



Human History Through Fiber

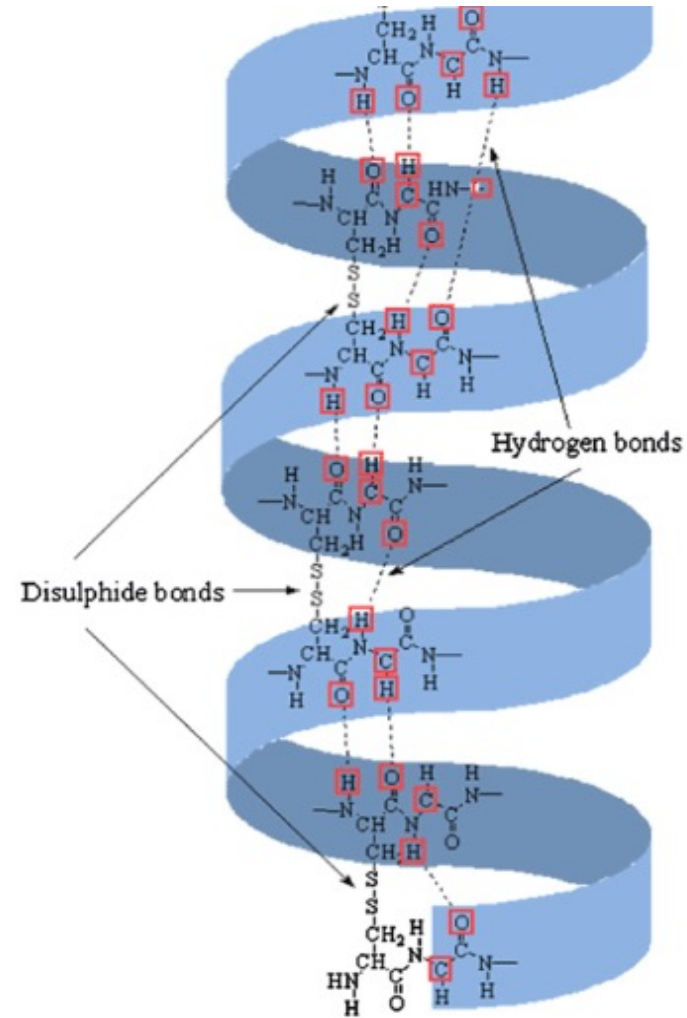
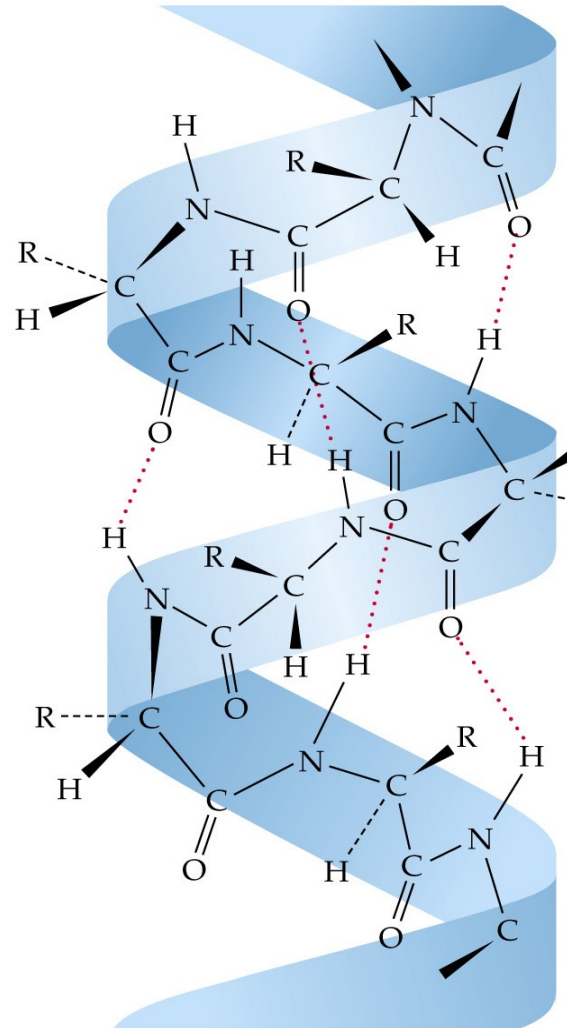
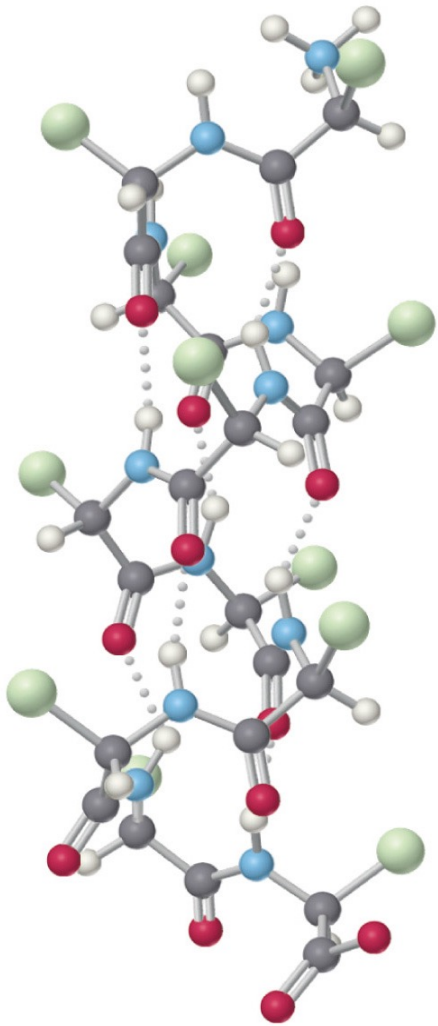
How Fiber Changed the World

Howard Seltman and Kathy McIntyre-Seltman

Course Overview

- Week 1
 - Prehistory and early history
 - Process overviews of spinning and weaving
- Week 2
 - Hemp and flax and other bast fibers
 - Cotton
- Week 3: Silk
 - Silkworms and silk properties
 - Sericulture and silk in China
 - Silk Road and silk outside of China
- **Week 4: Wooly mammals**
- Week 5
 - Dyeing
 - Synthetics
 - Fiber hobbies

