Camping at Brigham

PLS
A. Original Principles
B. Legacy Effects

MASC-SW Chap
Joint Meeting
18 Jun 2025

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A. Original Principles

Survey aspects

- Survey before sale
- Unique location and identification
- Systemized subdivision procedure

Government aspect

- Reserve 4 Sections per Township for future sales
- School Section – sale funds to be used for local school est.
- PLS Township serve as nucleus for local government

B. Legacy Effects

Land Use Patterns

Aerial image: no doubt a PLSS state.

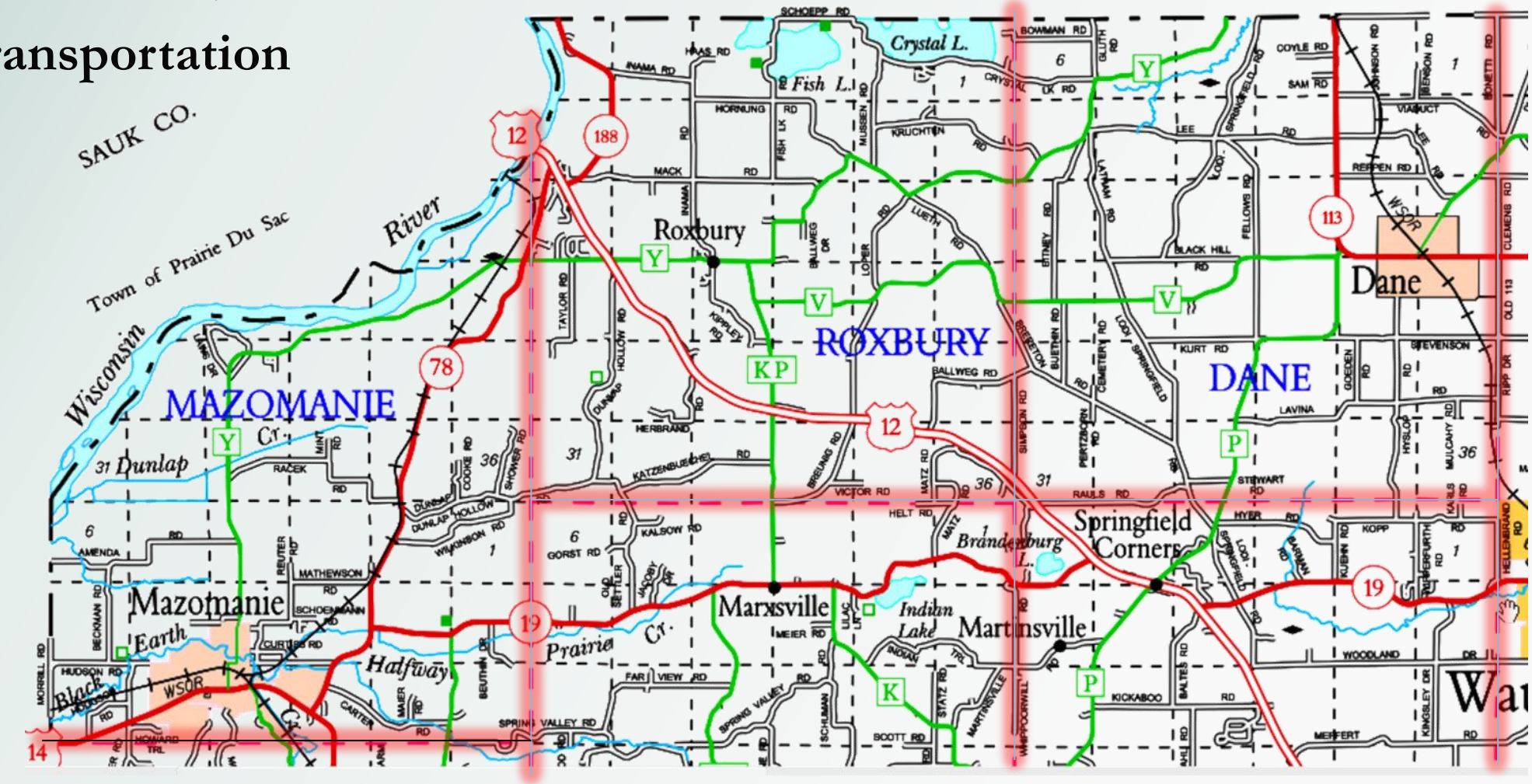
40 acre aliquot part ownerships units.

Land use patterns follow aliquot lines.

B. Legacy Effects

Local Gov't;

Transportation



B. Legacy Effects

Transportation

You're driving north on a straight road.

