

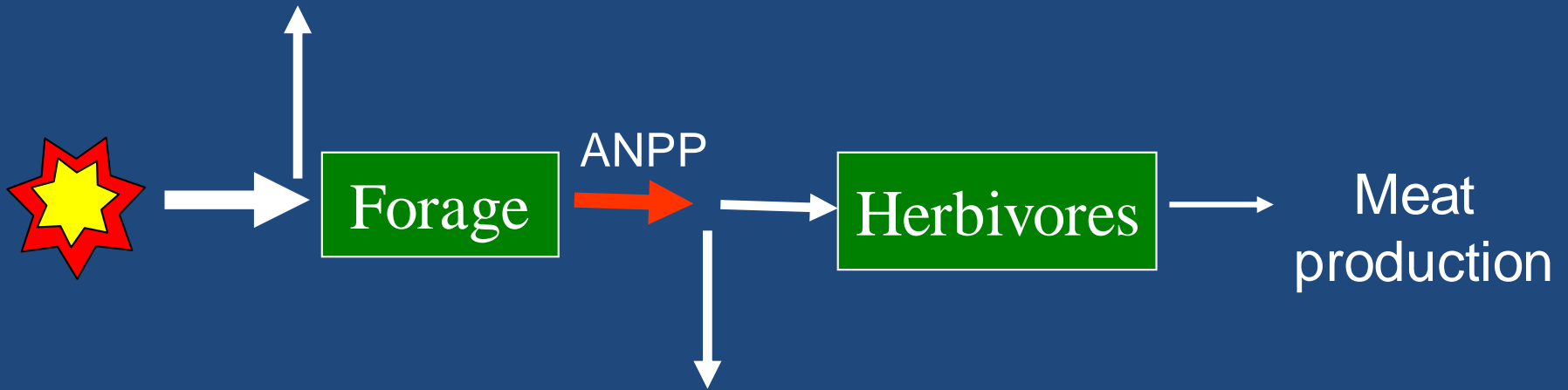
# Monitoring forage production in Argentina

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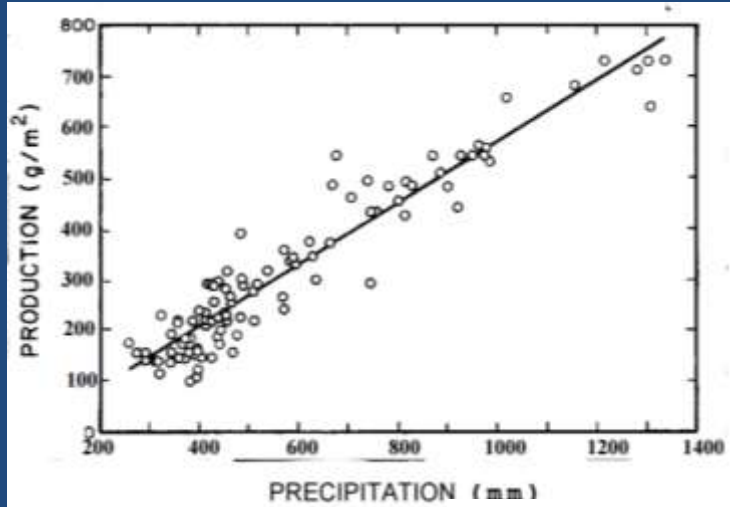
# Energy flux in agroecosystems



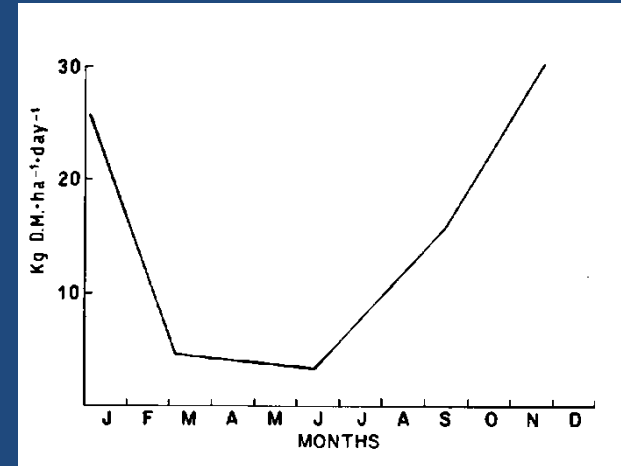
ANPP: Aboveground net primary production

