
WEIGHTS AND MEASURES

Agenda

- A Little History
- Lengths, Distances, and Areas
- P's and Q's (Pints and Quarts)
- Weights
- Money and Jewelry
- Farming and Industry

A Little History

- Most measurement terms in the USA and its founding colonies come from England
- Most measurements are multiples of 2, 3, 5, or their combinations
- Much of the terminology can be traced to Latin words
- There was very little standardization, hence much variation in measurements
- The United Kingdom established the Imperial System in 1824

  U.S. measurements diverged from Britain at this time

NOTES:

Measurements in this presentation will be in U.S. units unless otherwise stated.

Many of the terms did and in some cases still have varying definitions.

The terms in this presentation are not exhaustive but most were in common use by our ancestors.

Measuring Lengths and Distances

Common Systems Through the Ages

Common Units:

- Inch
- Foot
- Yard
- Mile

Out of date:

- Pole (aka rod or perch)
- Chain
- Link
- League (3 nautical miles)
- Fathom (6 feet)

Less Common:

- Furlong
- Hand (4 inches)

Antiquated:

- Cubit (18 inches)
- Span (9 inches)
- Palm (3 inches)
- Barleycorn

What is a Mile?

From the Latin *mille passus*, or “thousand paces”

- The Roman mile was supposedly 5000 feet, and was used in the British Isles with great variation
  - Welsh mile (3 English miles)
  - Scots Mile
  - Irish Mile
- The “Norwegian Mile” was at one time considered to be seven miles but was then standardized as 10km.
- Nautical mile: $\frac{1}{60}$ of a degree at the equator
  - 1852 meters or 6076 feet
  - The “knot” is one nautical mile per hour
- The British mile was standardized in 1593 at 5280 feet
  - Previously based on the armlength of various kings over the centuries
  - The foot and inch varied in step with the yard

But wait, why is 5280 divisible by 11 ???

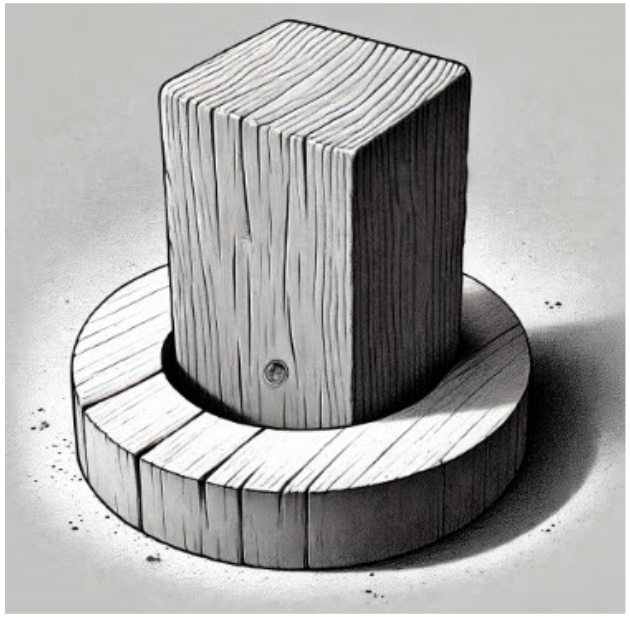
What is a Furlong?

The length of a furrow

- When plowing, where your horse, mule or ox would rest and turn around
- Somewhat standardized long before, and independently of, the mile, yard, and foot

Aligning the Furlong and the Mile

Most alignments over the ages required some adjustments to be made.



Aligning the Furlong and the Mile

Compromises were necessary.

In 1593, the furlong was set at 220 yards and the mile set to 8 furlongs.

Inches, feet and yards thus became standardized, too.