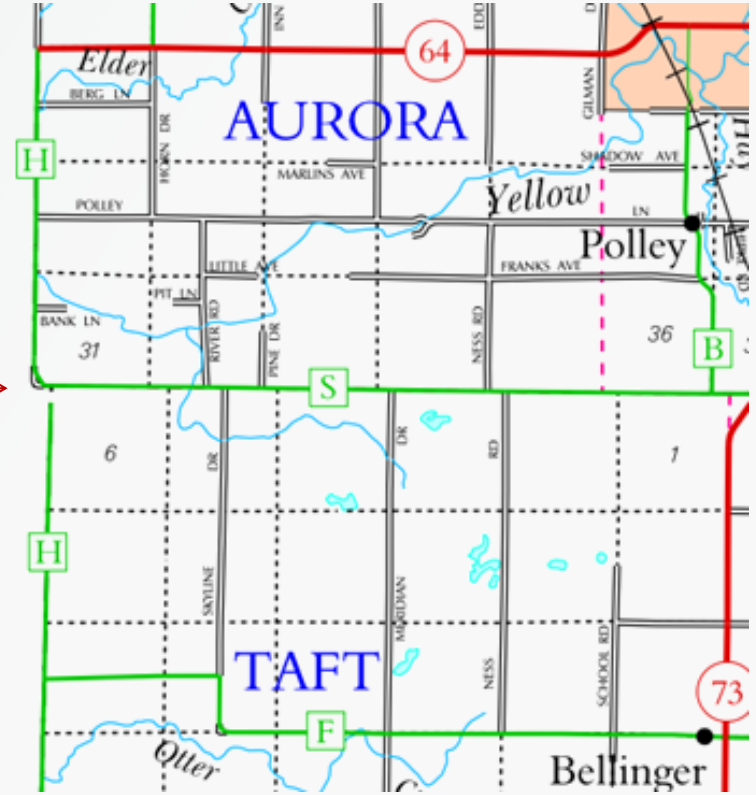
All of a sudden the road curves sharply 90° to the left, then almost immediately sharply 90° to the right.

What happened?

You just crossed a PLSS correction line

Langlade Co WI

3rd Corr'n Line N



B. Legacy Effects

Land Grant Universities

a. Impetus

Higher education by mid-1850s

Most institutions were still in East, had not spread to west as fast as settlement was occurring.

Heavy emphasis on liberal arts.

Industrial revolution was growing.

New agricultural technology was not being efficiently applied.

Need for increased technical education.

B. Legacy Effects

Land Grant Universities

b. Act of July 2, 1862 (Morrill Act)

Act granted federal lands to states to generate funds to establish and endow "land-grant" colleges.

Mission of institutions: focus on teaching practical agriculture, science, military science and engineering "without excluding ... classical studies", in response to the industrial revolution and changing social class.

c. Morrill Act (1890)