Aboveground biomass

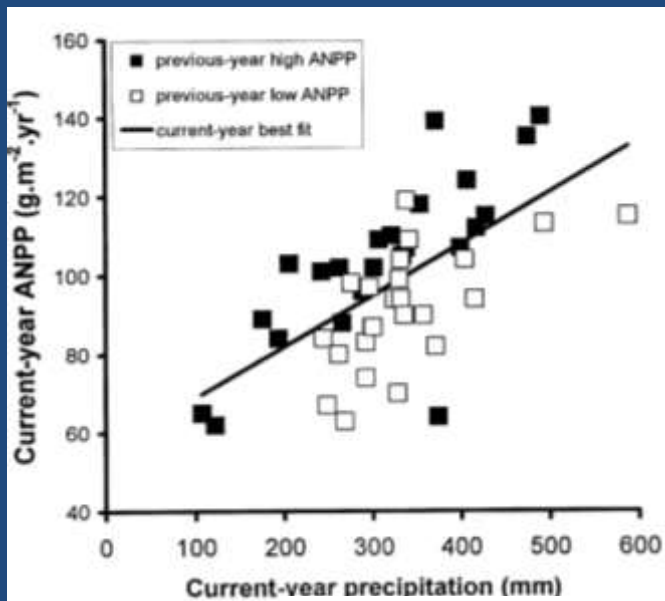
# ANPP varies widely



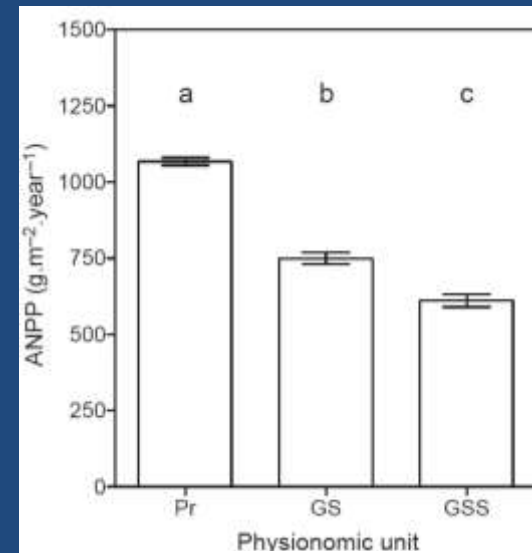
Sala et al. 1988



Sala et al. 1981



Oosterheld et al. 2001



Irisarri et al. 2012

# Problem

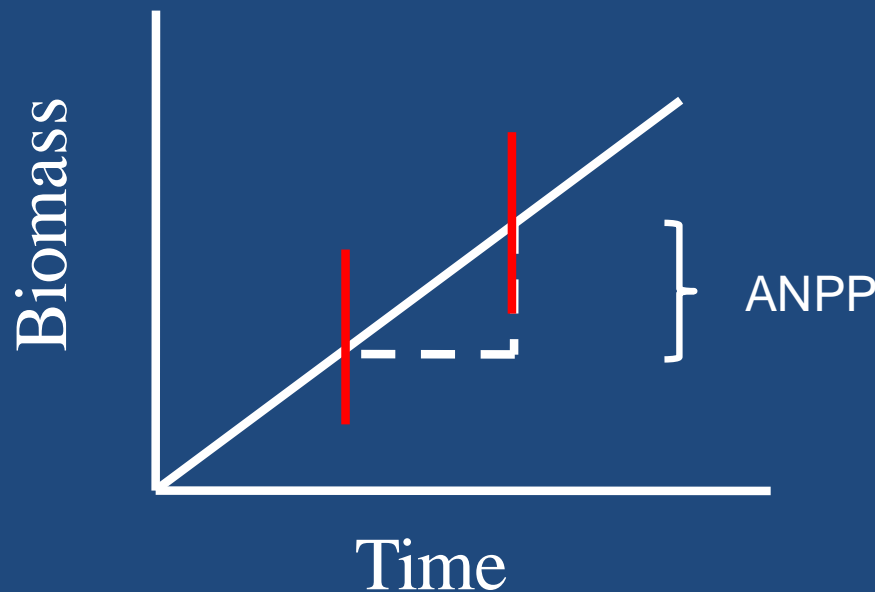
We should to know ANPP variations.  
How can we estimate ANPP?

