Livestock GPS collars for $40 – Development of an open-hardware location tracker

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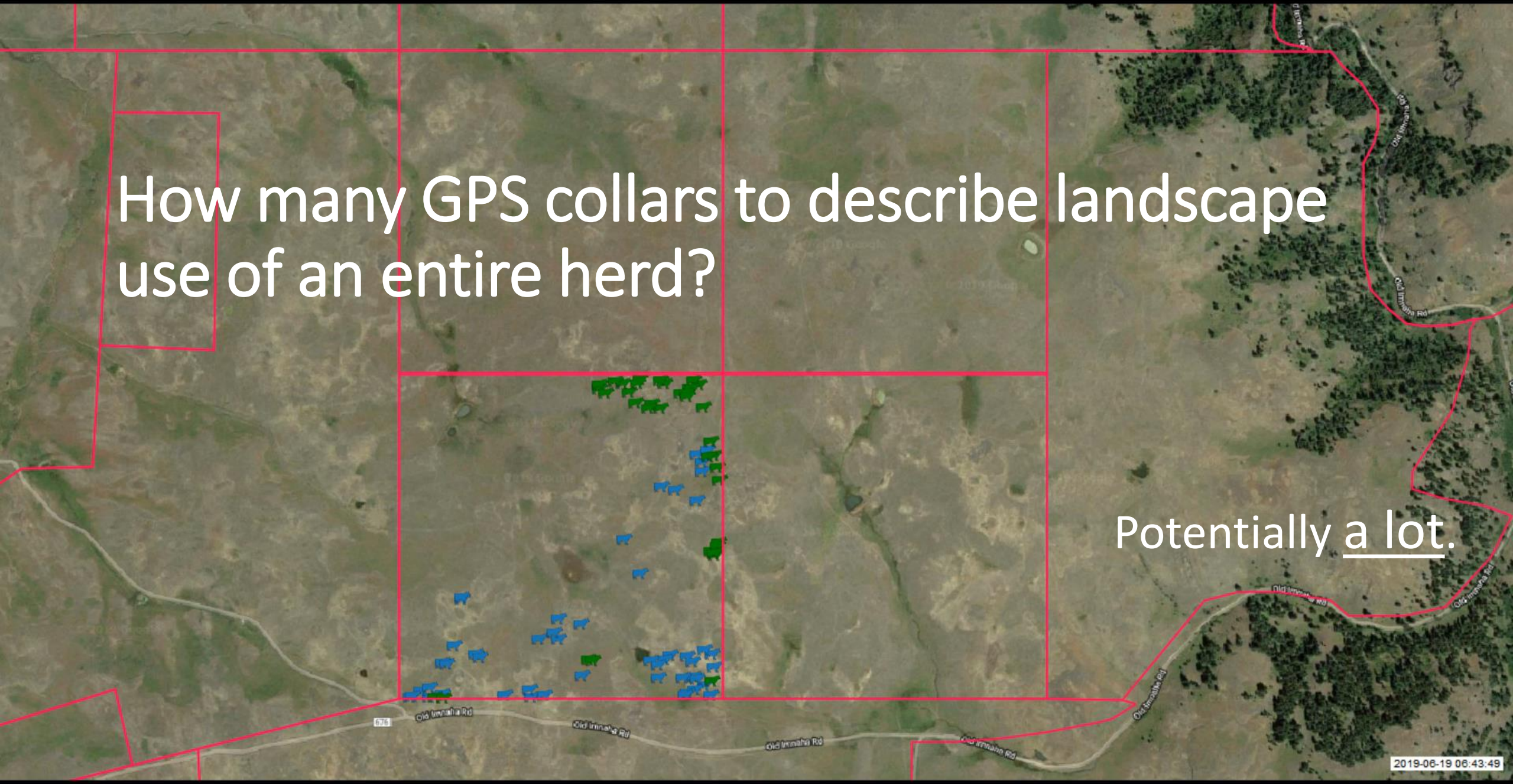
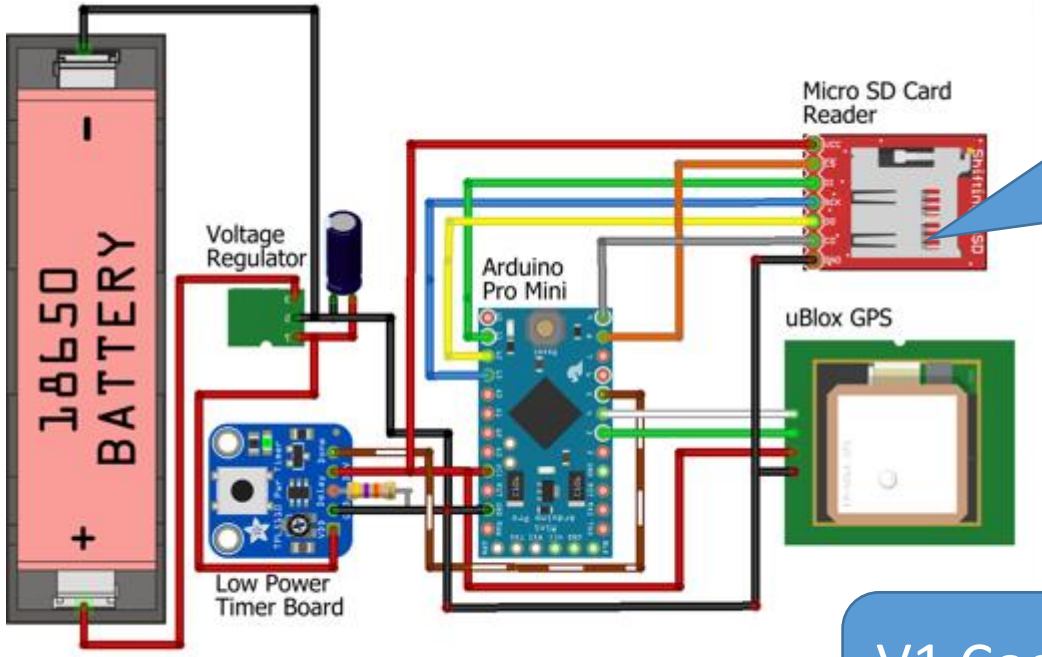