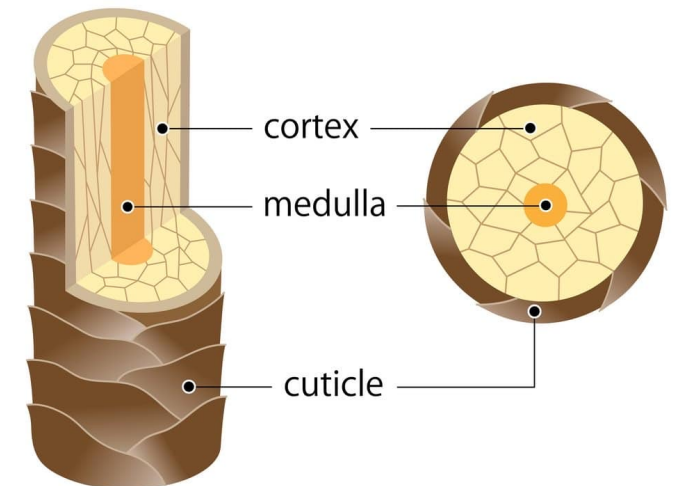
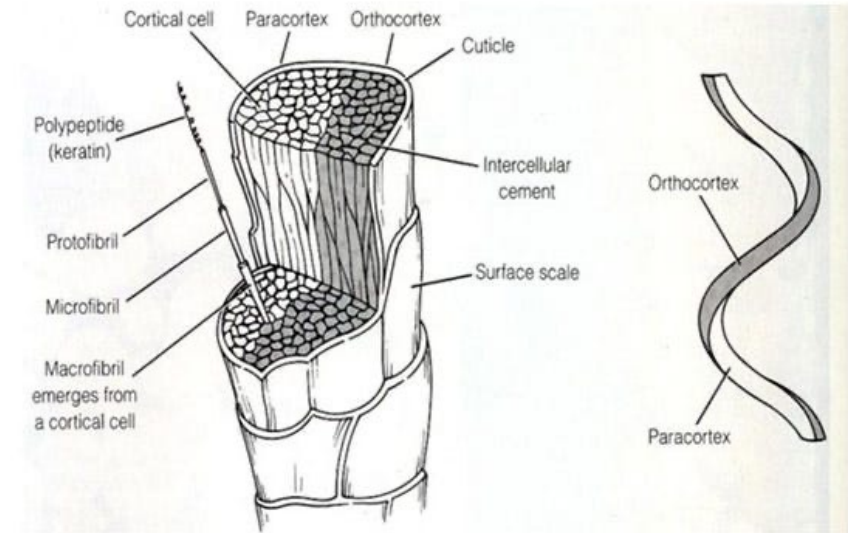
What is wool? It's made of keratin

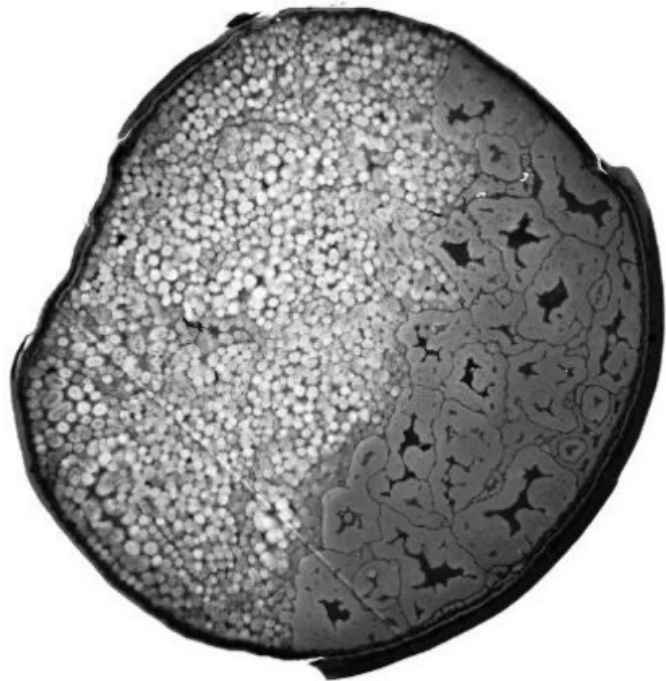
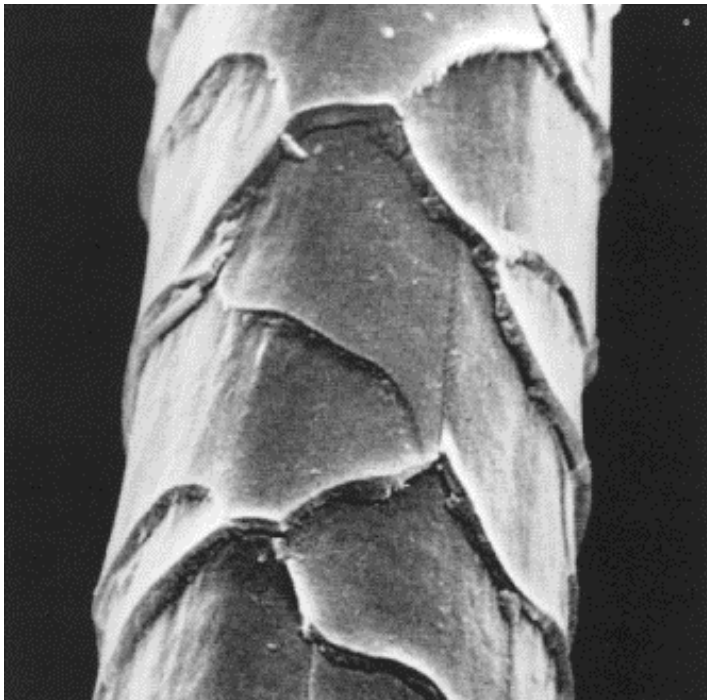


What is wool?

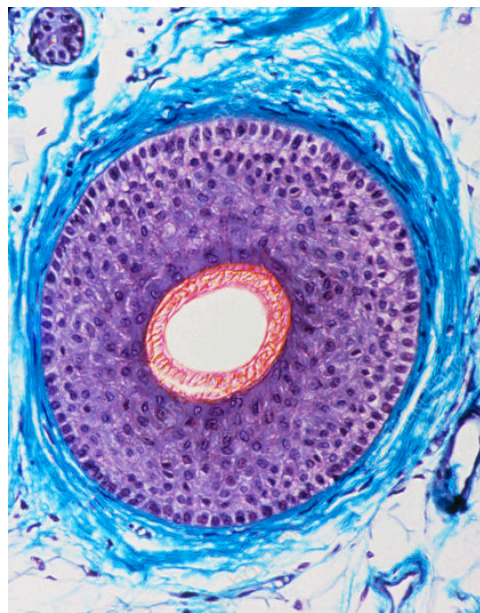
Difference between Wool and Hair

parameter	WOOL	HAIR
Medulla	Almost absent	Present and pronounced
cuticle	irregular	Regular and smooth
sides	Scaly projections	smooth
diameter	Less	more
Growth	Continuous if not sheared but not shed	Reaches maximum and then shed
Softness	More	Less
Elasticity	More	Less
Heat retention	More	Less
Moisture retention	More(12 to 17%)	Less(7 to 12)
Dye retention	permanent	temporary
Luster	More	Less
Inflammability	Less(transmit uv light)	more
Transparency	Semi transparent	Semi opaque
Produced from	Secondary follicle	Primary follicle