## Objetives

- To show two experimental approaches to estimate ANPP
- To show some ANPP estimations at regional and paddock level

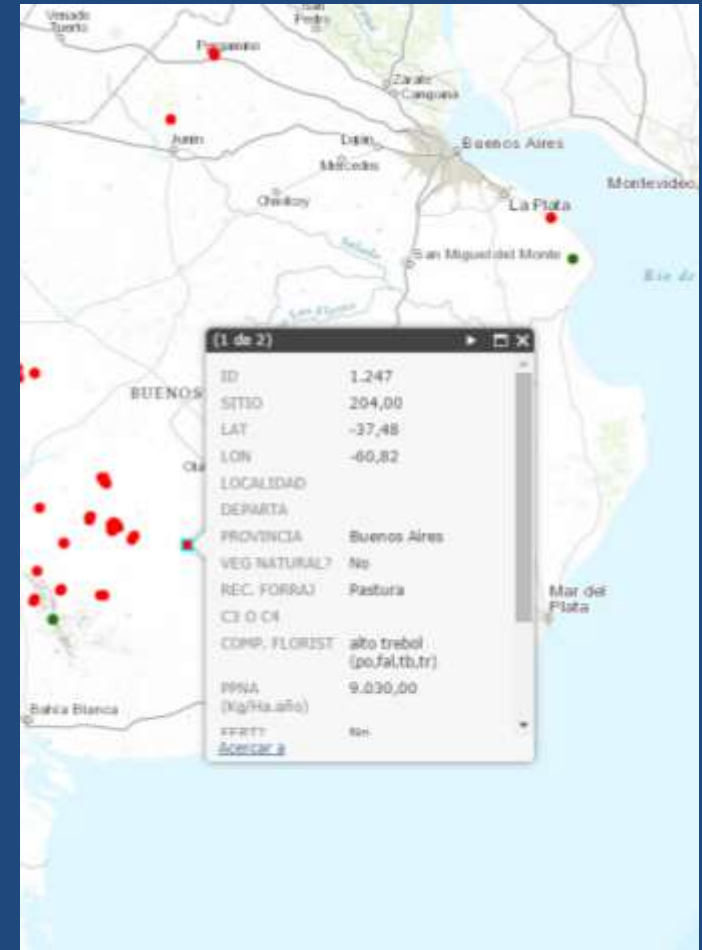
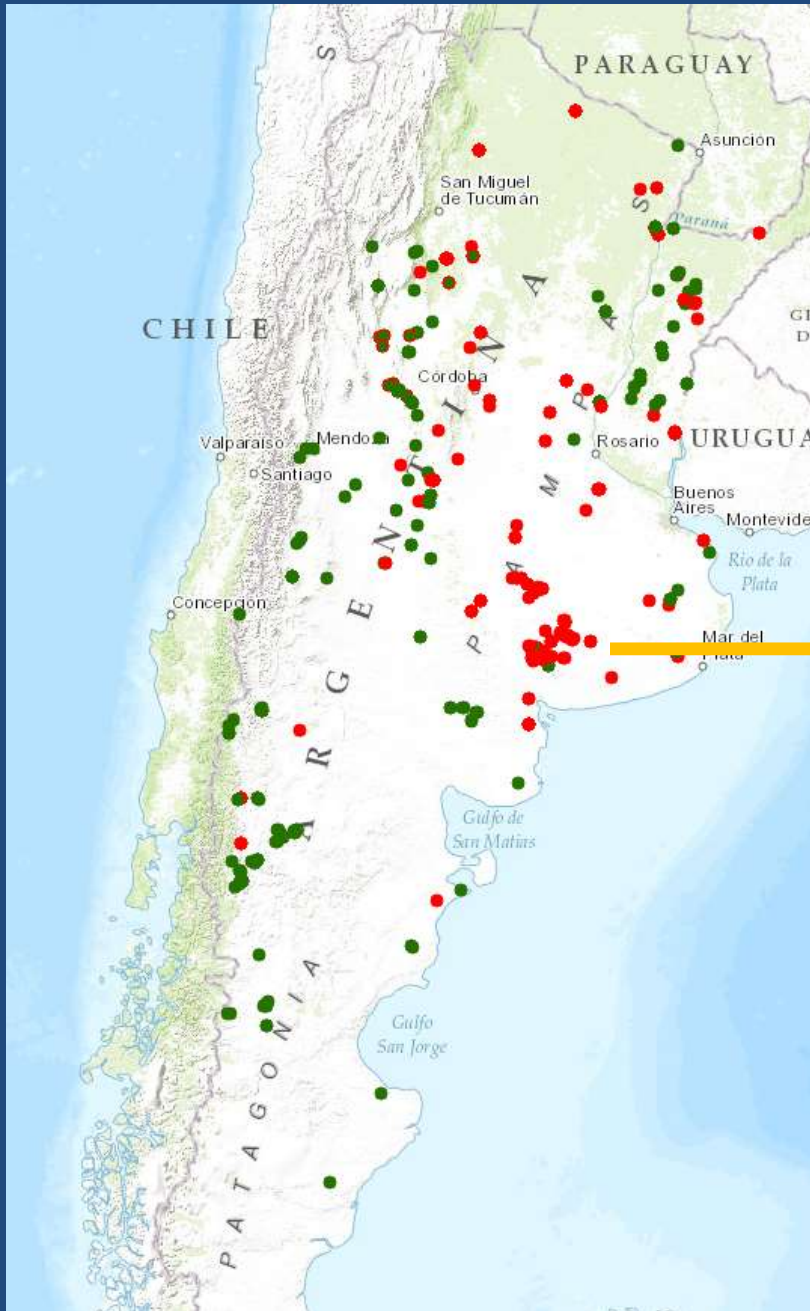
# Approach 1: From biomass to ANPP