Using the Furlong in Surveying

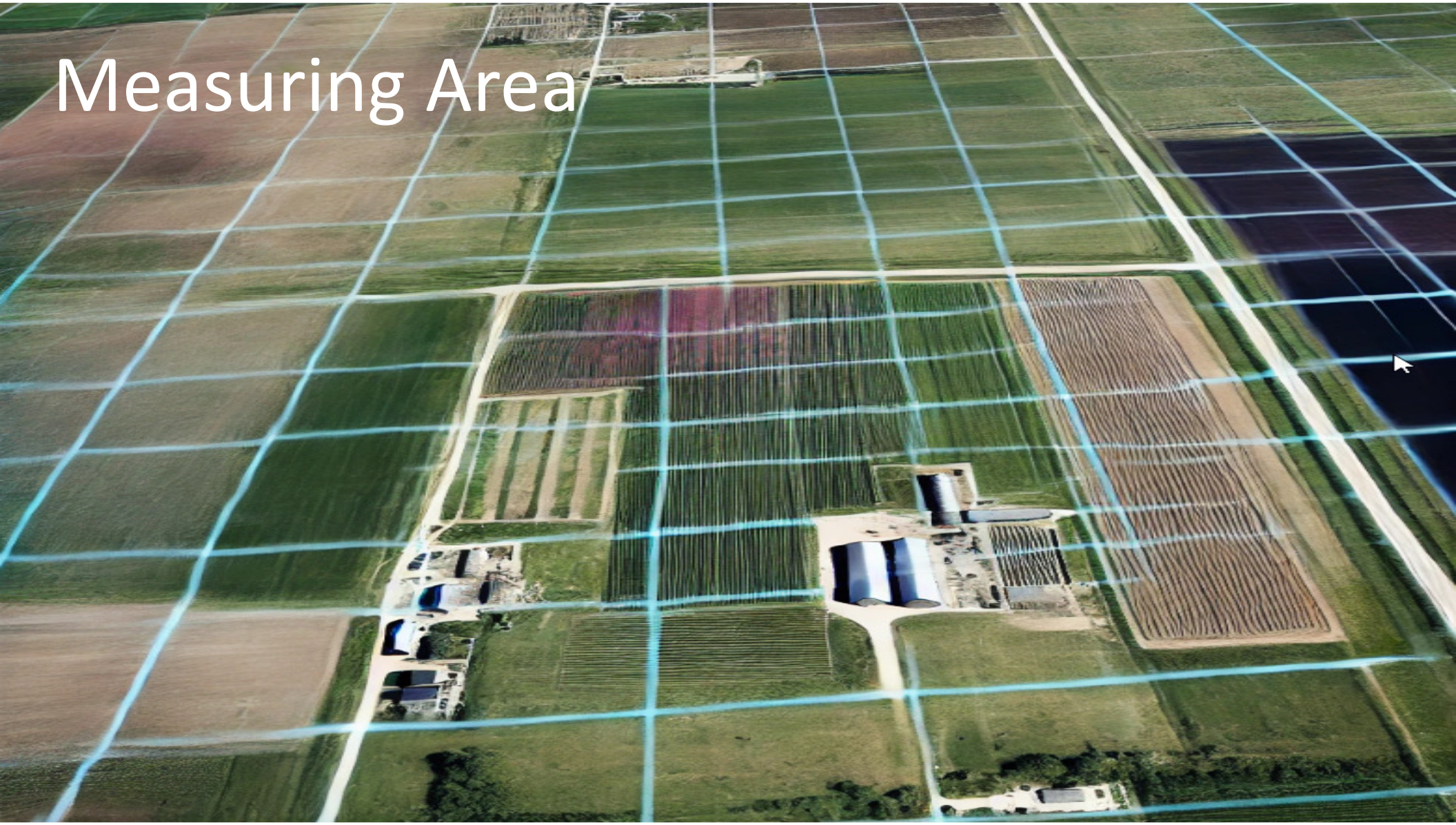
The furlong as a standard – the math is easy!

- 1 furlong = 10 chains
- 1 chain = 100 links
- ¼ chain = 25 links = 1 pole = 1 rod = 1 perch

For feet and inches – not so easy!

- 1 chain = 66 feet
- 1 link = 7.92 inches

Measuring Area



Understanding the Furlong Standard

The furlong as a standard – the math is easy!

- 1 furlong X 1 furlong = 10 acres
- 1 acre = 160 squared poles

“Perch” can be one pole or one squared pole

- 1 acre = 160 perches
- ¼ acre = 1 rood = 40 perches

Surveying the Land

Land requires surveying

- Acreage is easy to calculate with chains and poles

Famous Surveyors

George Washington
In 1749, at the age of 17, George Washington was appointed as the official surveyor of Culpeper County, Virginia. He was a surveyor well into the 1750's

Thomas Jefferson
His knowledge of land and its use influenced his later roles in government championed the expansion of the United States and commissioned the Lewis and Clark Expedition.

Daniel Boone
Known primarily as an explorer and pioneer. He used his skills to explore and map parts of Kentucky and the Missouri territories, playing a significant role in the westward expansion of the United States.

Andrew Ellicott
Perhaps one of the most famous surveyors of his time, Ellicott surveyed the federal territory which would become the District of Columbia. He trained other significant surveyors, including Meriwether Lewis of the Lewis and Clark Expedition.

Benjamin Banneker
An African American polymath, Banneker was involved in surveying the boundaries of the original District of Columbia in 1791 alongside Major Andrew Ellicott. Banneker was also a self-taught scientist, astronomer, and author of almanacs.

Henry David Thoreau
Although better known for his writings and philosophy. His surveys were conducted primarily around Concord, Massachusetts.

George Everest
Sir George Everest was a British surveyor and geographer for whom Mount Everest is named. He served as Surveyor General of India from 1830 to 1843 and established the meridian arc from the southernmost point of India north to Nepal.

Typical Early Land Survey – “Metes and Bounds”

Typical survey in the 1700’s and 1800’s

State of North Carolina to Alexander Smith, 250 acres, Nov 2, 1784

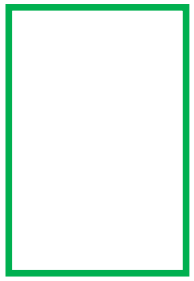
Beginning at a black oak in or near Thomas Hill's line, then north bounded by William Coltrane, 116 poles to a black oak, then west bounded by William Bell 44 poles to a post oak, then north 55° west 210 poles to a post oak, bounded by Burney McDade, then south to Samuel Millikan's corner along his line 117 poles to a black oak, then east 30 poles to a small post oak, then south 110 poles to a stake in Millikan's line, then east to Thomas Hill's line 138 poles to a stake, then north to his corner 50 poles, then east to beginning.

… But Not Always Accurate

Survey were not necessarily accurate

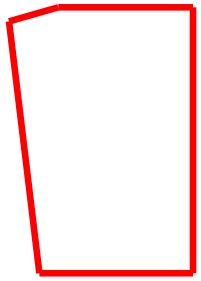
- Description:

  On the Waters of Caraway Beginning at a post oak corner tree to his own Deeded land thence East with said line Ninety-two poles to a post oak on Stephen Alexander's line thence North with said line one hundred & fifty-four poles to a Black on Thomas Hills line thence East thirty-two poles to a Hickory thence South one hundred & fifty-four poles to the place of Beginning, containing 88 acres.