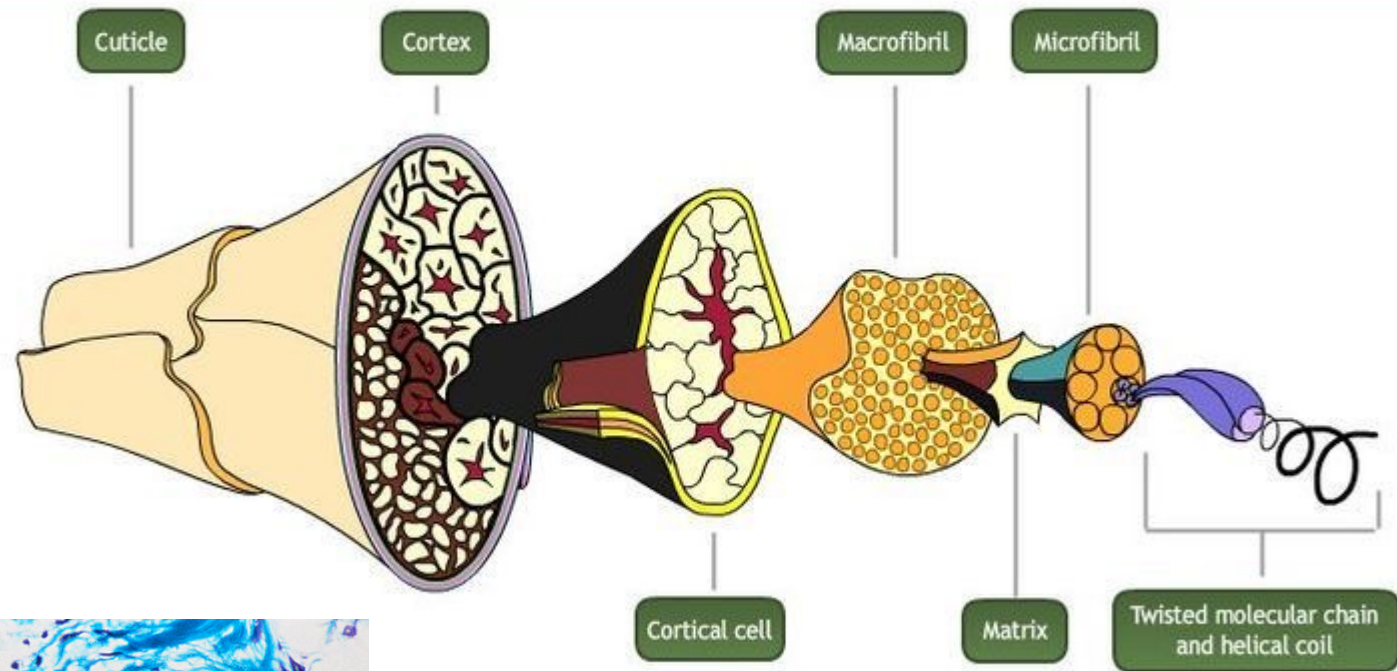




5 μ m



WOOL FIBRE STRUCTURE AND PROPERTIES



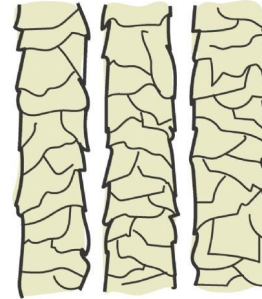
Felting

Unspun fiber

Heat + wet + pressure / agitation → scales will interlock

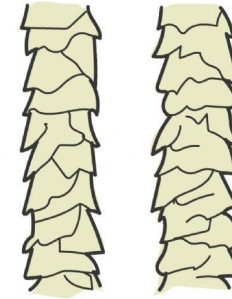
- Durable, warm
- Won't unravel
- Warm, waterproof and windproof
- Dampens sound

Wool
Fibres



Wool fibres are covered in microscopic scales.

Scales
Opening

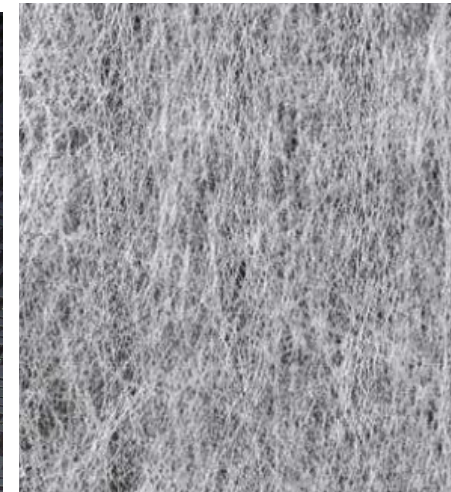


Scales lift with warmth, opening up the fibre.

Felted
Fibres



Scales hook together, resulting in a strong bond.



Fulling (Waulking)

Woven or knitted textile

Heat + stale urine + pressure / agitation → scales will interlock a little bit

- Makes fabric softer, stronger but it maintains its structure
- Urine (stale = concentrated) provides ammonia which scoured the lanolin
- Urine was collected at public places and saved in medieval times
- Fuller's guilds
- In Scotland, done by groups of women who sang call and response based "waulking songs"



What determines wool characteristics?

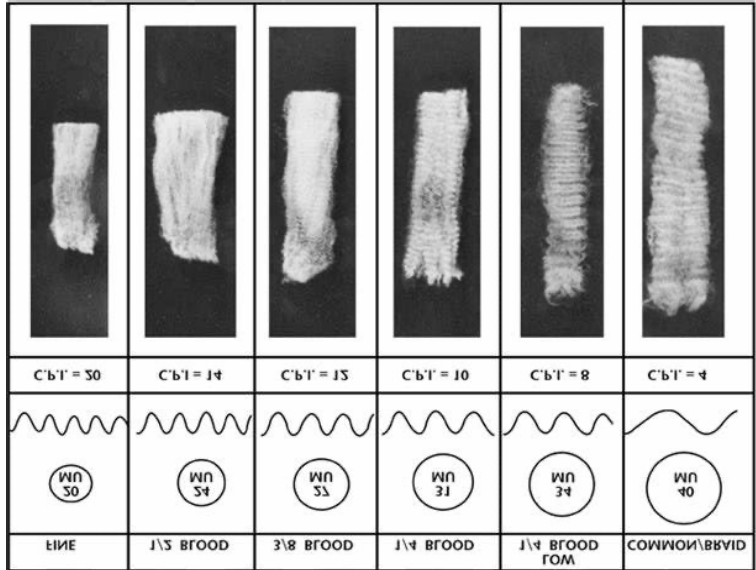
Fiber diameter



Staple length



crimp



Wool Fiber Grades		
	From	To
Fine	<17.5	21
Medium	22	30
Coarse	31	35
Very Coarse	36	40<
Human hair	50	90





What's so great about wool?