How many GPS collars to describe landscape use of an entire herd?
Potentially a lot.
Old Immaha Rd
676
2019-06-19 06:43:49

How low (cost) can we go?

- Commercial GPS collars are expensive
  - $300-$600 each
  - Unnecessary features
- Existing DIY collars still too expensive
  - $150-$200 each
- Open source electronics components are not that expensive
- Should be able to build a GPS collar for **less than $50 each***.

*Original goal

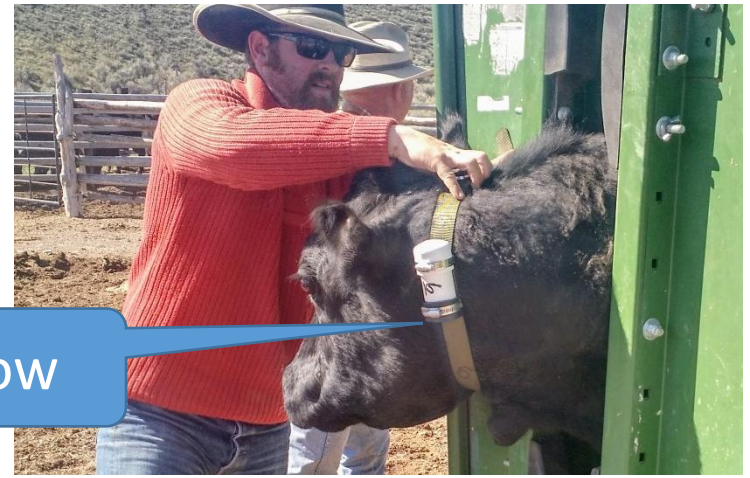
GPS Collar Version 1 (2018)