As surveyed

Calculated Size : 86 + 5/8 acres



Actual boundary

Actual Size: ~90 acres

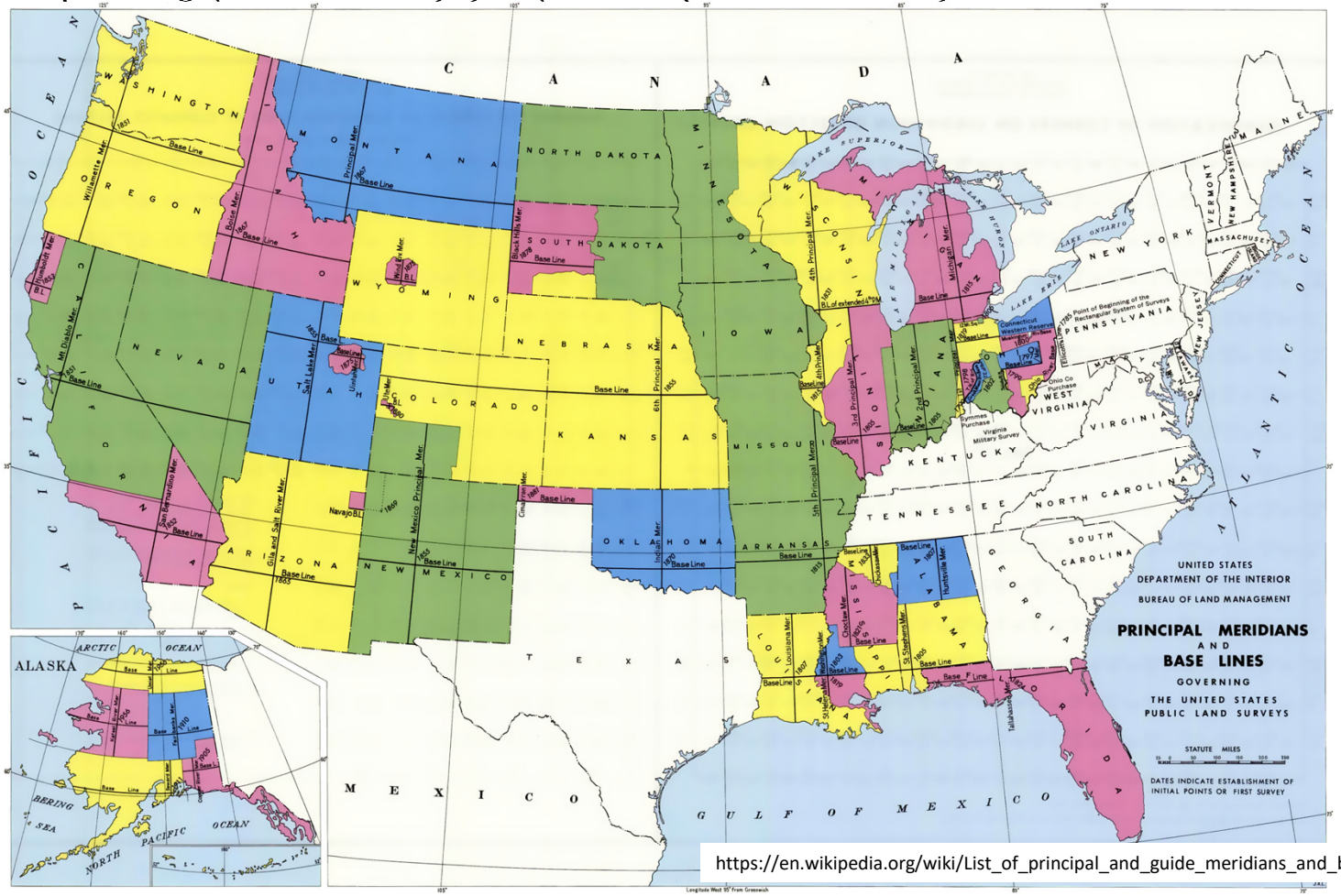
Other Early American Land Measures

Other Systems

- California, before statehood in 1850, was surveyed with the boundaries of Spanish and Mexican land grants (*ranchos*)
- Georgia surveyed its remaining central and western lands into a grid of land lots between 1819 and 1821
- Hawaii adopted a system based on the Kingdom of Hawaii native system in place at the time of annexation.
- Louisiana recognizes early French and Spanish descriptions called *arpents*
- Alabama recognizes Spanish-era land claims, especially near the coast.
- New Mexico retains some older metes and bounds from Spanish and Mexican rule.
- Texas retains some grants made in Spanish Texas
- Wisconsin and Michigan retain some French *Long Lot* plots along the Great Lakes.
- Parts of Washington, Oregon, Idaho and Wyoming were settled as Donation Land Claims.

Townships and Ranges using Meridians

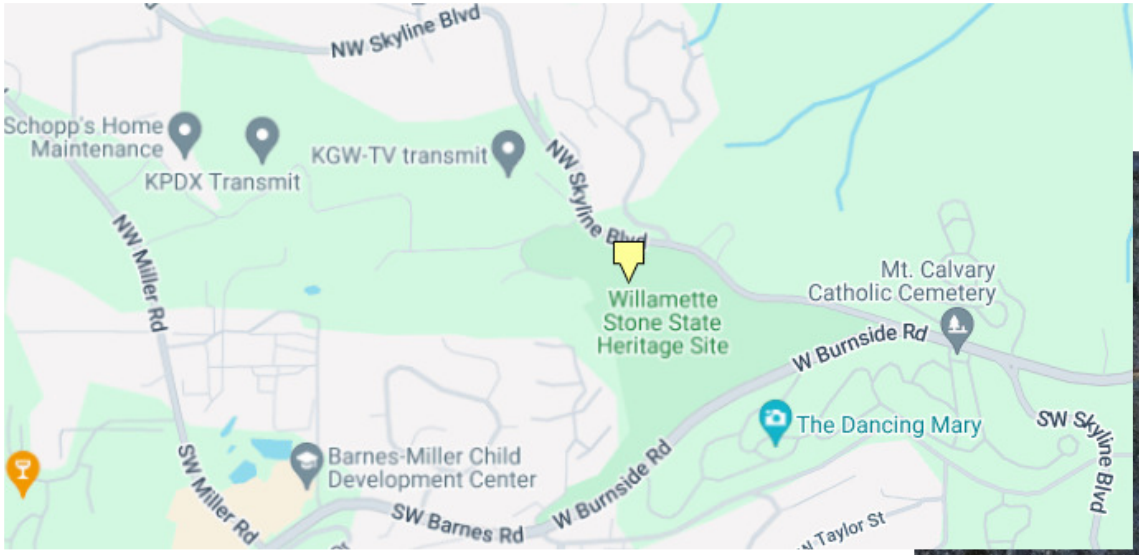
Township and Range (Public Land Survey System) was developed for better accuracy