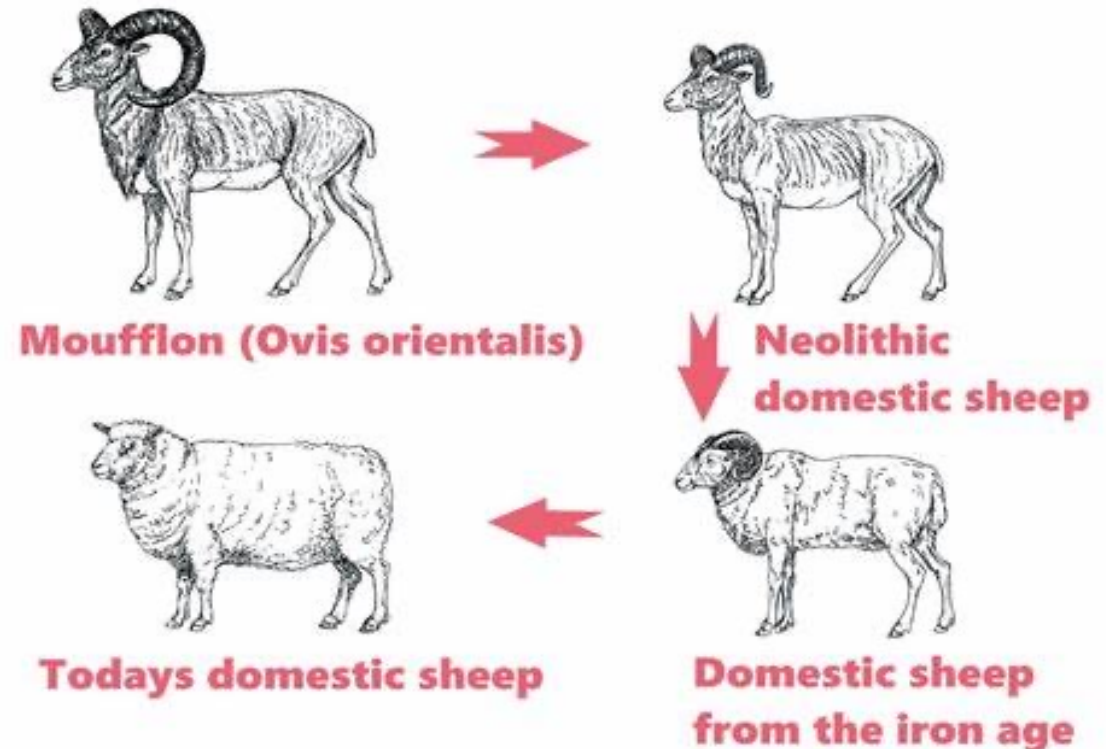
- Elasticity – can stretch 20 - 30 %
- Resilient-can bend >20,000 times without breaking (vs cotton 2000x)
- Hydrophilic
 - Absorbs 40% of its weight in water before it feels damp
 - Water held in cortex as vapor
- Insulates even when wet
- UV protective
- Fire retardant
- Many species have lanolin – water resistant
- Most species will felt

Where did sheep come from?

- Evolved maybe 50 million yrs ago
- Domesticated at least 9,000 BCE
 - Aşıklı Höyük site
 - for meat, milk?
- 1st use of wool 6000 BCE
- Selective breeding known to be practiced since antiquity – Jacob and Laban Genesis 30



- Now at least 260 registered breeds and many, many cross breeds



What came with sheep?

Dogs - Domesticated earlier, but when sheep were domesticated, dogs were bred for guarding the flock from predators, and for herding



Shears



Herding video

How do we get the wool from the sheep?

Rooving

- Primitive breeds shed in spring
- Wool can be gathered from bushes, rocks
- Fleece can be separated, combed or plucked



Rooing video

How do we get the wool from the sheep?

Shearing

- Non shedding sheep must be sheared – wool keeps growing
- 1-3 x per year depending on breed



BEFORE



AFTER

**What happens
if they are not sheared?**



Shrek

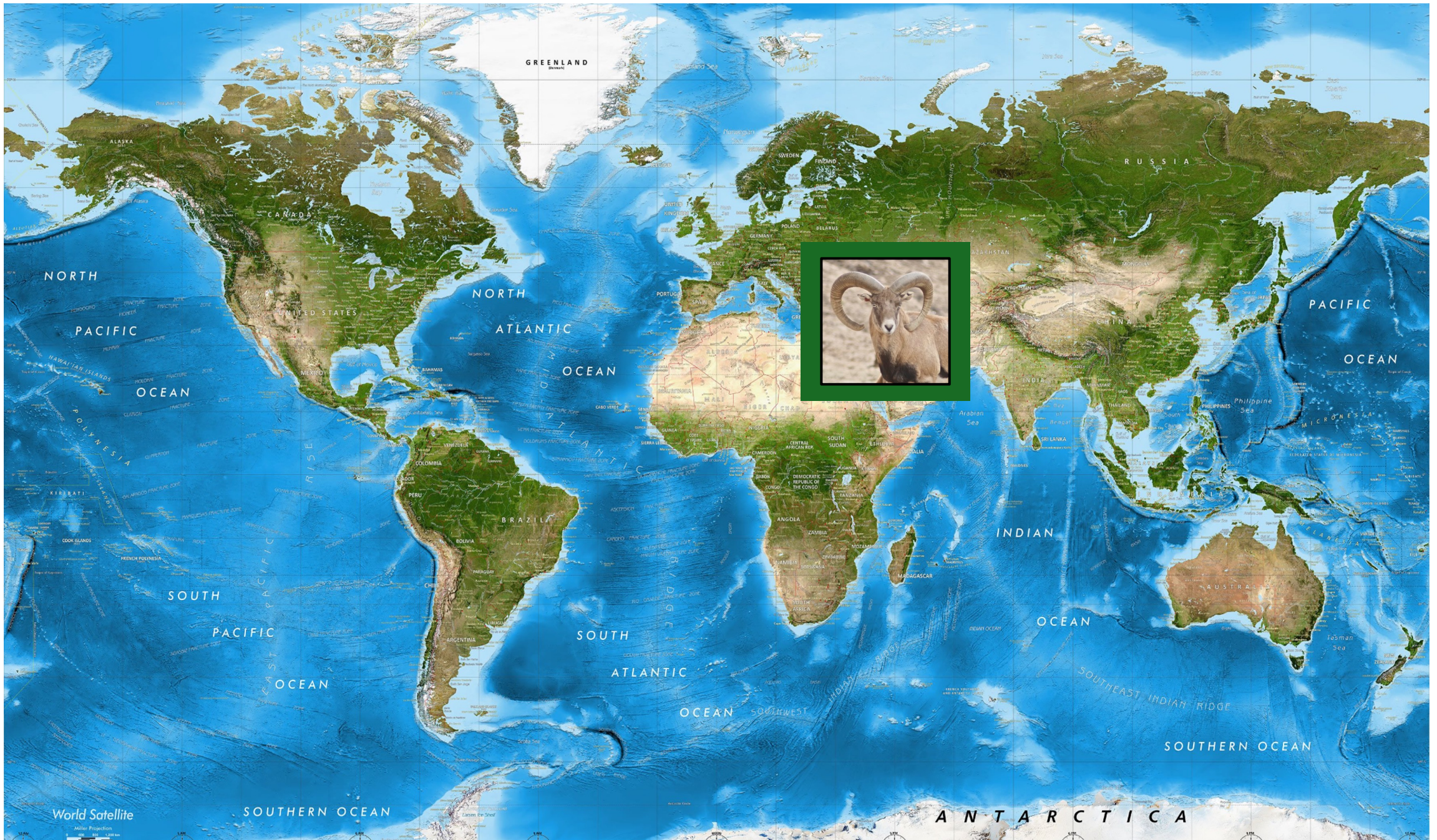


Fiona



Hand shearing video

Shearing video



Africa

- Sheep domesticated in Sudan and Egypt by 3000 BCE
- Origin of central African sheep uncertain – ongoing DNA studies
- Subsistence farming for meat (except in South Africa)
- South African sheep: Merino imported from Netherlands because climate better suited