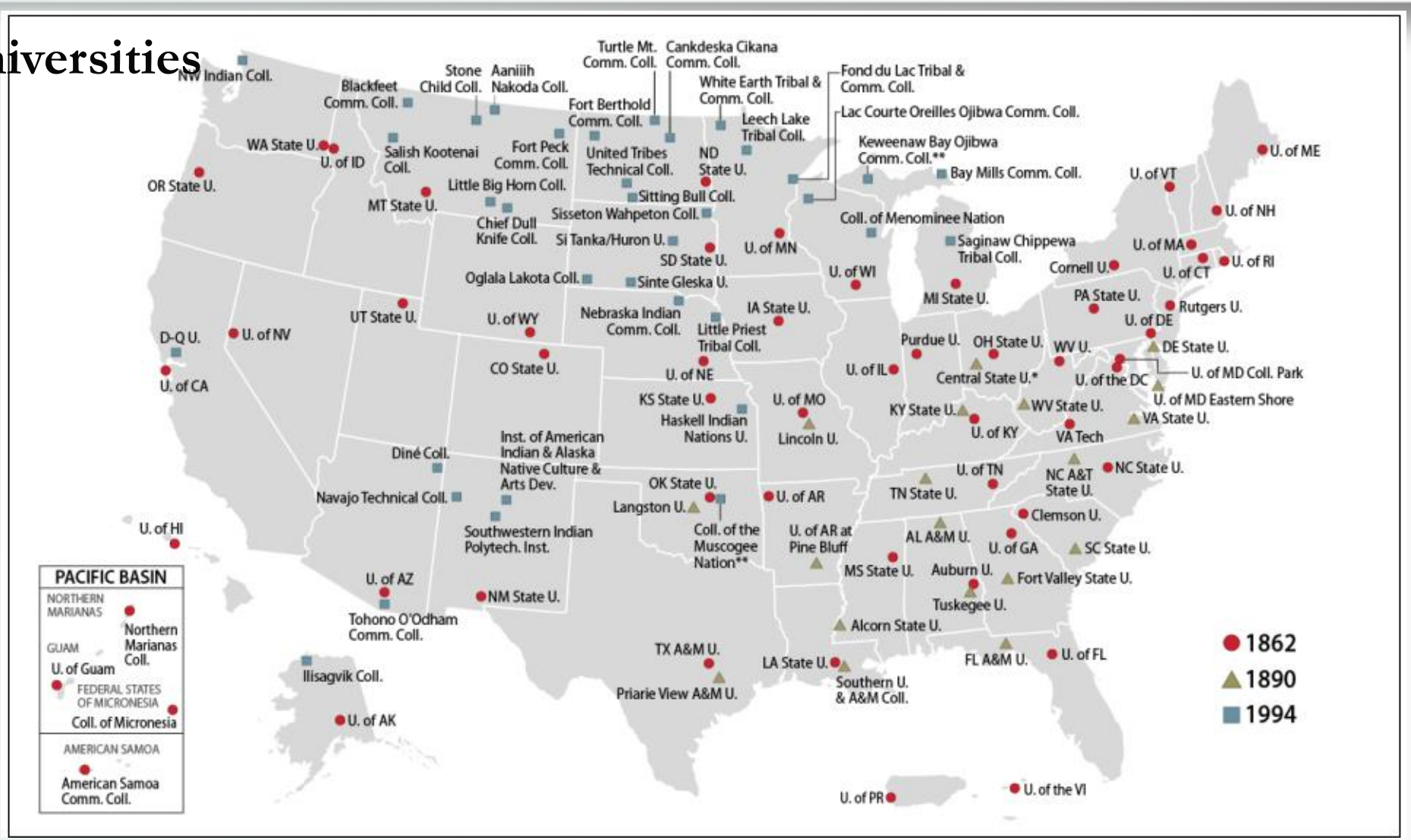
Aimed at former Confederate states

Required states to establish separate land-grant institutions for Black students.

Resulted in the establishment of several historically Black universities and colleges, including Alabama A&M, Prairie View A&M University, and Tuskegee University.