Consumer Electronics Components

Sophisticated Housing

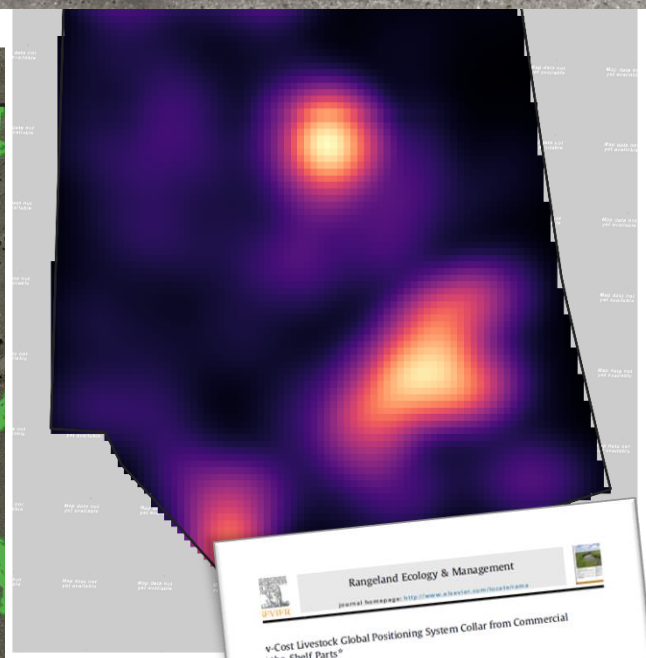
V1 Codename “Robot Turd”



Stylish Cow

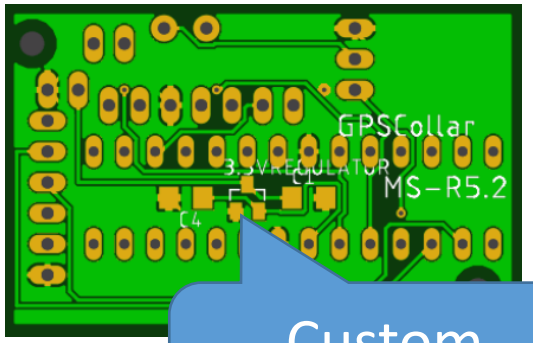
GPS Collar Version 1 (2018)

- Proof of concept (n=25)
  - Cost per unit = $54*
- Mostly successful
  - REM Tech Note
- Problems encountered
  - Battery holder
  - Soldered connections between components
  - $%^@$& Reset buttons!



* Not including labor costs

GPS Collar Version 2 (2019)

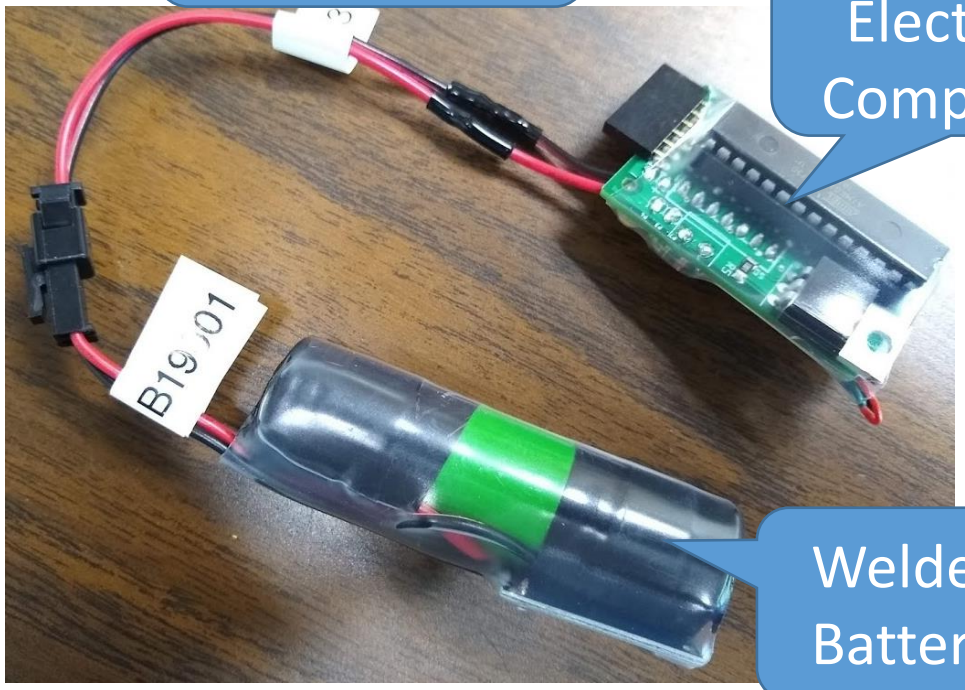


Custom Circuit Boards

Bulk Electronics Components

Red Angus “Land Whale”

Engineering Students



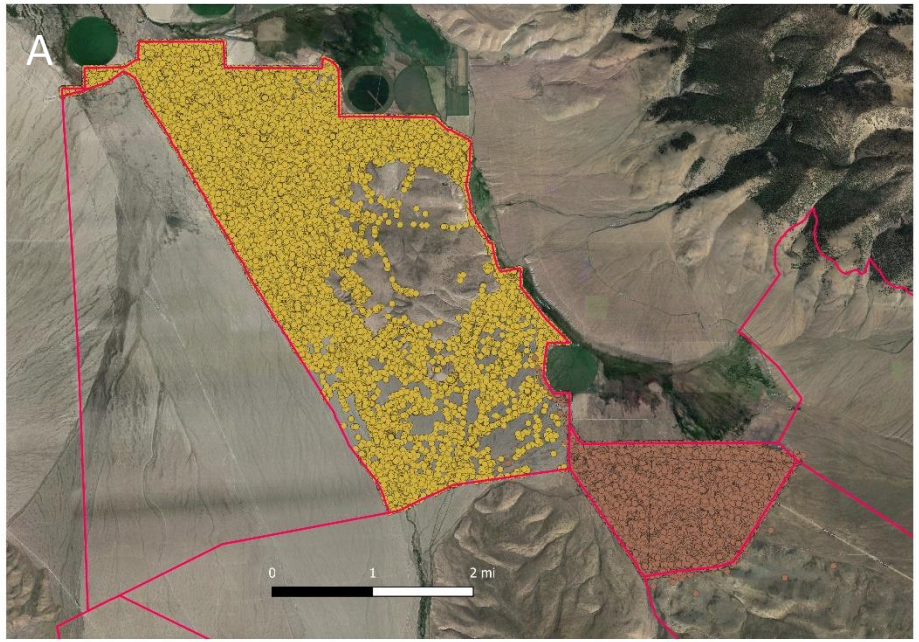
Welded LiPo Battery Pack

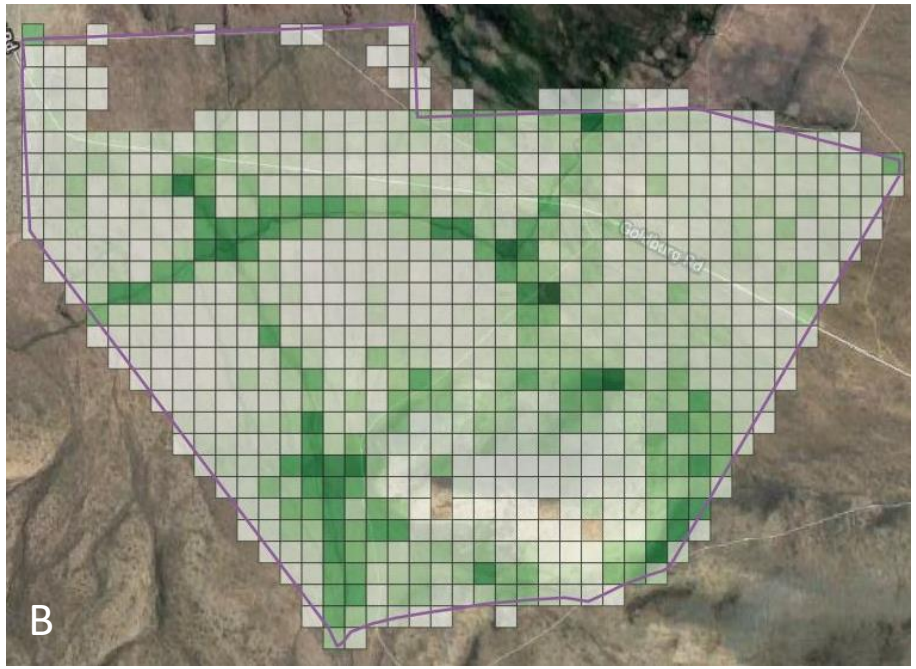
Same Sophisticated Housing

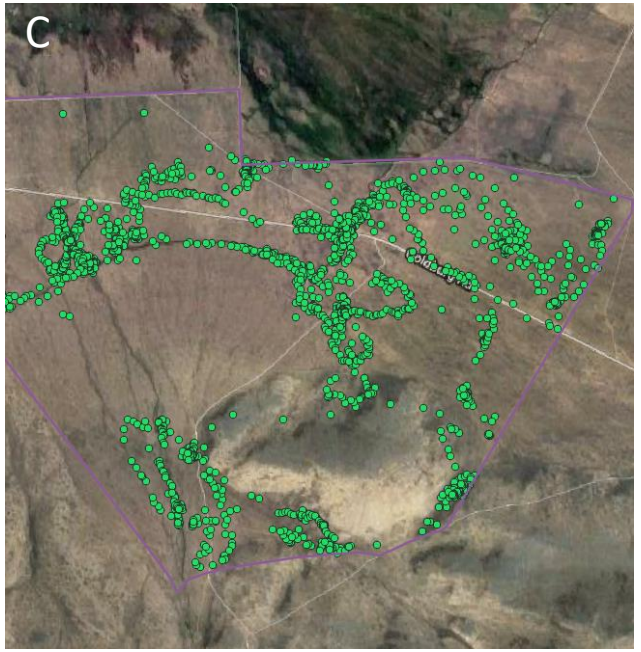
GPS Collar Version 2 (2019)

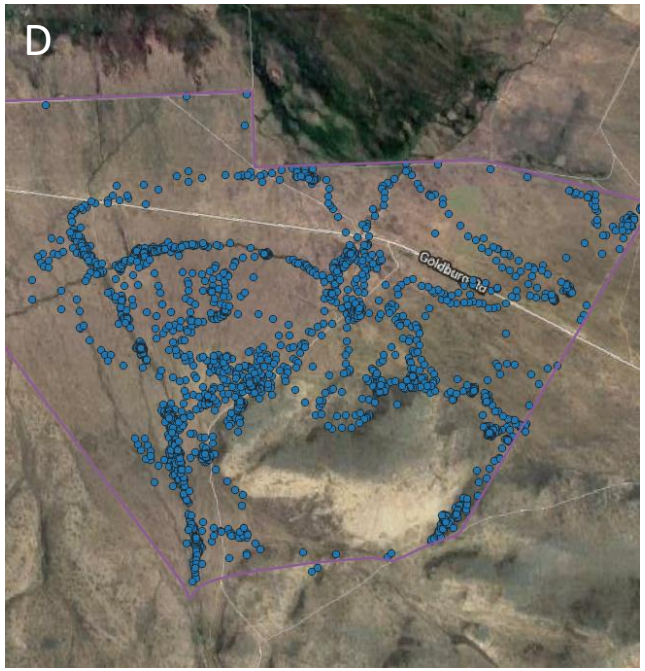
- Measure grazing intensity
  - 3 Study Areas
  - 10-min intervals
  - Average unit life 4 weeks
- n=150
- <u>Cost per unit $38*</u>
- Much more reliable
  - Few problems with soldering/ microcontroller chips

* Not including labor costs

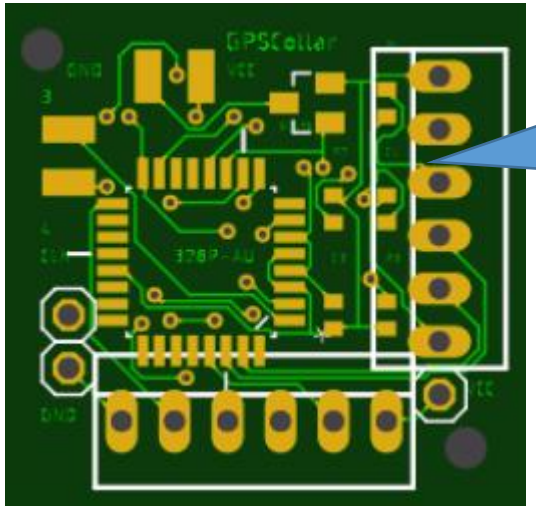








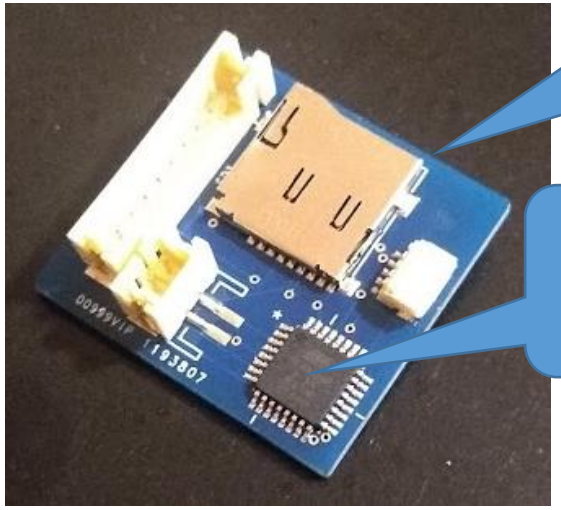
GPS Collar Version 3 (2020)



Custom Circuit Boards

More sophisticated housing (maybe)

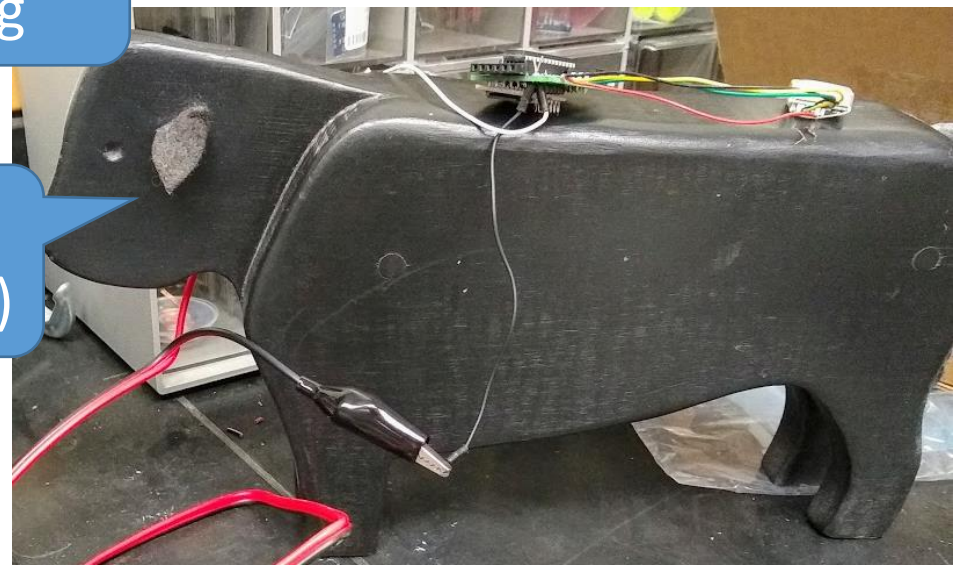
Solar battery charging



Factory Soldering

Surface Mount Parts

Test Steer (no IACUC required)



Labor Costs

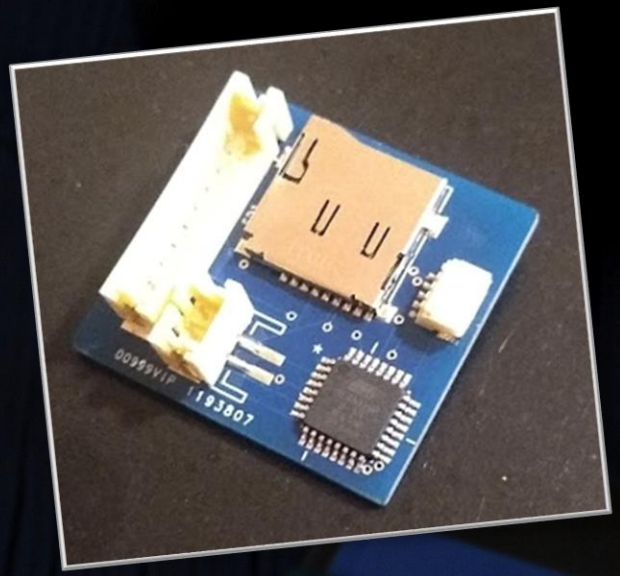
- 2018 (pilot phase)
  - Priceless
- 2019 (V2 Production)
  - Engineering & Range Undergraduate Students
  - Labor cost ~ 270 calories* per unit
- 2020 (V3 Production)
  - SeeedStudios PCB assembly (~$4/unit)
  - Plug/Play assembly (volunteer)

UI Undergraduate Engineering Students working on the assembly line

* Approximately 2/3 piece of meat-lover's pizza

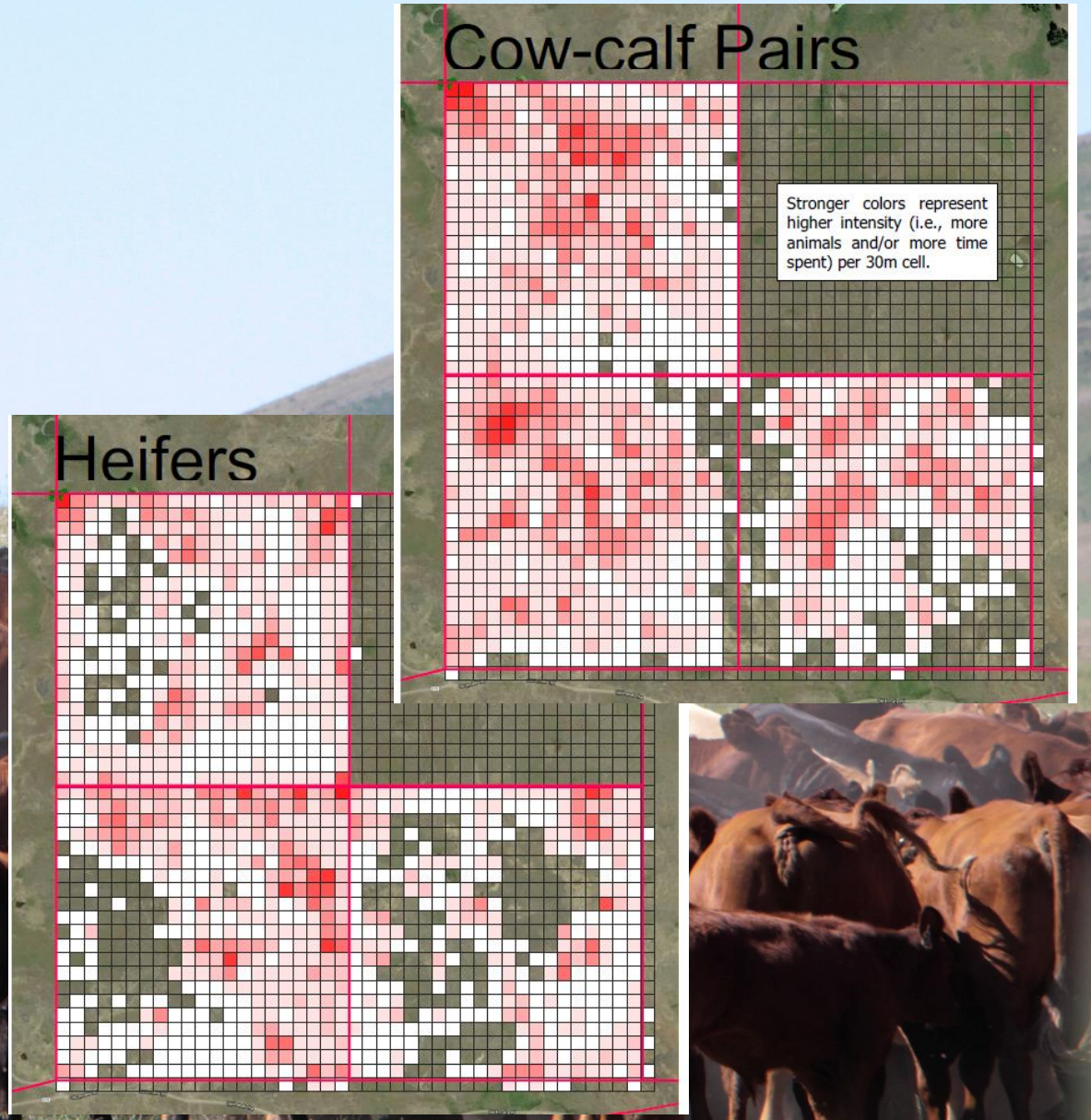
Lessons Learned

- Start with a simple idea
  - Refine
  - Build Complexity
- It’s not as hard as you think
- Maker Movement has led to an explosion of tutorials, how-to’s, documentation
- Many students are looking for opportunities to gain experience



Conclusion

- Inexpensive, reliable GPS Collars are possible
  - Cost continues to decline with quantity
- Allows for much wider implementation of sensors than previously possible
- Ask new questions
- Value in open source projects



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https://github.com/jkarl/COTS_GPS_Collars