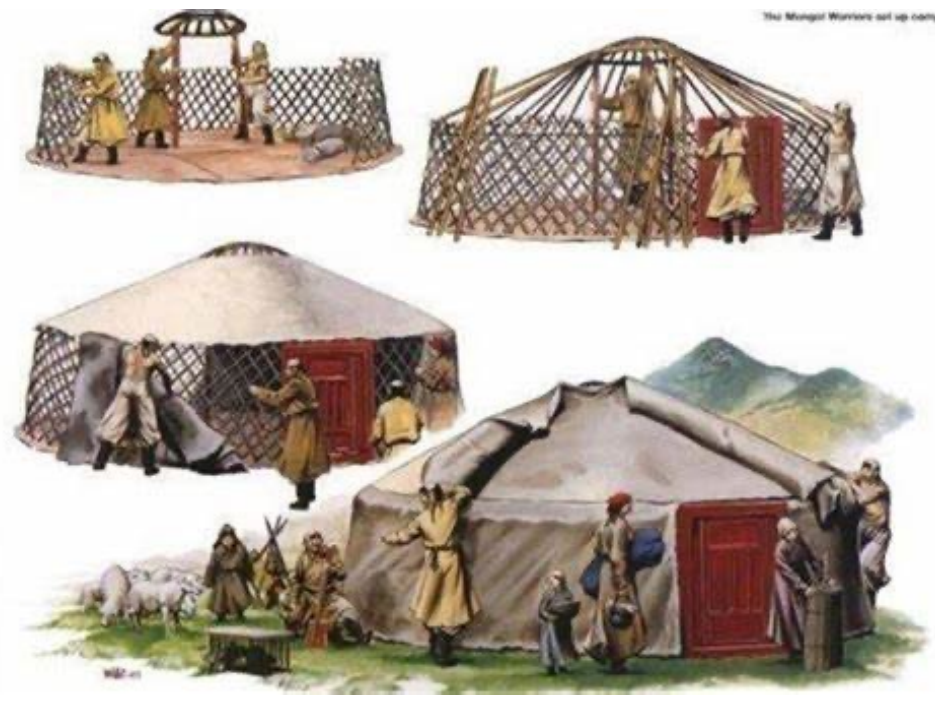
West African Dwarfs

Mongolia

- Domesticated sheep by 6th C BCE
- Primitive breed, adapted to high altitude, cold climate, scrub diet
- Wool and felt used for outer clothing, blankets, rugs and shelter



Yurt



Norse Countries

- Primitive breeds, able to eat scrub, moss, kelp, tolerant of harsh climates
- Spun, woven and nålbinding wool products from 2500 BCE
- Clothing, household goods and SAILS
- Spread with Viking raids – ancestors of Icelandic, Hebridean, Germanic breeds
- Island populations isolated primitive breeds

1021 Viking whorls found in L'Anse-Aux-Meadows



Old Norwegian Breed



Soay – St Kilda

Icelandic Sheep

- Unique pure breed due to island isolation
- More sheep (half million) than people (375,000)
- Was 1° milk and wool breed, recently marketing for meat
- Double coated – both the soft down and coarser kemp used
- Spun and knit -
- Important industry in Iceland



Italy: wool = wealth

- Sheep farming established 3rd c BCE
- Sheep cheese, wool and wine primary export products of Tuscany
- Italy replaced Britain as biggest wool exporter when Edward I tariffs priced Britain out of the market (1275)
- Florence 1300's – European center of wool and textile industry
 - *Arte della Lana* – wool guild established 1308 – great wealth, power, and control of export markets
 - *Medici family* – from Tuscany, made their fortune with wool, entered banking with their wealth



Arte della Lana



Spain: Merino = wealth

- Merino bred from North African Berber sheep
- Medieval economy was based on merino wool – “finest wool in the world”
- Herds were nomadic- summers in northern mountains, winters on plains
- 13th C – formation of the *Mesta*, organization of wealthy wool merchants, nobility, sheep owners, Catholic clergy
 - Controlled grazing and migration lands without regard to private property – sheep had right of way
 - Controlled breeding, export of wool
- Mesta monopolized legal and economic systems until 16th century- aggregated great wealth
- Wool wealth funded Columbus, conquistadors
- Smuggling sheep punishable by death
- Merino monopoly maintained until 18th century



France and Low countries

- Sheep were present in 5000 BCE-primitive breeds, coarse wool- used for milk, meat, some for household, clothing
- Medieval France – Bergeries: large scale farms
- Flanders imported raw wool, spun and wove, exported fine woolen textiles – dominant source of both linen and woolen throughout Europe
- 1786 - King of Spain gifted Louis XVI small flock of Merino which were kept at Rambouillet, Marie Antoinette's summer palace, were crossbred to their own breed
- 1789 Merino gifted to William of Orange in Netherlands – were shipped to Dutch South Africa for better climate



Britain

- Domestic sheep arrived 3000 BCE with spread of Neolithic peoples from Norse and central European regions
- Celtic woolens found in Eastern Europe from 1500 BCE
- 50 CE – Romans appropriated Celtic sheep, wool, especially cloaks
- Unlike Spain, land supported stationary herds → many distinct breeds developed for local conditions and needs
- Anglo-Saxon 400–700 subsistence farming
- By 1100, more sheep than all other livestock put together (Domesday Book)



Britain :1000 – 1300 – wool was major driver of British economy

- Raw wool became commodity → international commerce, urbanization, centralization, regulation, shipping, trade in dyestuffs – Flanders and Florence were largest market
- Church was major landholder esp Cistercian order – grazed sheep and controlled wealth
- State taxed wool
- 1275 Edward I - price increases and tariffs to raise money for war with France → export market dried up- also slew all wolves in Britain



Baa Baa Black Sheep
Have you any wool?
Yes Sir, yes Sir, three bags full

One for the Master
One for the Dame
One for the little one who lives
down the lane



Britain: people died but not the sheep

- 14th – 15th C - woolen textiles replaced raw wool exports
- Black Death resulted in untended lands and decimated population → sheep were ideal agricultural product
- Croft industry of keeping sheep, spinning, dyeing, weaving
- Edward III (1327-1377) legislated the wearing of wool, burial in wool, and the Woolsack
- Henry V (1413-1422) wool textile was 70% of national economy