$$\text{ANPP} = \text{Biomass}_{t_1} - \text{Biomass}_{t_0}$$



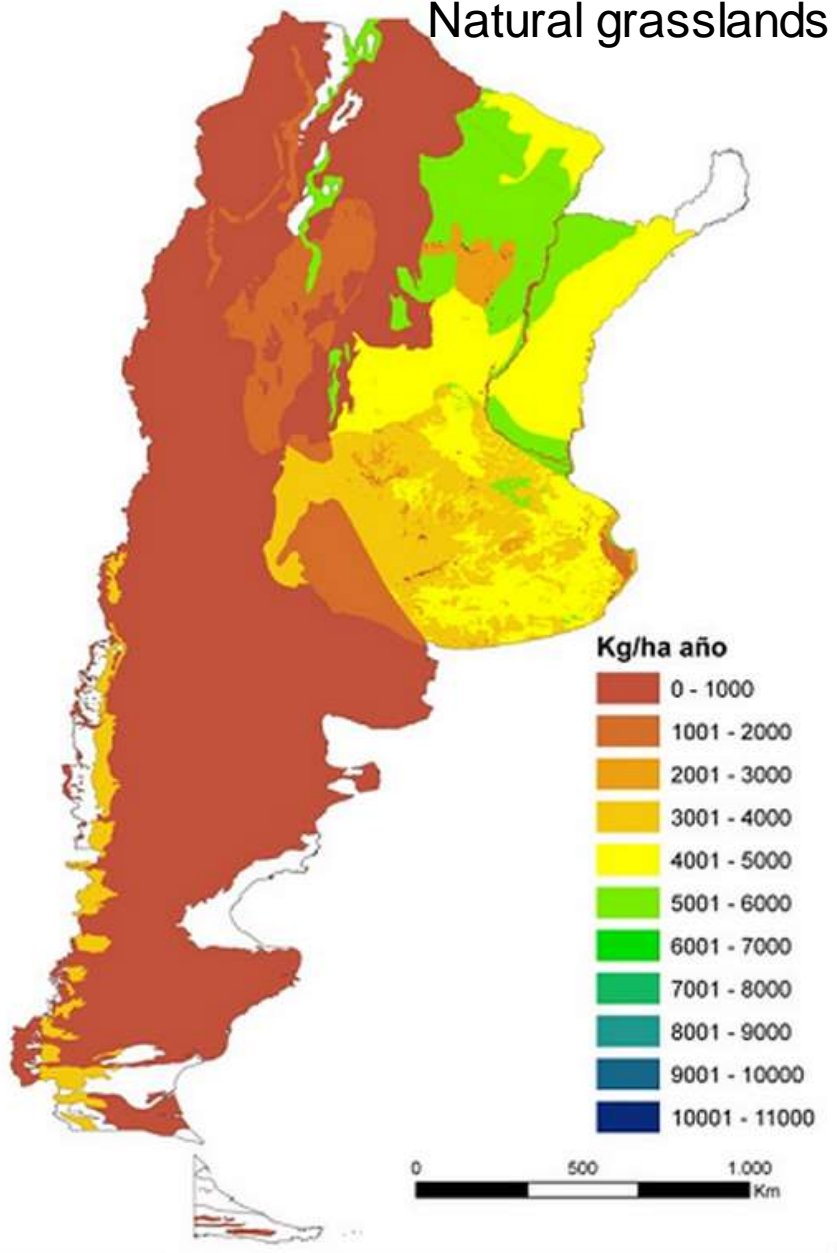
Imprecise  
~~Grazing~~  
~~Senescence~~