B. Legacy Effects

Land Grant Universities

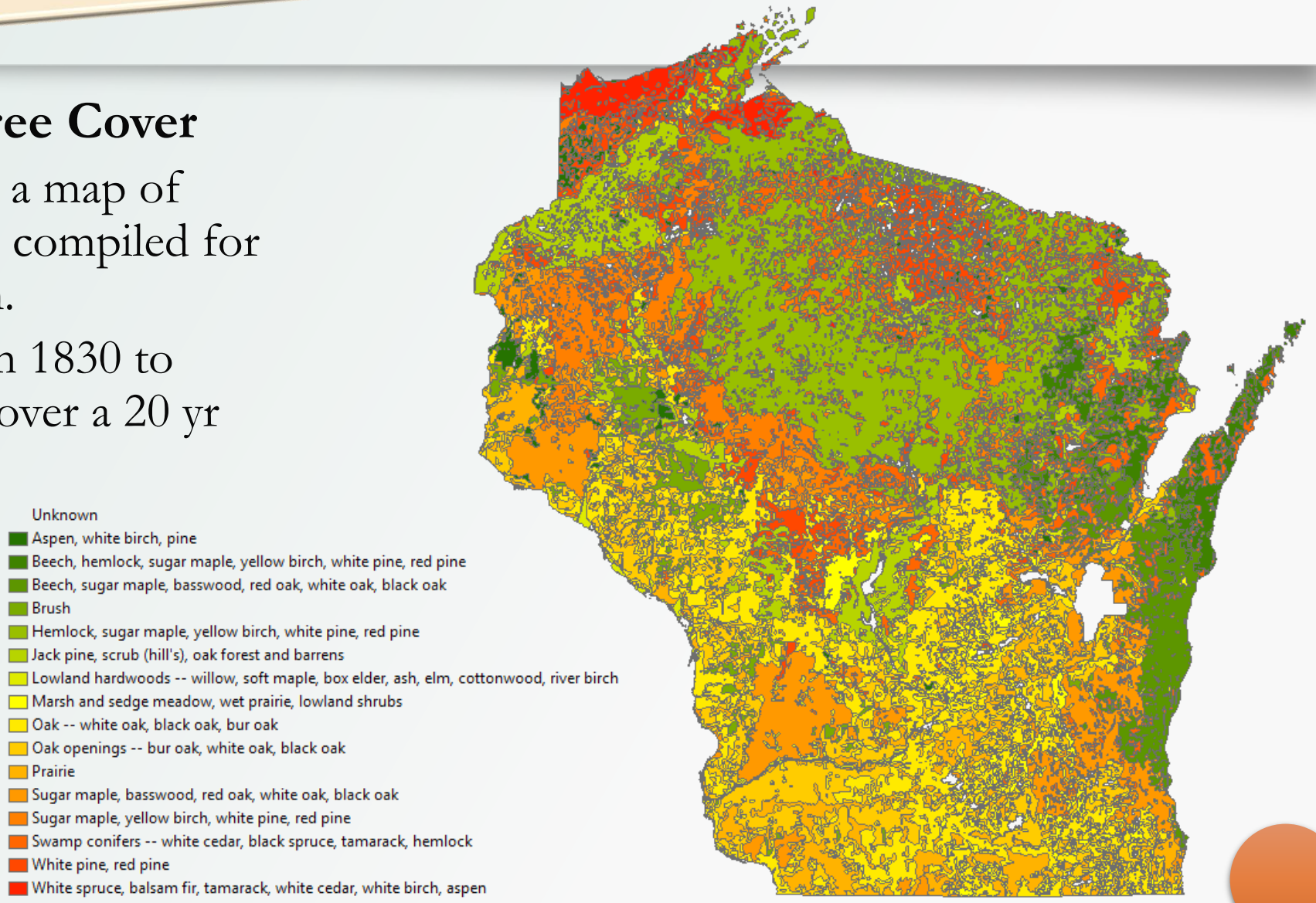


B. Legacy Effects

Wisconsin Original Tree Cover

Using PLS field notes, a map of original tree cover was compiled for the state of Wisconsin.

Wis Surveys were from 1830 to 1870s so tree cover is over a 20 yr span.



C. Chains, Miles, and Meters

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Gunter Chain

Edmund Gunter

b.1581

Went to Oxford U 1599 to be educated as Church of England priest.

Remained until 1615 having discovered math more inspiring than religion.

Was particularly interested in ratios & proportions and math relationship with real world.

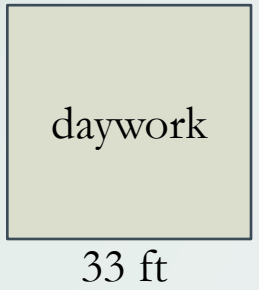
Constructed and improved on the quadrant and cross-staff. Developed methods to measure and solve intersection problems using logarithms.

1624: *The description and use of the sector, cross-staffe, and other instruments for such as are studious of mathematical practice* published, reluctantly, in English.

Gunter Chain

Usual Land Units

Daywork: area of agricultural land that could be worked by one person in one day.



1 perch = 16-1/2 ft
33 ft = 2 perches
1 daywork = 4 sq perches

Acre: area that could be worked by a team of oxen in a day.

1 Acre = 40 dayworks = 160 sq perches

1 sq mile = 640 acres = 160 dayworks

Multiples of 4 prominent to determine different land areas.

Gunter Chain

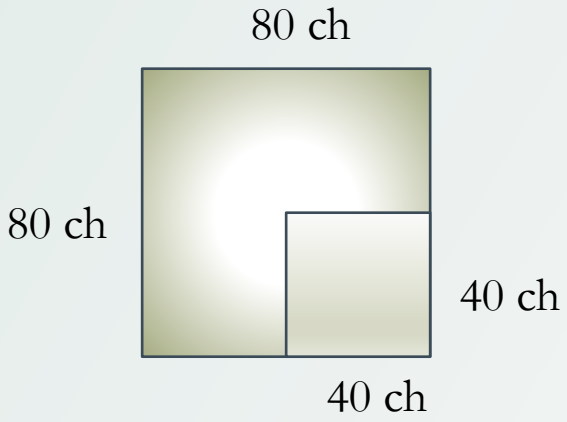
Edmund Gunter

Chain: "For plotting of ground, I hold it fit to use a chaine of foure perches in length divided into 100 links"

The chain was a mechanical converting device:

It was based on four (4 perches) and decimal (100 links).

To convert an area measured in square chains to acres, divide by 10



(80 ch x 80 ch = 6400 ch^2) /10 = 640 ac

(40 ch x 40 ch = 1600 ch^2) /10 = 160 ac

Simple computations

Gunter Chain

Universal adoption

Ease of use

Flexible

Easily transportable

Durable

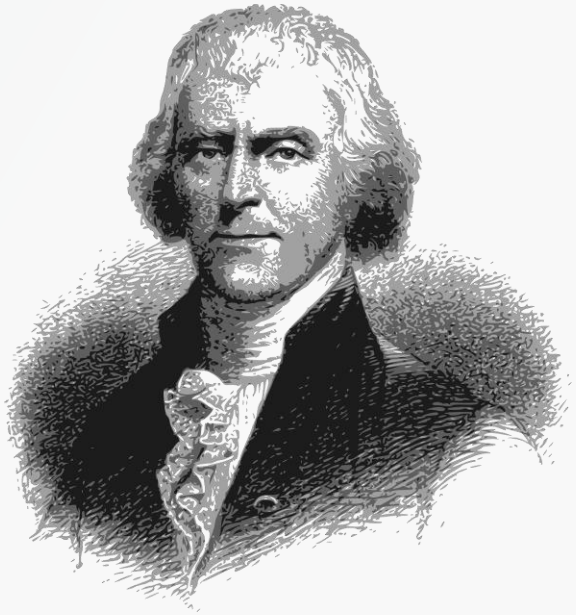
Did not stretch or shrink like rope

More accurate and consistent measurements

American Mile

Jefferson

- Influential on many levels in early US history
  - Penned *Declaration of Independence*
  - Served in State and Federal legislatures
  - Principle conceptual designer of the Public Land System
  - Secretary of State
  - Ambassador to France
  - President
  - Purchased Louisiana Territory from France
  - Sent off Lewis and Clarke on an expedition of discovery
  - Amateur scientist and mathematician
  - Etc....



American Mile

Jefferson

1794: As Sec of State was charged with establishing uniform weights and measures for the country

Population was amalgamation of many cultures who used their home country's monetary, volume, weights, etc, units

Made it difficult for equitable trade practices between states, even within them.

Prices based on dimensions (length, volume, weight) which varied between markets.

Jefferson believed in a strong agrarian society with as many land owners as possible producing agricultural goods. Markets needed units standardization

Strong advocate of decimal systems

Easy to understand, simple calculations

American Mile

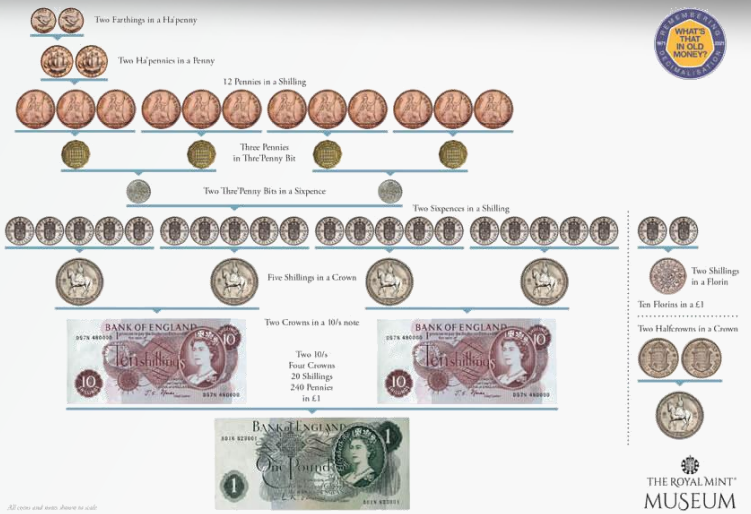
Jefferson

Tackled currency first

Common currencies used in US:

English pound-shilling-pence

1 pound = 20 shillings = 240 pennies



Spanish silver dollar (common worldwide), aka, Piece of Eight

1 dollar = 8 reales

Using Spanish dollar as starting point, Jefferson proposed, and Congress accepted:

1 dollar = 10 dimse (dimes) = 100 cents

American Mile

Jefferson

Where he went off the deep end (a little) was with length.

He believed length should be scientifically defined, linked to some aspect of the earth.

He decided to start with the mile and determine its length for 1 minute of longitude along the equator.

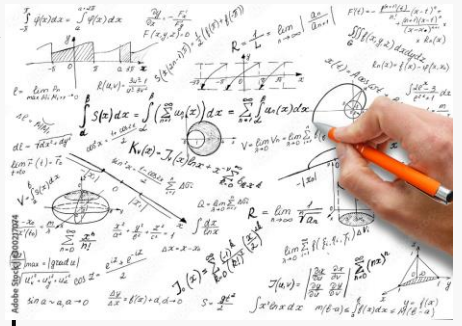
American Mile

Jefferson

But no one had measured the equator's length, and Jefferson wasn't about to.

It had already been established previously by English, French, and Dutch surveyors and scientists that the earth wasn't a perfect sphere

However, there was no consensus on its actual dimensions.



Jefferson did his own computations based on the previous published works and determined that a minute of longitude along the equator was 6086.4 ft.

This he initially called a geographical mile.

Later, while developing the PLS, he changed it to the *American mile* for he intended it to be incorporated in the PLS.

American Mile

Jefferson

Compared to the traditional mile:

Mile	American (decimal)	English
Length	6086.4 ft	5280 ft
Furlong	608.64 ft	660 ft
Chain	60.864 ft	66 ft
Pace (Fathom)	6.0864 ft	6 ft

There were two fundamental problems with Jefferson's approach:

1. It redefined the Chain which was a unit of measure, a physical length, and in widespread use.
2. His mile was still based on feet which weren't scientifically defined. He could have assigned a length to his mile thereby fixing its smallest division.