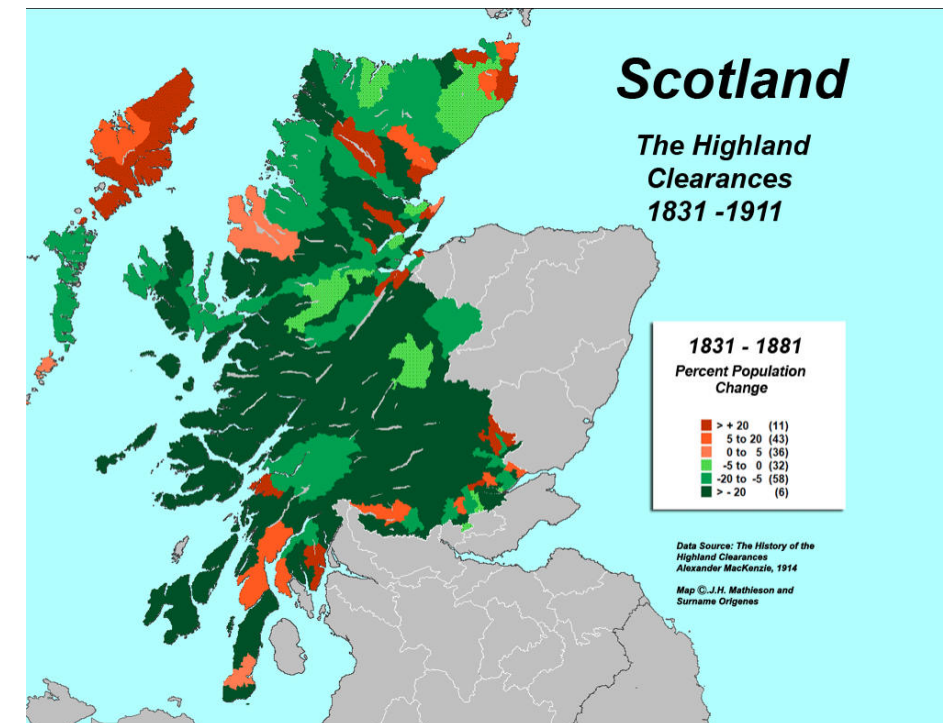
Highland Clearances 1746 – late 1800's

Up to 1740's Highlanders were loosely organized by clans with common land and sheep holdings

- Duke of Argyll put liens on peasant land 1710
- Jacobite rebellion 1745-46
- 1746 wearing of plaids and kilts outlawed

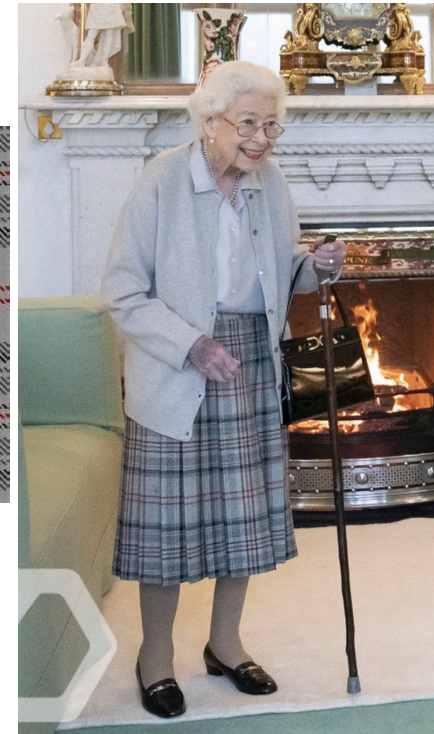
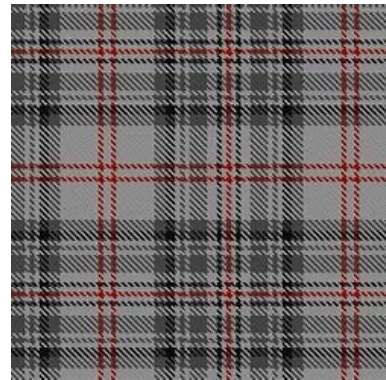
Wealthy Anglo-Saxon landowners forcibly evicted Highlanders to use their lands for grazing sheep

- Burned homes, broke up clans
- Moved crofters to poor coastal land, subsistence kelp farming and fishing
- Famine-potato blight
- Forced emigration – Canada and America



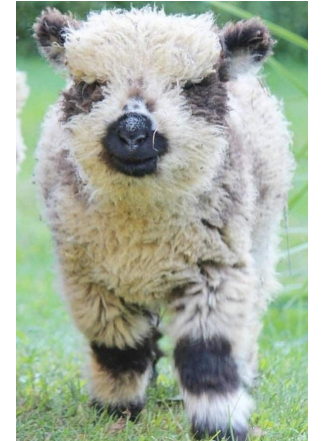
Scottish Woolens

- Waulked (fulled) after weaving
- 2022: 2.5 million sheep in Scotland
- Price of wool ↓↓ in last 8 years
- Harris tweed – still handwoven on Isle of Harris
- Tartan fabrics – mostly for tourists



Britain today

- Selective breeding – for diverse environments, different uses → 200 distinct British breeds
- 22.2 million sheep in UK
- Preservation of primitive breeds on British islands
 - Shetlands
 - Hebrides
 - Isle of Mann



Australia and New Zealand

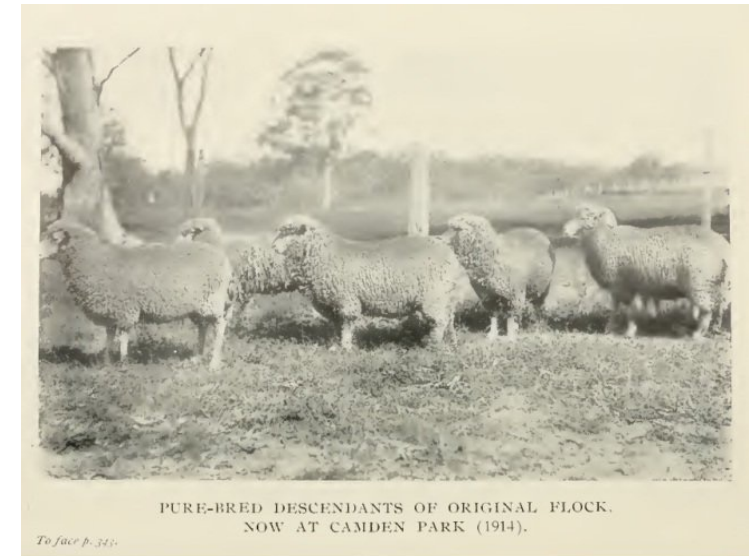
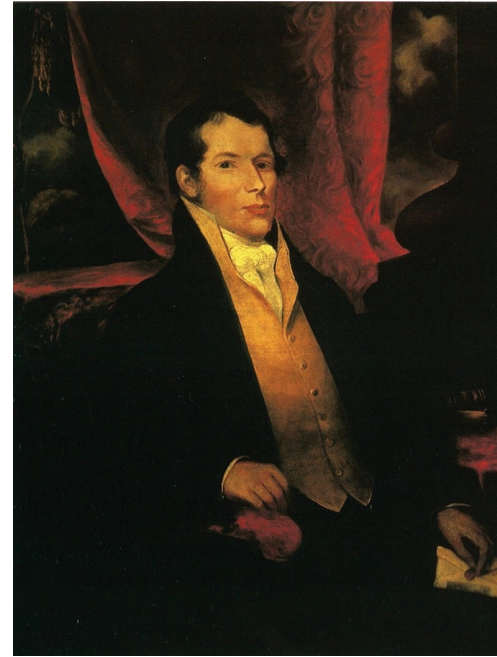
- First Fleet of 11 ships set off from Portsmouth England May 1787, arrived at Botany Bay Jan 1788
- 1400 persons aboard – 778 convicts (586 men, 192 women)
- Picked up sheep in South Africa
- Second and Third Fleets followed

There has been a longstanding debate over whether the key consideration in the decision to establish a penal colony at Botany Bay was the pressing need to find a solution to the penal management problem, or whether broader imperial goals — such as trade, securing new supplies of timber and flax for the navy, and the desirability of strategic ports in the region