https://en.wikipedia.org/wiki/List_of_principal_and_guide_meridians_and_base_lines_of_the_United_States

Our Local Basepoint

The Willamette Meridian

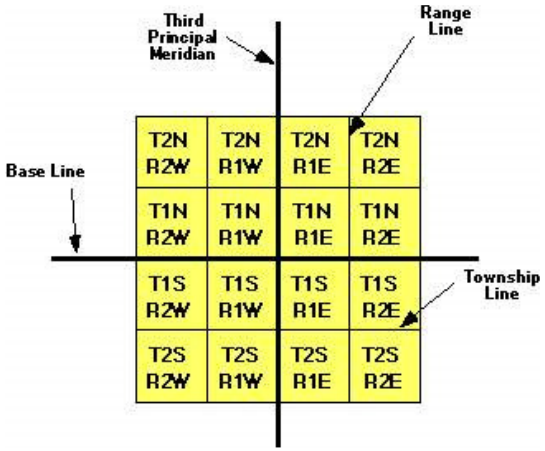


https://clui.org/ludb/site/willamette-meridian-initial-point

What is a Township?

Township and Range (Public Land Survey System) was developed for better accuracy

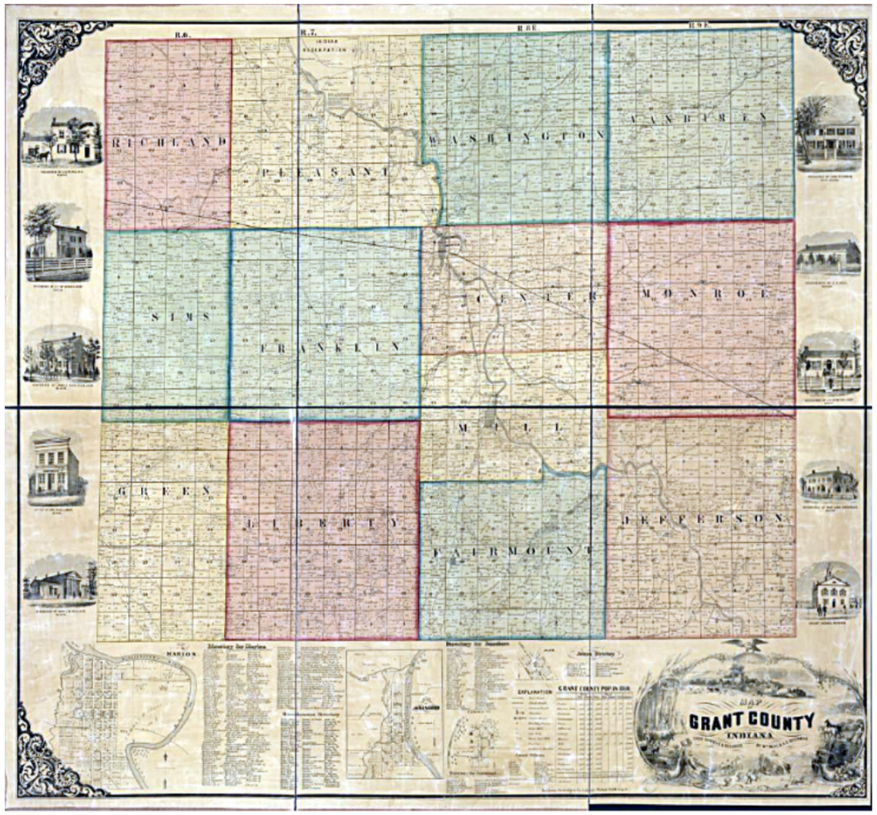
The township standard: not uncommon but not always followed



https://web.gccaz.edu/~lynrw95071/Township%20Range%20Explanation.html

What is a Township?

Named townships are not necessarily perfect squares

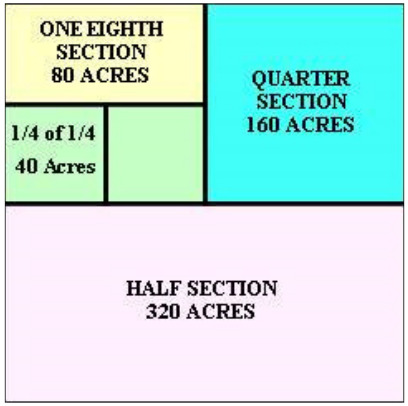


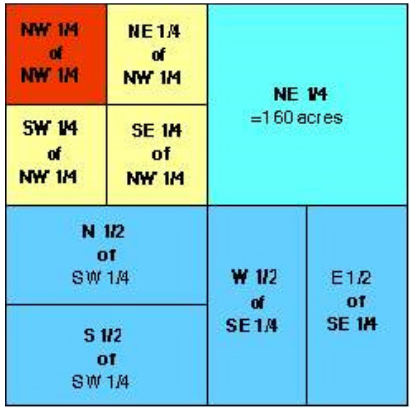
But Township and Range numbers still hold true. Often found on the top of a census page!