American Mile

Jefferson

Potential effect on PLS?

Jefferson wanted Townships to be *Hundreds,* 10 ami x 10 ami, instead of 6 mi x 6 mi.

Eventually he was argued down to using English miles instead of American, but still 10 mi x 10 mi Townships.

Before PLS design completion, he was shipped off to France as ambassador.

During his absence, Townships were reduced to 6 mi x 6 mi, and because of its prevalence in property surveys, the Gunter chain was adopted as the fundamental PLS unit.

Congress so enacted and the American mile was no more.

Birth of the Meter

France: 1790

Acadamie of Science ordered to set up a new general set of weights and measures

For universal adoption to minimize unit differences across borders

Acadamie decided unit divisions should be decimal for simplicity and easy comprehension. Should also be scientifically-based allow others to replicate.

Considered three ways to define the fundamental linear unit

Pendulum

Equatorial quadrant

Meridional quadrant

Birth of the Meter

Length

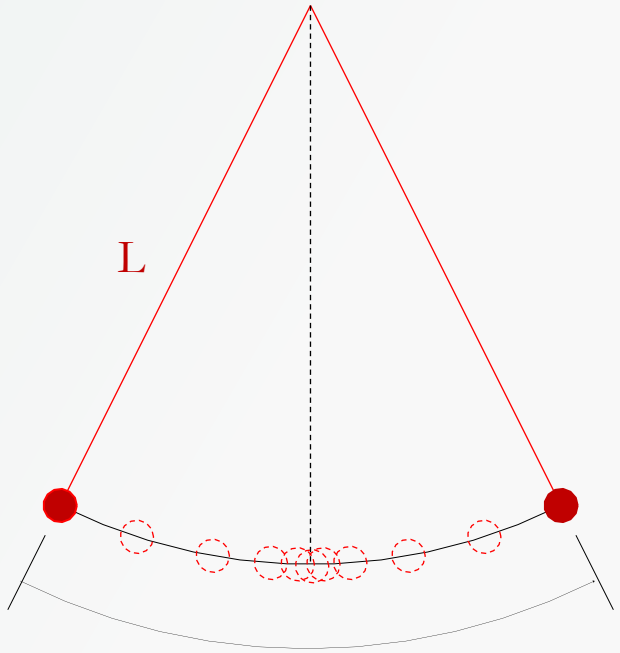
Pendulum

Arm length, L, needed for a one-second period (swing)

Rejected because

- 1 sec was an arbitrary unit not scientifically based
- Pendulum influenced by gravity so L would change based on location.
- Would need to operate in a vacuum

Sidenote: Pendulums are still used today to measure gravity differences.



t = 1 sec

Birth of the Meter

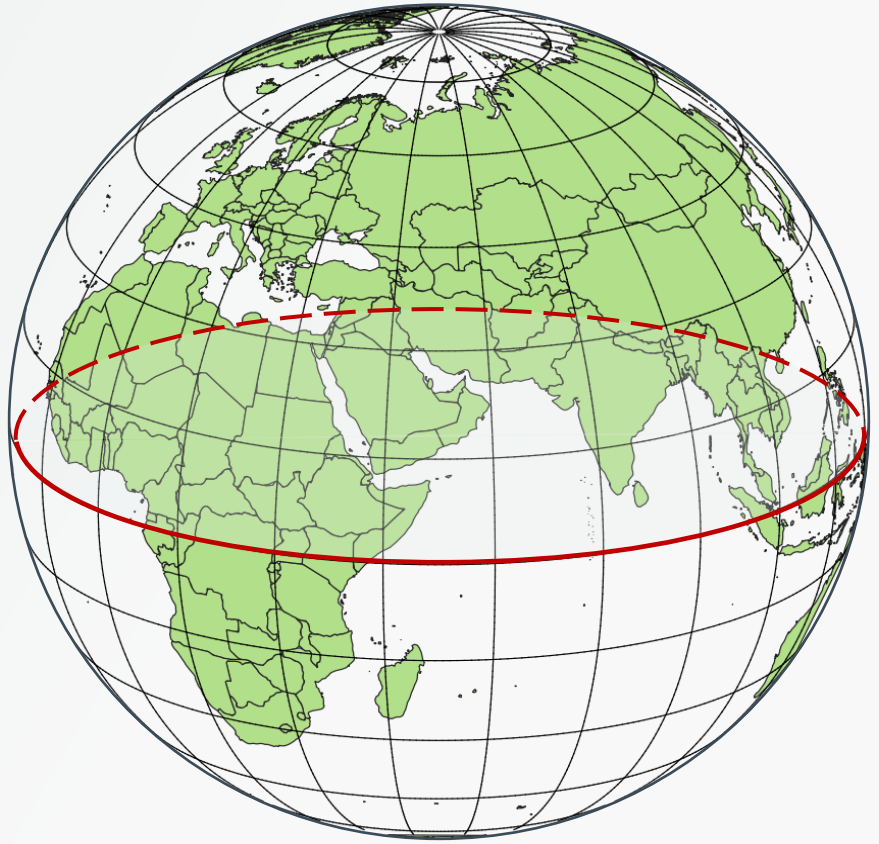
Length

Equatorial quadrant

A proportional part of the equatorial circumference.

Rejected because

- Circumference wasn't known; different values depending on the mathematician/scientist
- Would be too difficult and costly to determine.



Birth of the Meter

Length

Meridional quadrant

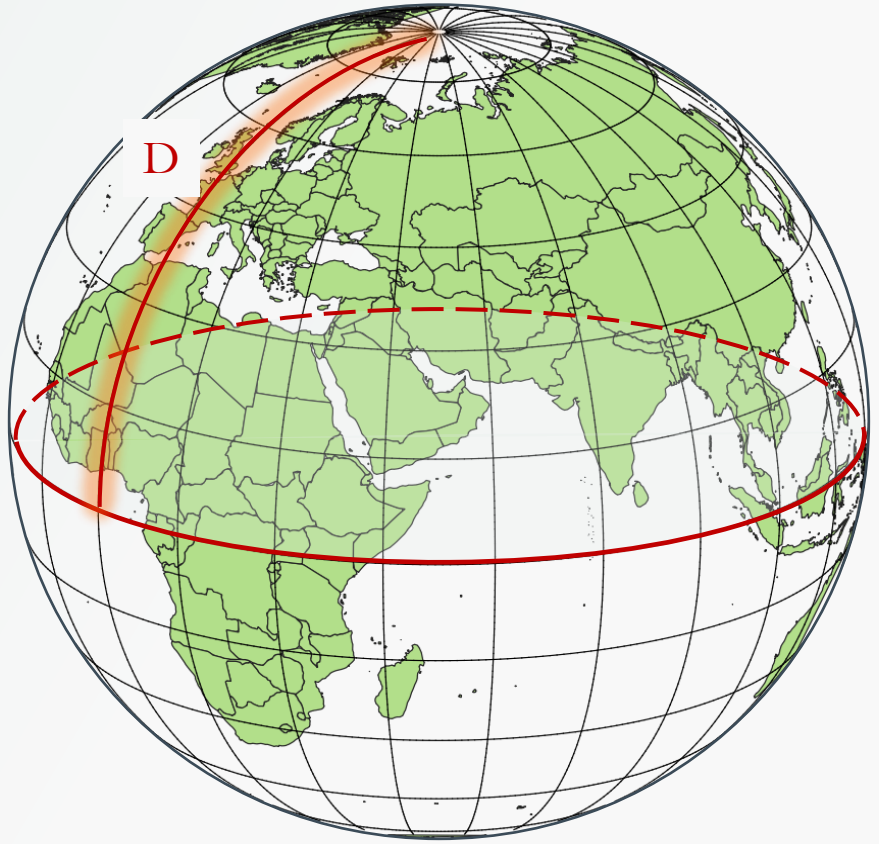
A proportional part of a meridian length, equator to pole

Accepted; part of a meridian was already measured.

Measured 9-1/2° of meridian and extrapolate the rest.

Completed in late 1793

Meter = 1/10,000,000 D



Birth of the Meter

Length

Of course, then the French Revolution came along.

Everyone associated with the ruling class and the elite were removed or disbanded, including the Acadamie.

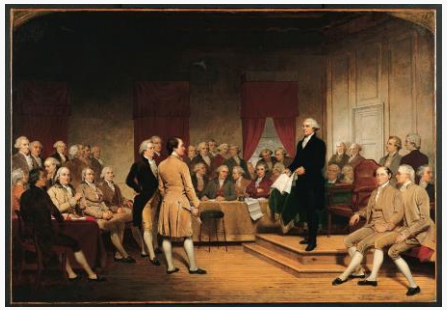
That could have been the end of the metric system except for Maximilien Robespierre

- Controlled the Committee of Public Safety
- Member of the Committee of Public Instruction
  - Mandate included enlightenment of the citizenry.
  - He reasoned scientifically defined weights and measures were rational and logical.

Dombey

International Standard?

Committee of Public Safety thought it would be a sign of solidarity with the American revolutionaries to share the metric system with them.



Joseph Dombey was selected as France's envoy.

- 52-year old doctor and botanist
- Gentile sympathetic nature
- Had integrity, courage, and ambition

Only one problem: he had lousy luck.

Dombey

If it weren't for bad luck...