Australia: The MacCarthurs - Parents of the Merino Industry

- 1797- 26 Merino sheep brought from Dutch South Africa, 8 survived the trip
- Cpt John MacCarthur and his wife Elizabeth negotiated to purchase them
- They purchased / were granted 15,000 “unoccupied” acres, imported and carefully bred the sheep, by 1820’s they owned 5000 head
- John in England for court martial, made trading contacts
- First to export wool to England, built Australia’s biggest industry



Australia and New Zealand: Merino Capital of the World

- 1830's -40's multiple herds brought to New Zealand from Australia
- 1850's – 1900 – importation of multiple Merino strains from around the world for selective breeding → distinct Australian Merino breed
- Sheep outnumbered people 12:1 (Aus), 20:1 (NZ) now more like 5:1
- Wool dominated the economy of both nations
- 1950-sharp decrease in wool exports due to synthetic fibers
- Now: Australia and NZ 100,000 million head, produce 50% of world's Merino



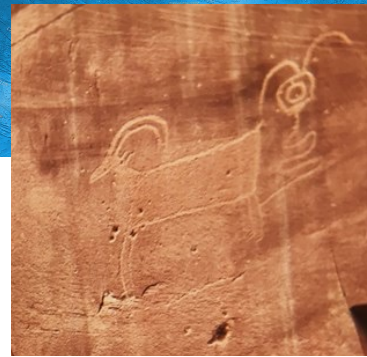
The Americas

- Indigenous Bighorn sheep never domesticated



“some Sheep as big as a Horse, with very large horns and little tails.” 1540 Conquistador

- Domesticated Churro sheep brought by Columbus 1493 and Spanish conquistadors in 1500's for food
- Caribbean islands evolved their own breeds



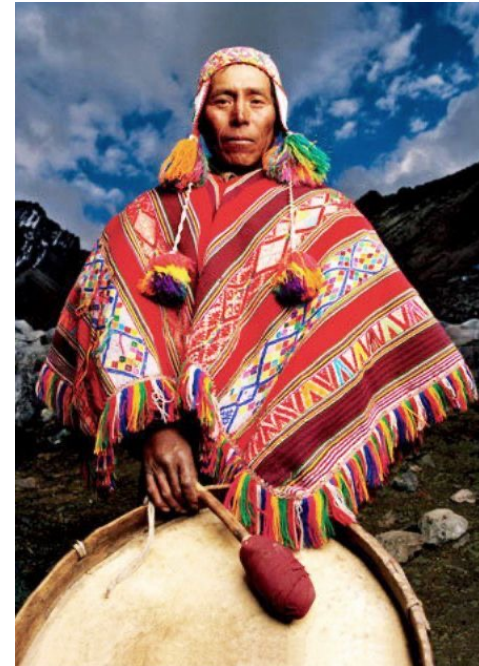
America: The churro

- Domesticated by Native Americans, Central and South Americans, most associated with Diné people
- Coarse strong fibers
- Used mostly for rugs, household goods, and outerwear



Central and South America

- 1500's Mexico produced and exported wool, but switched to cotton as it was more profitable
- Inca and Aztec kept few sheep
- Sheep industry in South America: 56 million head mostly for wool – Merino and Corriedale, and Criollo derived from Churro
- Challenges due to overgrazing and logging, and decreased wool prices



American Colonies

- Sheep brought to Virginia 1609 but were eaten due to famine, additional stocks brought in the next 20 years
- By 1650's New England exporting wool to England, Virginia was trading tobacco for woolens from New England colonies
- 1664 Massachusetts law required all children to learn spinning & weaving
- Textile mills produced lindsey – woolsey
 - Warp was linen, weft was wool
 - Less expensive, more durable, versatile
 - Shatnez – wearing wool and flax together forbidden by Jewish law (Leviticus 19:19)

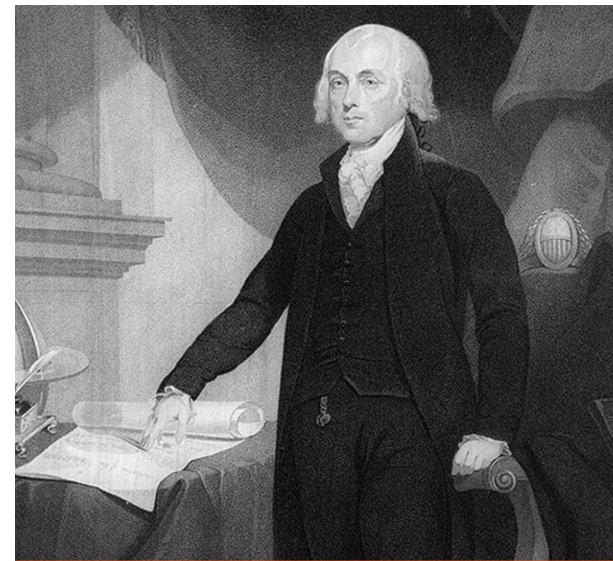


Hog Island Sheep at Mt Vernon



American Colonies: Wool is Patriotic

- 1669 England outlawed importation of colonial woolens and transport of sheep to colonies
 - 1760's new wool tariffs
 - Homespun fabrics promoted
 - Patriotism and domestic wool
 - George Washington, Thomas Jefferson, James Madison kept sheep
 - Homespun Ball – House of Burgesses in VA
- Didn't end with the Colonies
- Wartime push for woolens for “the boys over there”
 - Roosevelt grazed sheep at White House



James Madison Inaugural Address of 1809



United States: Go west, young man

- Sheep and cattle both important in westward expansion
- Specific breeds of sheep developed to thrive in semi arid, high altitude western states
- Now 88,850 sheep ranches and 5 million sheep in US