Dividing up the Sections

Dividing up the Land

Typical land entry descriptions:





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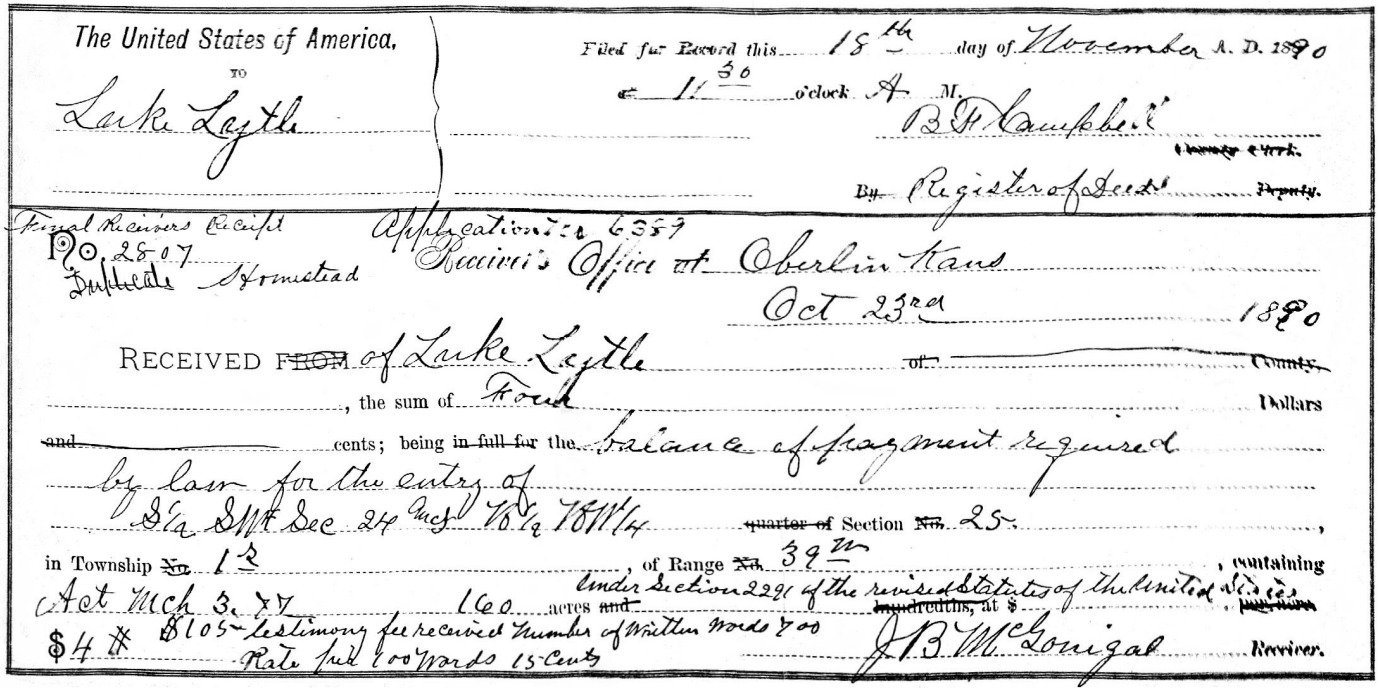
The 1862 Homestead Act

- One of several, including ones before and after
- Allotted 160 acres (one quarter section)
- Several qualifications to earn and keep the land
- Race was not a factor



The United States of America,
To
Lake Leytle

Filed for Record this 18th day of November A. D. 1890
at 11 30 o'clock A. M.
B H Campbell
Register of Deeds
By Deputy.

Final Receiver's Receipt
No. 2807
Duplicate Homestead
Application No. 6359
Receiver's Office at Oberlin Kans
Oct 23rd 1890

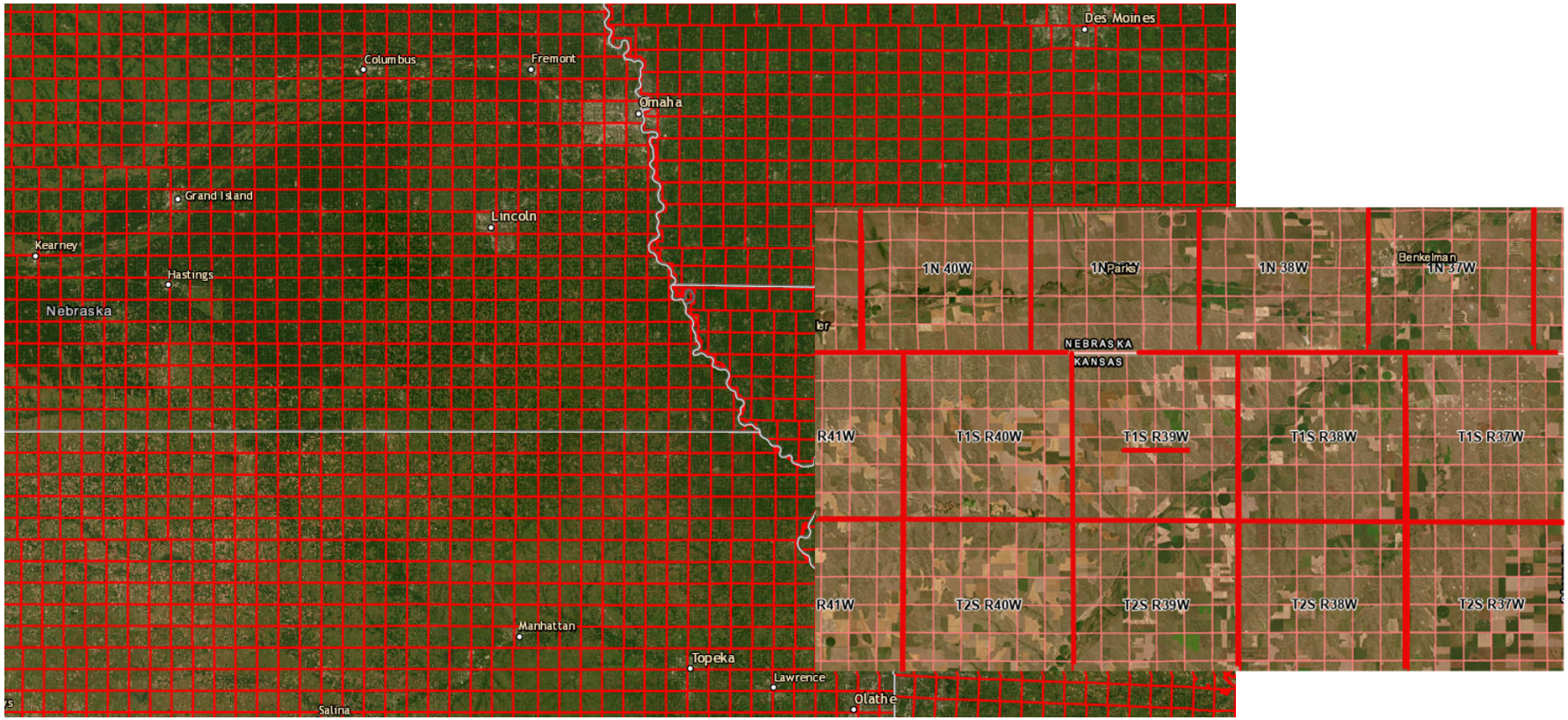
RECEIVED ~~FROM~~ of Lake Leytle of ~~County~~,
the sum of Four Dollars
and ~~cents~~; being ~~in full for~~ the balance of fragment required
by law for the entry of
E½ SW¼ Sec 24 and W½ NW¼ quarter of Section ~~No.~~ 25,
in Township ~~No.~~ 1 S, of Range ~~No.~~ 39 W, containing
160 acres ~~and~~ ~~hundredths~~, at $ ~~per acre~~
under Section 2291 of the revised Statutes of the United States
Act Mch 3. 77
$4 ~~00~~ $1.05 Testimony fee received Number of Written Words 700
Rate fee 100 words 15 Cents
J B McDougal Receiver.

See also: https://en.wikipedia.org/wiki/Homestead_Acts

Finding The Family Farm

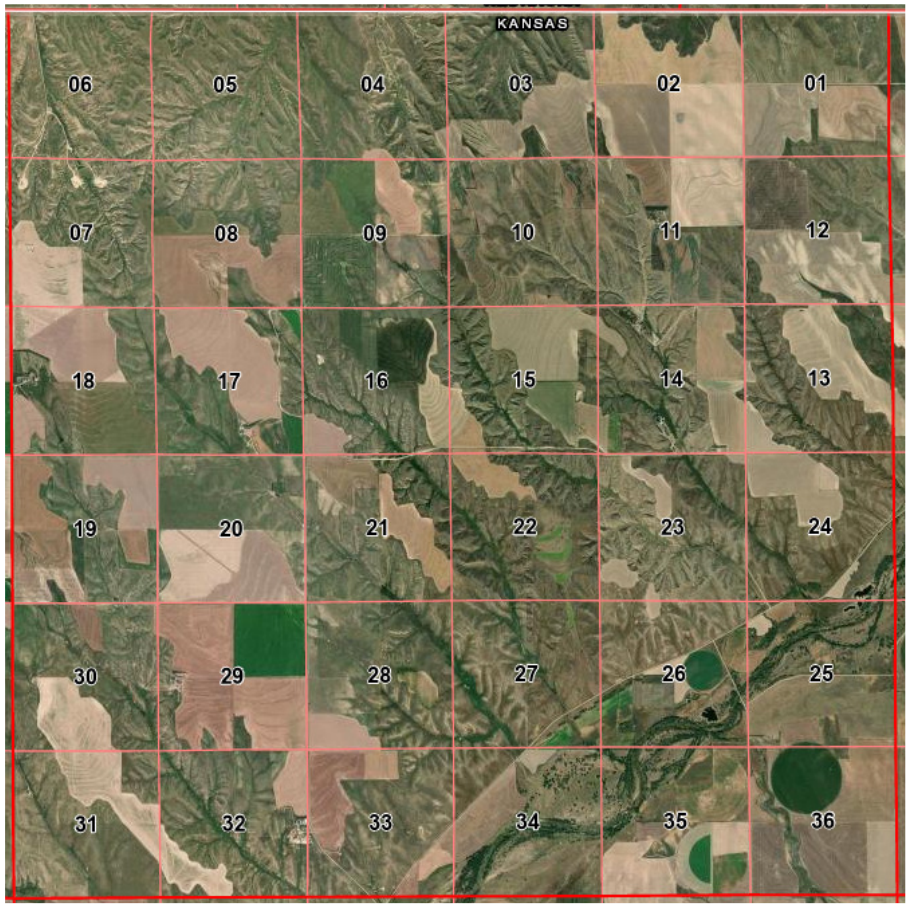
Finding Land by Township and Range

- https://www.arcgis.com/apps/View/index.html?appid=019dd6f39fda4d3b811abfab0878b63b



Finding The Family Farm

Finding Land by Township and Range



S ½ SW ¼ of Section 24 and
N ½ NW ¼ of Section 25
160 acres

Rural roads are often on the section lines

How Was it Found?

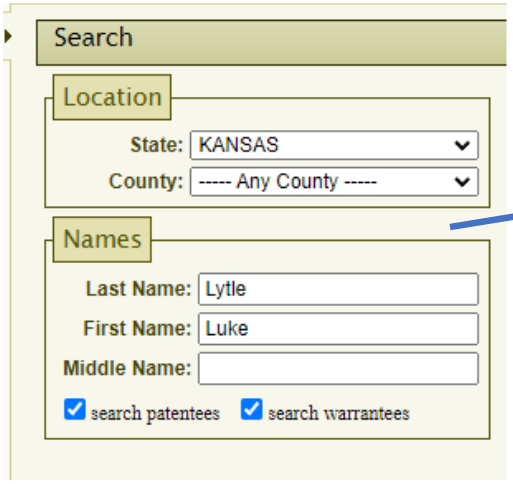
Finding Land Claims by Name

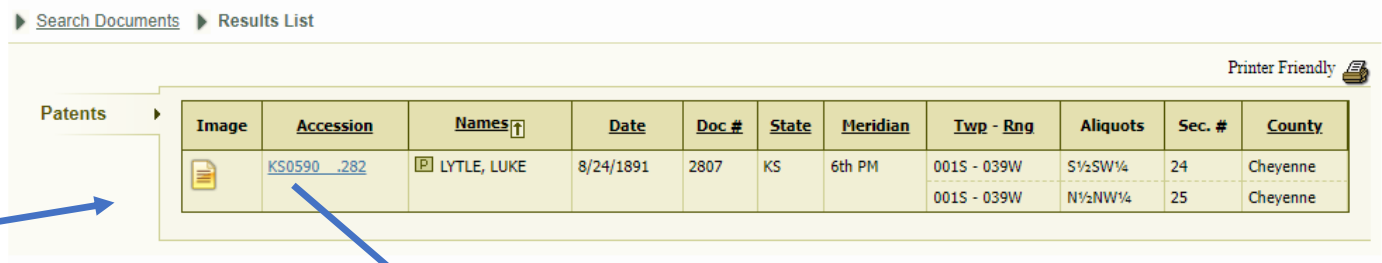
https://glorecords.blm.gov/

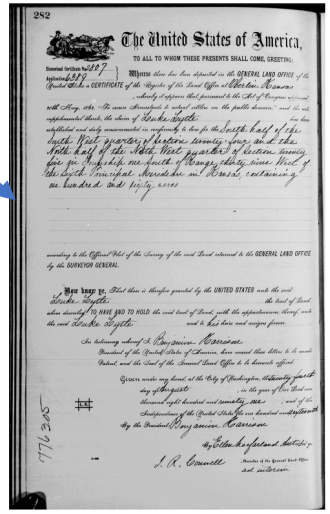
Area (Two Dimensions)

Finding Land Claims by Name

https://glorecords.blm.gov/







Measuring Volume

Volumetric Standards

US Standard is the gallon

- From French measure *galon* and older Latin *galleta,* meaning bucket or pail
- Divisible into 4 quarts, 8 pints, 16 cups, 32 gills, or 128 fluid ounces
- 1 cup = 2 gills, 16 tablespoons or 48 teaspoons

British Imperial System established in 1824

- The *imperial gallon* was defined as 10 lbs. of water
- The British gill is *five* fluid ounces, not *four* (as in the US)
- All larger measurements are 20% larger than US volumes (1 pint = 20 ounces)

Weights

The avoirdupois system

Derived from French: *aveir de peis*: “goods of weight” and common since the 1200’s

- “A pint is a pound, the world around”

  (but no longer in Britain or its (former) territories)
- From the Latin *libra pondo: the weight of a pound*
- From which, the abbreviation: lbs.
- 1 pound = 16 ounces
- 1 ton = 2000 lbs.
- 1 stone = 14 lbs.

The octothorpe can be used *after* a number to indicate lbs.:

50#

Industry, Farming and Agriculture

Bushel: 8 “dry” gallons or ~9.3 fluid gallons

1 Peck = ¼ bushel

In weight 1 bushel is equal to:

- 32 lbs. of oats
- 48 lbs. of barley
- 56 lbs. of shelled corn
- 60 lbs. of wheat
- 60 lbs. of soybeans

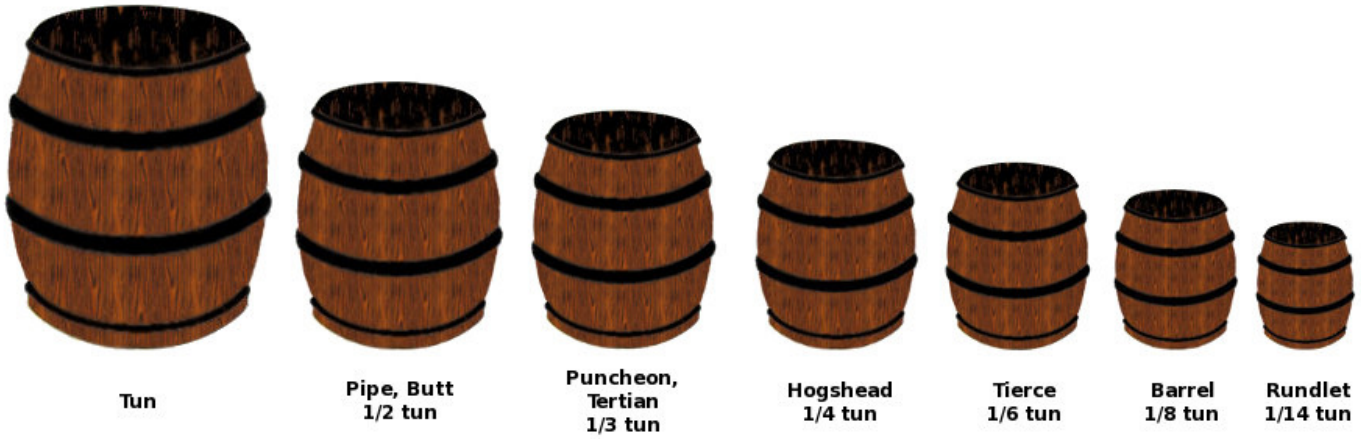
1 cord = 28 cubic feet of cut wood

Industry, Farming and Agriculture

Hogshead: nickname for a large barrel for its resemblance to a hog snout,
but corrupted from “oxhead” in most other Germanic languages.

Volume varies greatly depending on content:

- Tobacco: 145 gallons
- Wine: 63 gallons
- Beer and ale: 54 gallons



Industry, Farming and Agriculture

Wire Gauges

- Large numbers = smaller sizes
- The gauge was the number of reduction operations to reduce a metal bar to the desired size.
- This formula also works:

$$\text{Diameter} = 0.005 \text{ inch} \times 92^{\frac{36 - Gauge}{39}}$$

Wire Gauge Conversion Chart Size listed is AWG (American Wire Gauge)		
Wire Gauge	Inches	Millimeters
10	0.102	2.59
12	0.080	2.03
14	0.064	1.63
16	0.051	1.29
18	0.040	1.02
20	0.032	0.813
22	0.025	0.635
24	0.020	0.508
26	0.016	0.406
28	0.013	0.320
30	0.010	0.254
32	0.008	0.203

Industry, Farming and Agriculture

Before electrical applications, wires wire used for:

- Creating decorative jewelry and ornaments
- Frameworks for sculpting in wax, clay or other materials
- Frameworks for hats, corsets and hoop skirts
- Agricultural fencing and barbed wire
- Binding of bundles, such as wooden planks or hay bales
- Household items such as hangers, clips and handles
- Fishing hooks and related gear
- Musical instrument strings, including certain pianos, harpsichords, guitars, etc.

Medicine

Apothecary Measurements

Apothecary ounce (weight) – identical to the troy ounce

1 Dram = 1/8 ounce; also, the weight of a *fluid* dram

1 Minim = 1/60 of a dram, or approximately one drop


Money

Founded in Precious Metals

Precious metals are measure in *troy* weight

1 troy ounce is approximately 10% larger than the avoirdupois ounce

1 troy ounce = 20 pennyweights = 24 carats

1 pennyweight = 24 grains

But: 1 troy pound = 12 troy ounces, making in lighter than the avoirdupois pound

The British pound (£) was established as 1 troy pound of *sterling* silver.

Sterling is standardized as 92.5% pure (a ratio of $\frac{37}{40}$)

The pound was divisible into 20 shillings and the shilling divisible by 12 “pence” (pennies)

British Money

Some other monetary terms in the British system:

- Pence – the plural of penny
- Farthing – ¼ penny
- Ha'penny – ½ penny
- Tuppence – 2 pence
- Thruppence – 3 pence
- Groat – 4 pence
- Florin – 2 shillings
- Crown – 5 shillings (1/4 pound)
- Guinea – varied by the price of gold vs. silver, then standardized at 21 shillings

  Retained today as £1.05 at racetracks

The British pound was converted to 100 pence in 1971.

Colonial Money

£/s/d – pounds, shillings, and pence

- From the terms libras, shillings, and denarius (a Roman coin)
- Seen colonial records
  - 20£/6s/4d (20 pounds, 6 shillings, 4 pence)
  - Or sometimes simply 20/6/4

Colonial Money

The United States established its Treasury in 1789 and the dollar as its formal currency in 1792.

Like the Spanish *peso de ocho reales* (weight of 8 royals), it was sometimes cut into eighths.

Each piece was known as a “bit.”

25¢ = “two bits”.

Shave and a haircut: six bits!

Colonial Money

Whether pounds or dollars, numerous governments, banks and businesses issued “scrip” – which had denominations or “good for” values.

Clothing and Apparel

Prior to the Industrial Revolution and mass production there were no standard sizes for:

- Garments (shirts, jackets, dresses, trousers)
- Shoes
- Rings

Measuring Time

How Long is a Year?

Assumed to be $365 + \frac{1}{4}$ in 45 B.C.E.

But much closer to 365.2425 days

$$365 + \frac{1}{4} - \frac{1}{100} + \frac{1}{400}$$

- Discrepancy known as far back as the 8th century
- Spring Equinox delayed by 3 days every 400 years
- The Gregorian Calendar was first adopted in 1582
- Leap years did *not* occur in 1700, 1800, and 1900, but did in 2000
- Changeover resisted by Protestants
- Adopted in Great Britain, its territories and colonies in 1752

  September 2nd was followed by September 14th
- New Year's Day moved from March 25th (Feast of the Annunciation) to January 1st

Consequence of the Calendar Change

- The Julian Calendar was termed “Old Style” and abbreviated as O.S.
- The Gregorian Calendar was termed “New Style” and abbreviated as N.S.
- “Dual dating” is seen in many old documents
- Example: January 15th, 1691/2
- George Washington was born February 11, 1731 O.S.
- Officially changed to February 22, 1732 N.S.
- Re-dating of documents was widespread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