thanks to Badi Besbes for his insight on sheep grazing and Bryndís Marteinsdóttir for her help in getting the Icelandic data. I would also like to thank Pablo Pérez-Ramos for inspiring me with fabulous site precedents.

Thanks to my friends who have supported me through this process: Tian Wei Li, Olivia So, Sophia Xiao, Echo Chen, and Natalie Khoo. I am especially grateful for Jingjing Xiao's help in developing my thesis, and give special thanks to Laura Cui for her constant feedback and support whenever I needed her.

Last but not least, I want to thank my parents for always being there for me. And to Gi chul Choe, for always listening to my sheep stories no matter if it's 3 a.m. or 3 p.m. Without him, this thesis would not have existed in the first place.

REFERENCES

Arnalds, O. and Barkarson, B.H. "Soil erosion and land use policy in Iceland in relation to sheep grazing and government subsidies." *Environmental Science & Policy* 6, no.1 (2003): 105-113.

Austrheim et al. "Sheep grazing in the North-Atlantic region – A long term perspective on management, resource economy and ecology." *Rapport Zoologisk Serie* 2008-3. Trondheim, 2008.

Ball-Gisch, Laurie. "Intensive Grazing: Experiences and tips from our resident experts." *Icelandic Sheep Breeders of North America* 6, no.4 (2002): Accessed in 2002.

Bjarnason, Tjörvi. "Financial and standing rights 2020." *Bændablaðið*. Accessed August 20, 2020.

Carmichael, Karen. "Bringing in the sheep in Iceland is a fall celebration full of laughter, drinking and music." *Los Angeles Times*. Accessed August 5, 2018. <https://www.latimes.com/travel/la-tr-iceland-sheep-20180805-story.html>

Clément, Gilles. "Working with (and never against) Nature." *Environment: Approaches for Tomorrow*. Skira, 2006.

Clément, Gilles. "In Praise of Vagabonds." *Qui Parle* 19, no. 2 (2017): 275-297. Accessed April 01, 2017.

Daly, Natasha. "Domesticated animals, explained." *National Geographic*. Accessed July 4, 2019.

Darwin, Charles. *On The Origin of Species by Means of Natural Selection, or Preservation of Favour Races in the Struggle for Life*. London: John Murray, 1859.

Einarsson et al. Internaional Sheep Session Focus on Iceland.

Einarsson, Eypór. "Objective evaluation of lean meat yield and EUROP scores for Icelandic lamb carcasses by video image analysis." *Agricultural University of Iceland*. Accessed November 2011.

Fontaine, Andie Sophia. "Iceland's Looming Sheep Crises." *Reykjavik Grapevine*. Accessed August 28, 2017. <https://grapevine.is/mag/2017/08/28/icelands-looming-sheep-crisis/>

Fontaine, Andie Sophia. "'Too Much Lamb' Being Produced In Iceland, Says Farming Head." *Reykjavik Grapevine*. Accessed Feburary 27, 2017. <https://grapevine.is/news/2017/02/27/too-much-lamb-being-produced-in-iceland-says-farming-head/>

Grad, Isobel. "Reflections on Sheep, Landscape, and Defining Locality." *Gastronomica* 14, no. 2 (2014): 64-67. Accessed May 19, 2021. doi:10.1525/gfc.2014.14.2.64.

GróLind. *The Soil Conservation Service of Iceland*. 2019.

Heenan, Lisa and Doherty, Isaabella, director. 2015. *Polyfaces*. Regrarians.

Lally, Anne Elyse. "Extending terroir: Icelandic lamb production and the taste of land(rights)." *Anthropology of Food* S14 (2020). <https://doi.org/10.4000/aof.10647>

Landmælingar Íslands. *Databases*.

Pollan, Michael. *The Omnivore's Dilemma: a Natural History of Four Meals*. New York: Penguin, 2007.

Sanchez, Marie. "Butcher a lamb. Humane sheep slaughter." YouTube Video. October 27, 2016, https://www.youtube.com/watch?v=uaqRzWft_b4.

IMAGE SOURCES

Figure 1: Vallendar, Saskia. "Gathering Sheep: They're Bloody Stubborn!" *Reykjavik Grapevine*.

Figure 2: Carmichael, Karen. "Bringing in the sheep in Iceland is a fall celebration full of laughter, drinking and music." *Los Angeles Times*. Accessed August 5, 2018.

Figure 3: Ratcliff, Tray. *The Slaughterhouse*. Flickr. November 5, 2007.

Figure 4: Ćirić, Jelena. "Iceland to Permit Limited Home Slaughter This Fall." *Iceland Review*. Accessed June 3, 2020

Figure 5: Arnarson, Sveinn. *Vill að brugðist verði við offramleiðslunni*. Accessed December 16, 2016.

Figure 6: Carmichael, Karen. "Bringing in the sheep in Iceland is a fall celebration full of laughter, drinking and music." *Los Angeles Times*. Accessed August 5, 2018.

Figure 7: Scholes, Edwin. "Analysis: The Forest Home Of The Birds-Of-Paradise Is Disappearing. Fast." *The Cornell Lab*. Accessed December 2020

Figure 8: Nat Geo WILD. *Rare Footage of New Bird of Paradise Species Shows Odd Courtship Dance*. YouTube. Accessed September 14, 2018.

Figure 9: *Avian Hybrids*. *The genetic recipe for a bird-of-paradise radiation*. Accessed March 10, 2019.

Figure 10: BBC. *Beautiful birds of paradise*. Accessed October 6 2014.

Figure 11: Leier, Doug. "Bighorns are North Dakota's wild sheep." *The Jamestown Sun*. Accessed October 19, 2018.

Figure 12: National Nordic Museum. *In Praise of Icelandic Sheep*. Accessed October 25, 2019.

Figure 13: Moynahan, David. *Icelandic Sheep and Barren Land*. Accessed October 24, 2007.

Figure 14: Moynahan, David. *Icelandic Sheep and Barren Land*. Accessed October 24, 2007.

Figure 15: Moynahan, David. *Icelandic Sheep and Barren Land*. Accessed October 24, 2007.

Figure 16: GuWjónsson and Gíslason. *Icelandic Institute of Natural History*. 1998.

Figure 17: Weinberg, Ross. "Iceland's réttir: sheep roundup and a country party." *Icelandair*. Accessed September 1, 2020.

Figure 18: FunIceland. *Réttir - Sheep Round Up*.

Figure 19: SAH Afurðir ehf. *Export*.

Figure 20: *The Slaughterhouse / Sláturhúsið – Culture Center*. Icelandic Info.

Figure 21: Sarpur: *Menningarsögulegt gagnasafn*.

Figure 22: Sarpur: *Menningarsögulegt gagnasafn*.

Figure 23: Sarpur: *Menningarsögulegt gagnasafn*.

Figure 24: Sarpur: *Menningarsögulegt gagnasafn*.

Figure 25: Swanson, David. "Three ways to see the Great Wall of China, two much greater than the other." *Los Angeles Times*. Accessed Feburary 5, 2017.

Figure 26: UNESCO World Heritage Centre. *The Great Wall*.

Figure 27: Wikiwand. *The Queensway facing west from Alta Vista Drive*.

Figure 28: NatureRules1 Wiki. *White-footed Mouse*.

Figure 29: Dia Art Foundation. *Robert Smithson, Spiral Jetty*.

Figure 30: Landing Studio. *Spiral Jetty*.