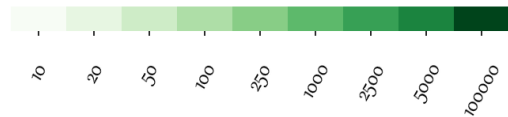
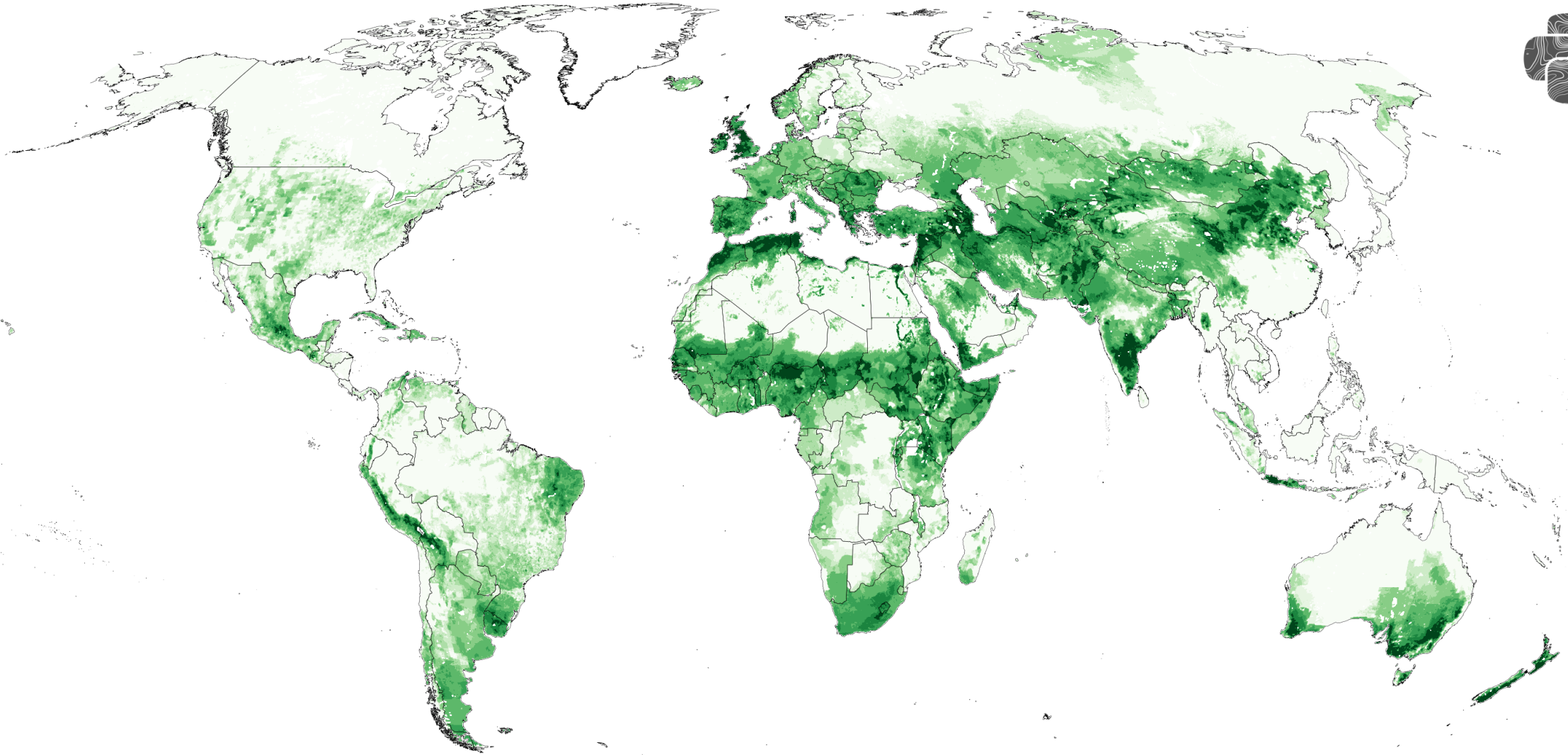


Romedale



Targee





Sheep Density

Gilbert, M. et al. Global distribution data for cattle, buffaloes, horses, sheep, goats, pigs, chickens and ducks in 2010. *Sci Data* 5, 180227 (2018).
@PythonMaps

Sheep Density

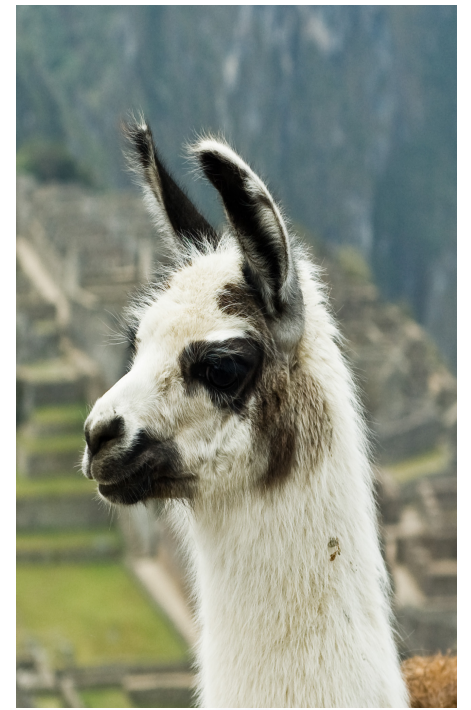
Other Fiber Critters

CAMELIDS	GOATS	CATTLE
Camels	Angora	Yak
Alpaca	Pygora	Bison
Llama	Cashmere	Musk ox
Vicuña	Pashmina	
Guanaco		and Bunnies

Alpaca



Llama



Vicuna



Guanaco



Yak



Musk Ox - Qiviut



Bison



Camel



Angora



Goats



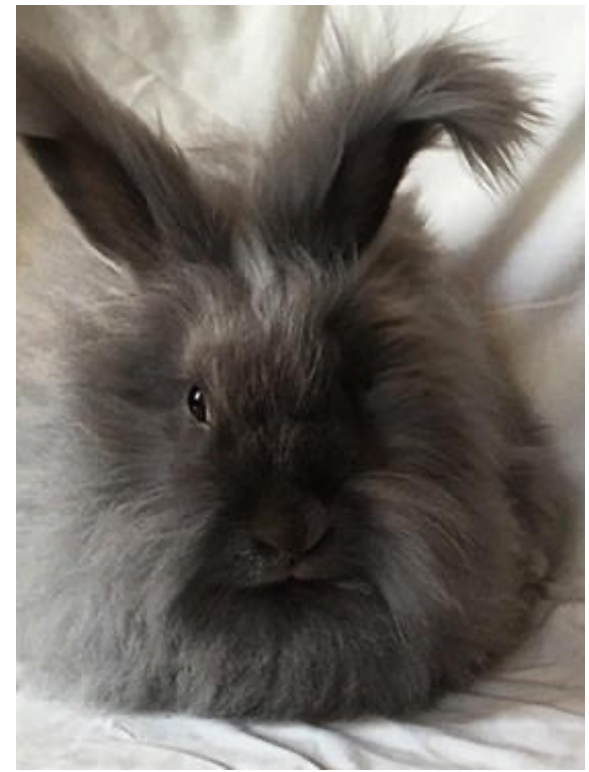
Cashmere



Pashmina



Angora rabbit



Wool

What did we cover today?

- Why wool is special
- How sheep populated the world
- How important to society sheep have been from neolithic times until the present
- Other woolly creatures

This is my fantasy!!

- Why wool is special
- How sheep populated the world
- How important to society sheep have been from neolithic times until the present
- Other woolly creatures

Spinning off of a rabbit video

Any questions?

Selective Breeding

Jacob and Laban, **Genesis 30:31-33**

31 And he said, "What shall I give you?" And Jacob said, "You shall give me nothing; if you do this thing for me, I will return, I will pasture your flocks, [and] I will watch [them].

32 I will pass throughout all your flocks today, removing from there every speckled and spotted kid, and every brown lamb among the sheep, and [every] spotted and speckled [one from] among the goats, and this shall be my wages.

33 And my righteousness will testify for me at a future date for it will come upon my wages before you. Whatever is not speckled or spotted among the goats or brown among the sheep [shall be counted as] stolen with me."

לֹא־וַיֹּאמֶר מָה אֶתֶן-לָךְ וַיֹּאמֶר יַעֲקֹב לֹא־תִתֶּן-לִי
מֵאוֹמָה אִם־תַּעֲשֶׂה־לִּי הַדָּבָר הַזֶּה אֲשׁוּבָה אֶרְעֶה
צֹאֲנֶךָ אֲשֶׁמֶר:



