Paddock Design
Fencing
Water Systems

2018 California Cattle Grazing School
FIRST THINGS FIRST

• Paddock design, fencing and stockwater systems (on their own) WILL NOT INCREASE PROFIT!

• If your bulls are infertile, fencing will not fix the problem!

• Fencing will not solve family relationship problems!

• Fencing and stockwater systems CAN help address:
  • Livestock distribution problems
  • Labor costs
  • Ability to rest pastures
CELL DESIGN

Re-designing your ranch with managed grazing principles in mind!
DESIGN FOR WHAT YOU WANT!

BUILD YOUR PLAN IN PHASES!

USE YOUR IMAGINATION!
WILL YOUR INVESTMENT IN INFRASTRUCTURE PAY FOR ITSELF?! 

- What are the benefits of investing in well-designed paddocks and water systems?
  - Forage production
  - Livestock distribution and forage utilization
  - Labor efficiency
  - Better control of livestock

- How do you calculate return on this investment?
  - Simple payback period
  - Cost of fence
  - Gross margin per cow
  - Increase in stocking rate
SIMPLE PAYBACK PERIOD

1 mile portable electric fencing (w/ energizer) – $1,500
Gross margin per cow – $250
Increase stocking rate by 4 cows

Simple Payback Period = 1.5 years

Alternatively, what if fencing reduced labor by 10 hours/month?
Block Design
Block Design
Wagon Wheel Design
12 paddocks radiating out from a cell center
8 paddocks radiating out from a cell center with a water point.
5 acre cell center. TOO BIG!
Cell center perimeter ≈ 5 yards from trough.
4 Paddock Cell Center
Ignore Existing Facilities
Cell center built around existing water trough?

Ignore existing facilities!
HOW MANY CELLS?

- Number of herds
- Size and carrying capacity of the property
- Physical constraints
- Management Constraints

Figure 3. How many cells are in this design?
DESIGN PROCEDURE

• Site the centers
• Sketch in the cell boundaries
• Draw in paddock fences
• Draw in existing fences and facilities
• Make adjustments
DESIGN PROCEDURE – SITE CENTERS
SKETCH CELL BOUNDARIES
DRAW IN PADDock FENCES
DRAW IN EXISTING FENCES
MAKE ADJUSTMENTS
FENCING SYSTEMS

Portable and Permanent
Fencing Options
The effectiveness of any electric fence depends on the ability of that fence to deliver a painful shock to animals that touch it.

- Effective electric fencing systems:
  - Energizer
  - Grounding system
  - Fence design
  - Training the animals
There’s never been a fence in the history of mankind that could keep a hungry animal contained where there is no feed!
ELECTRIC FENCE 101
Learning the Basics of Electric Fencing
BASIC ELECTRICAL TERMS

• AC – Alternating current, mains, 110/220v plug
• DC – Direct current, battery
• Amps – electrical rate of flow  1 amp = 1 volt / 1 ohm
• Ohms – electrical resistance  1 ohm = 1 volt / 1 amp
• Volts – electrical pressure  1 volt = 1 ohm x 1 amp
• Watts – rate of doing the work  1 watt = 1 amp x 1 volt
• Joules – electrical energy (measure of the power of an energizer)
• Output Joules – energy delivered to fence (usually about 1/3 less than stored joules)
• Stored Joules – energy in the energizer
• Load – loss of voltage, anything that draws power from the energizer, measured in ohms

• Short – large energy loss from fence line to the earth (ground). Total short circuit = 0 ohms.

• Leakage – small energy loss from fence (i.e., weeds touching the line, faulty insulator, etc.)

• Low impedance – In effect, the internal resistance of an energizer. Allows maximum energy to be transferred to the fence.
HOW AN ELECTRIC FENCE WORKS

1. Energizer generates high voltage pulses
2. Animal touches live wire
3. Animal receives painful shock by completing the electrical circuit back to the energizer via the earth (ground) system

Whole process takes about 0.3 milliseconds!
FENCE ENERGIZER

- Regulates the flow of electricity
- Electrons are stored and the released in a pulse
- Good energizer will have a pulse lasting for .0003 seconds
- Low impedance energizers resist leakage of current
- Power source can be AC or DC
- Overcome loads – fence network itself and animals or vegetation touching the fence
<table>
<thead>
<tr>
<th>Minimum Recommended Joule Rating</th>
<th>Miles of electrified wire</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
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# Energizer Performance

<table>
<thead>
<tr>
<th>Model</th>
<th>1000</th>
<th>36000RS</th>
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<tbody>
<tr>
<td>Output</td>
<td>1J</td>
<td>36J</td>
</tr>
<tr>
<td>Size</td>
<td>Small-Range</td>
<td>Large-Range</td>
</tr>
<tr>
<td>Range</td>
<td>40 acres</td>
<td>2,500 acres</td>
</tr>
<tr>
<td>Open Circuit</td>
<td>9,800V</td>
<td>9,500V</td>
</tr>
<tr>
<td>1000 ohm load</td>
<td>7,000V</td>
<td>8,800V</td>
</tr>
<tr>
<td>500 ohm load</td>
<td>5,300V</td>
<td>8,500V</td>
</tr>
<tr>
<td>100 ohm load</td>
<td>1,800V</td>
<td>8,000V</td>
</tr>
</tbody>
</table>

**NOTE:** Both energizers will produce over 8,000 volts. The difference is the amount of load (resistance) that each energizer can overcome. A larger energizer produces more energy to overcome bigger loads.