1778 Joined a Spanish botanical expedition to Peru & Chile

Over his 5 years there he

Sent back

>1500 plant species

Mineral specimens incl 38 lbs of platinum

Inca pottery

Discovered

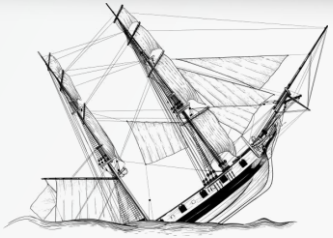
new hardwoods and shrubs

mercury

gold mines

Dombey

If it weren't for bad luck...



One shipment of plants disappeared in a shipwreck

Another was destroyed by Spanish officials

The rest were impounded and wouldn't be released until Dombey agreed to delay publishing his findings until *after* Spanish botanists published theirs first.

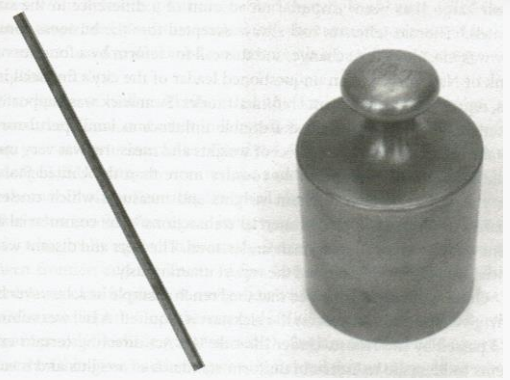
Gave up botany, set up doctor practice in Lyons - right before the revolution.

The city was sacked and all his hospital patients were executed. Dombey was spared because of his medical skills.

His friends, afraid his spirits were shattered, suggested him for the metric messenger position.

Dombey

If it weren't for bad luck...



Committee of Public Instruction

Order replica meter bar and grave (weight; later kilogram) be constructed out of copper.

Would be transported by Dombey to America where he would address Congress about the metric system

Dombey would also collect and send back plant and seed specimens, and find answers for a list of questions compiled by the Committee.

Dombey was provided a letter of introduction from Maximilien Robespierre.

He set sail on 17 Jan 1794, on the America ship *Soon*

under command of Captain Nataniel Brown.

Dombey

If it weren't for bad luck...

Expected to arrive in Philadelphia by end of Feb 1794.

Two weeks before landfall, severe storm drove the *Soon* southward.

Captain put in at Guadeloupe which was French: half royalists half revolutionaries.

Revolutionaries used Dombey's presence to start a nasty campaign against the royalist governor.

Governor ordered Dombey jailed as a troublemaker.

The revolutionary mob was going to storm the village. Dombey stood on a narrow bank blocking the mob's access and tried to reason with them.

The crowd surged, knocking him into the water, where the current swept him away.

A boat was launched and he was eventually rescued, unconscious.

Dombey

If it weren't for bad luck...

Governor took Dombey into custody but would just as soon have him leave so the revolutionaries wouldn't rally around him.

When *Soon*'s repairs were completes and Capt. Brown was ready to set sail, Gov asked him to take Dombey,.

The Caribbean was crawling with a British fleet, pirates, and privateers.

As soon as the ship broke harbor, she was captured by two privateers.

Dombey was taken to a nearby British colony and imprisoned until France would negotiate his release.

He didn't make it, and died in early April.

Dombey

If it weren't for bad luck...

Meanwhile, the *Soon* was taken as a prize ship. She and her cargo were auctioned off in 1794 in Boston.

A French sympathizer purchased the bar, weight, and introduction letter.

He sent the collection to Joseph Faucet, the French minister in Philadelphia.

Faucet presented them to Edmund Rudolph, the new Secretary of State.

Neither being a man of science, nor having Dombey there to explain, the men did not understand the significance of the bar and weight so they were never shown to Congress.

In 1795 the letter eventually made its way to Washington who used it to urge Congress to act on the yet unresolved weights and measures standards.

Congress

We resolve...

The House of Representatives appointed a committee to consider Washington's request and consider Jefferson's scheme

Business community was always the biggest resistance to weights and measures standardization.

This time, John Swanwick, founder of the Bank of New York, supported standardization.

House passed a bill to push forth with the effort and passed it to Senate.

Met no resistance and, because it was the end of the session, Senate said they would consider the bill at the next session,

The bill was never heard of again. It disappeared. Vamoose.

Congress

Act of 1796

Formally ended the experimental PLS stage (i.e., Seven Ranges) and ushered in the revenue-earning phase.

While Jefferson was off in France and the standards bill was somewhere in limbo, the Act adopted the Gunter Chain as the fundamental measurement device and unit for the PLS.

We were this close to being metric from the start.

The rest is history.

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B. Legacy Effects
C. Chains, Miles, and Meters

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