* An electric fence is like a water pump *(energizer)* and a pipe *(fence wire)* with water *(voltage)* flowing through it!
VOLTMETERS
GROUNDING

Figure 1A.
Soil Ground Return

Figure 1B.
Wire Ground Return
GROUNDING

Ground rods:
- Located in moist soil
- six feet long
- spaced 10 feet apart
- Connected with 12 1/2 gauge insulated wire
- Attached with ground rod clamps

Additional ground rods connected to ground wire every 1500'
POWER UNDER GATES

Always use 2.5mm cable /more conductive than 1.6
• Reduces ground system requirements to 1 ground rod
• Excellent control in even poor / dry soil conditions
• 100% delivery – all available energy goes into shocking animal
• No neutral wires – animal always shocked *(5kV one wire / 10kV two wires)*
• Delivers the **SAME** shock in the worst soil conditions that would be available in the best soil conditions with conventional grounding
FENCE MATERIALS

• Hi-Tensile Wire (galvanized) – 12.5 and 16 gauge – larger the diameter, less resistance and better carrying capacity
• Hi-Tensile Fixed Wire
• Polywire
• Polytape
• Polyrope
• Netting
HI-TENSILE WIRE
HI-TENSILE WIRE
• Post Type – Wood, Metal Pipe
• Wire Type – 12.5 ga. high tensile
• Use on corners and along line – line braces should be no more than 1320 ft apart
QUICK T POST BRACE
QUICK T POST BRACE
QUICK T POST BRACE
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QUICK T POST BRACE
US FOREST SERVICE BRACE

- Posts braced at ends and corners, sunk 2 1/2 to 3 feet
- Fiberglass stay
- Tension wire between post and brace
PERMANENT FENCES

- Perimeter, boundary
- Lasts 30-40 years
- Typically steel wire
- Short or long distance
- 2-7 wires depending on livestock/predator type
- Corner braces – wood or metal pipe
- Line – t-posts, rod, wood
- Renovate existing conventional fences with offsets/extenders
• Line Post – Wood, Metal Pipe, T-Post
• 15’ – 30’ between posts – depending on terrain, number of turns in fence line, or use of stays/droppers
• Smaller spacings for smaller animals
TEMPORARY FENCES FOR CATTLE

• Divide pasture/paddock
• Portable
• Poly – wire, tape, etc.
• Short distances
• 1-3 wires
• Pigtail / plastic tread-ins
• Rotational grazing, protect hay bales, graze wheat fields / corn stalks, riparian pastures
• Quick & easy to build
POLYTAPE AND WIRE
ELECTRO-NETTING
STOCKWATER SYSTEMS

Improving Utilization and Distribution through Stockwater Development
PUMPING WATER
NOSE PUMP
WATER PUMP AND TROUGH
WATER LOCATION

• Cattle can travel 1.5 – 2 miles in gentle terrain and 1 mile in steep terrain to water with minimal stress.
• When distances to water are over 1000 feet, the forage utilization will not be evenly distributed.
• Less than 1000 feet to a water point will result in animals watering individually.
• The greater the distance past 1000 feet, the tendency will be for the whole herd to water.
## WATER QUANTITY

<table>
<thead>
<tr>
<th>Cattle Wt</th>
<th>40°F</th>
<th>50°F</th>
<th>60°F</th>
<th>70°F</th>
<th>80°F</th>
<th>90°F</th>
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<tbody>
<tr>
<td><strong>LACTATING COWS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>900-1200 LBS</td>
<td>11.4 g/day</td>
<td>12.6 g/day</td>
<td>14.5 g/day</td>
<td>16.9 g/day</td>
<td>17.9 g/day</td>
<td>18.2 g/day</td>
</tr>
<tr>
<td>1100 LBS</td>
<td>6.0 g/day</td>
<td>6.5 g/day</td>
<td>7.4 g/day</td>
<td>8.7 g/day</td>
<td>9.1 g/day</td>
<td>9.3 g/day</td>
</tr>
<tr>
<td><strong>DRY COWS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1600+ LBS</td>
<td>8.7 g/day</td>
<td>9.4 g/day</td>
<td>10.8 g/day</td>
<td>12.6 g/day</td>
<td>14.5 g/day</td>
<td>20.6 g/day</td>
</tr>
<tr>
<td><strong>MATURE BULLS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 LBS</td>
<td>4.0 g/day</td>
<td>4.3 g/day</td>
<td>5.0 g/day</td>
<td>5.8 g/day</td>
<td>6.7 g/day</td>
<td>9.5 g/day</td>
</tr>
<tr>
<td>600 LBS</td>
<td>5.3 g/day</td>
<td>5.8 g/day</td>
<td>6.6 g/day</td>
<td>7.8 g/day</td>
<td>8.9 g/day</td>
<td>12.7 g/day</td>
</tr>
<tr>
<td>800 LBS</td>
<td>7.3 g/day</td>
<td>7.9 g/day</td>
<td>9.1 g/day</td>
<td>10.7 g/day</td>
<td>12.3 g/day</td>
<td>17.4 g/day</td>
</tr>
</tbody>
</table>

- Source: 1996 NRC Nutrient Requirements of Beef Cattle
- Water intake is a function of dry matter intake and ambient temperature. Water intake is constant up to 40°F.
DESIGN CONSIDERATIONS

• Storage capacity
  • In trough
  • Additional tank or storage

• Recharge rate – how fast will the trough refill?

• Space – how many animals are likely to drink at the same time
  • Can be managed by distance between troughs
  • Provide 27-39” of trough space per head expected to drink at one time.
  • Round troughs provide more storage, rectangular troughs provide more drinking space.
WATER STORAGE

Polyethylene tank mounted on a truck with attached trough

Water stored in steel grain bin rings above trough in field
WATER QUALITY

• Potential Problems
  • High concentration of minerals
  • High concentration of nitrogen
  • Bacterial contamination
  • Algal growth
  • Toxic chemical spills
WATER TROUGHES