# Mean annual ANPP at plot level

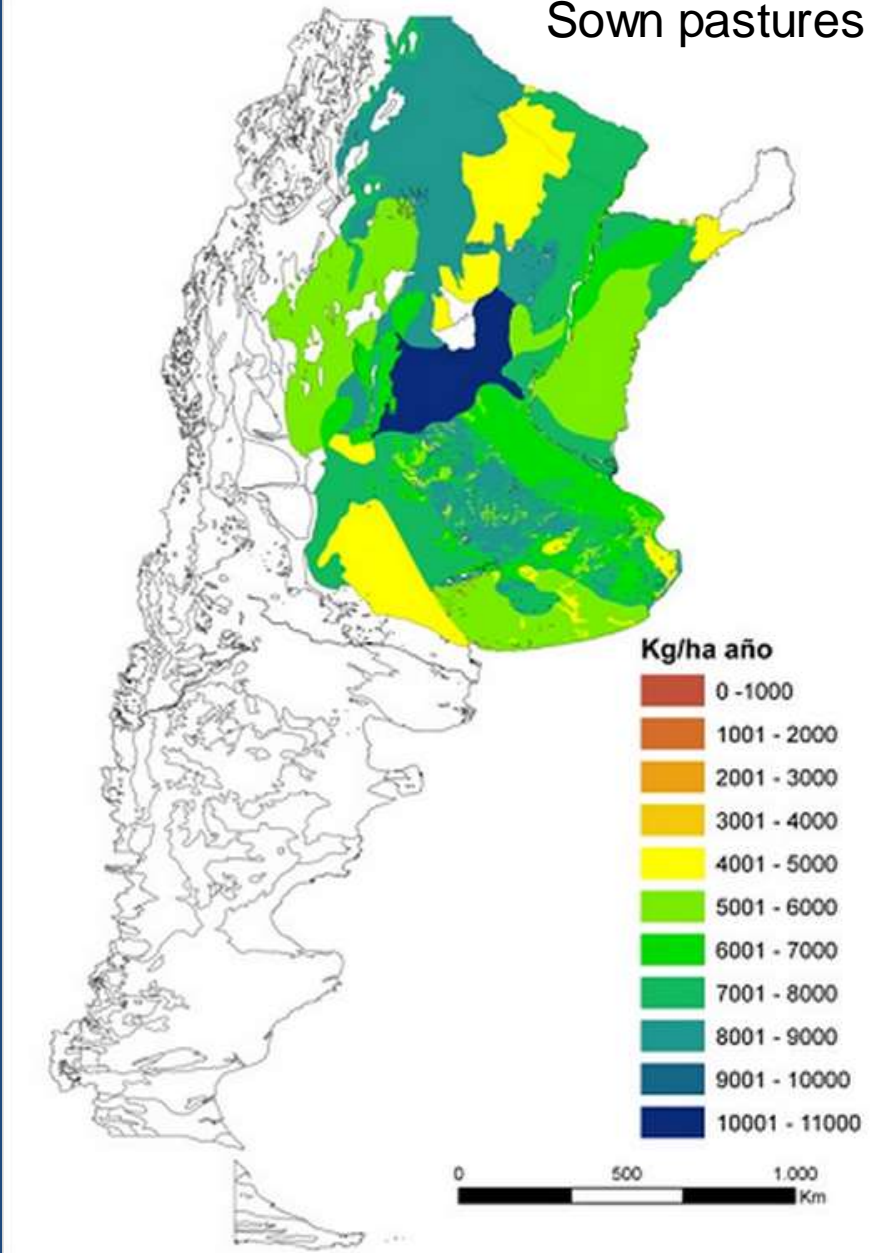


# Mean annual ANPP at plot level extrapolated to vegetation units

### Natural grasslands

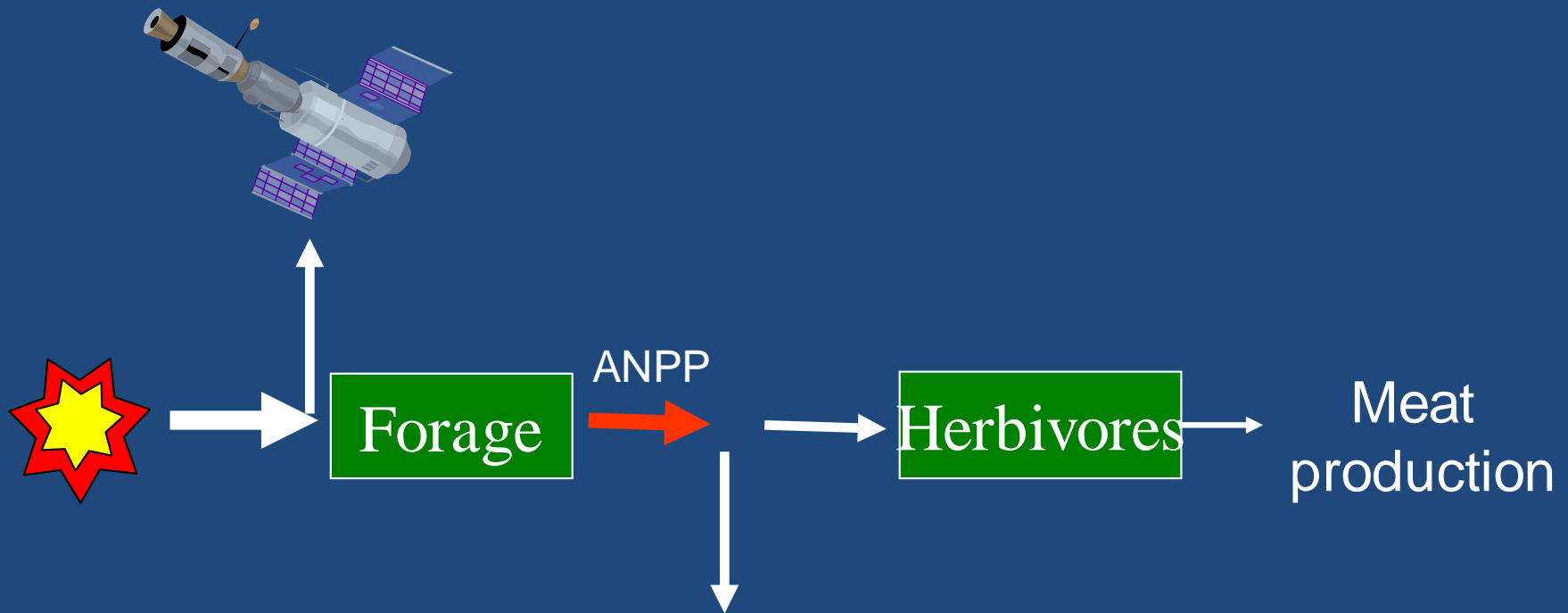


### Sown pastures



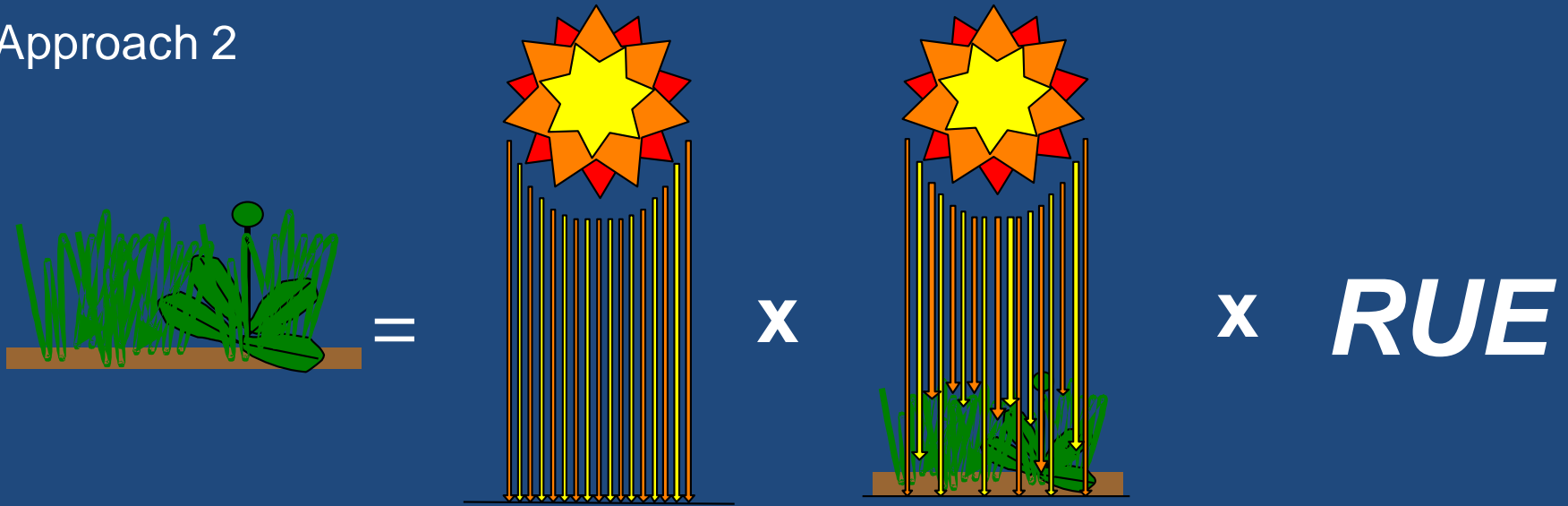
However, we can not estimate ANPP in a specific paddock from regional estimations

Approach 2: from absorbed radiation to ANPP





# Approach 2



Radiation absorbed

**ANPP**

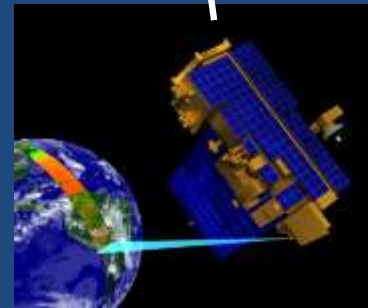
**Photosynthetic  
= radiation**

**X**

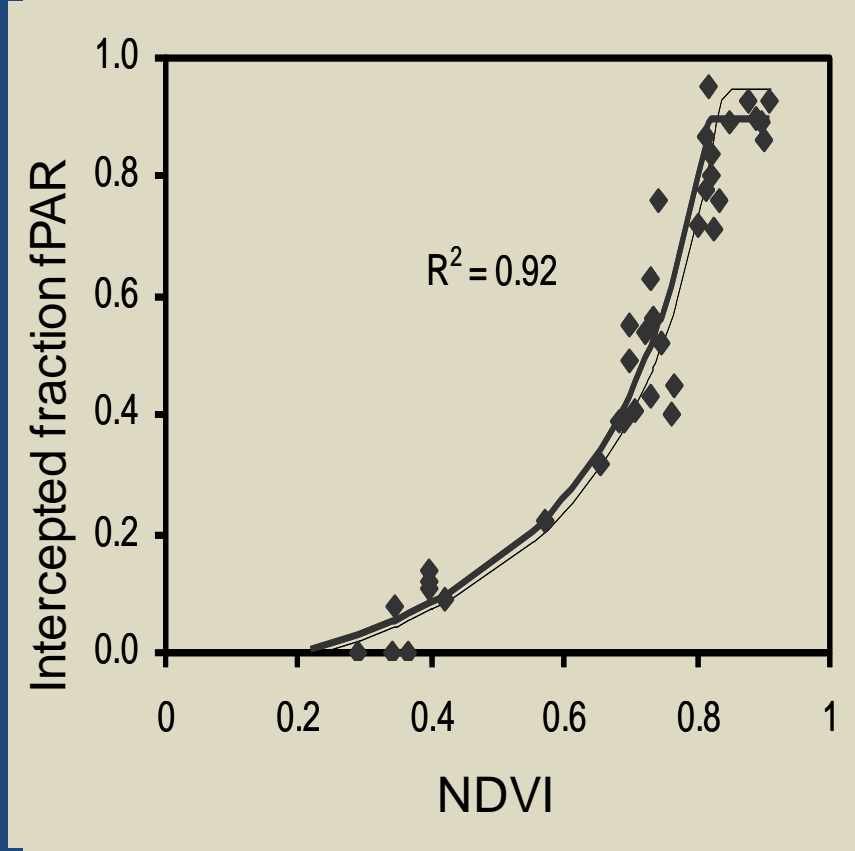
**Intercepted  
Fraction fPAR**

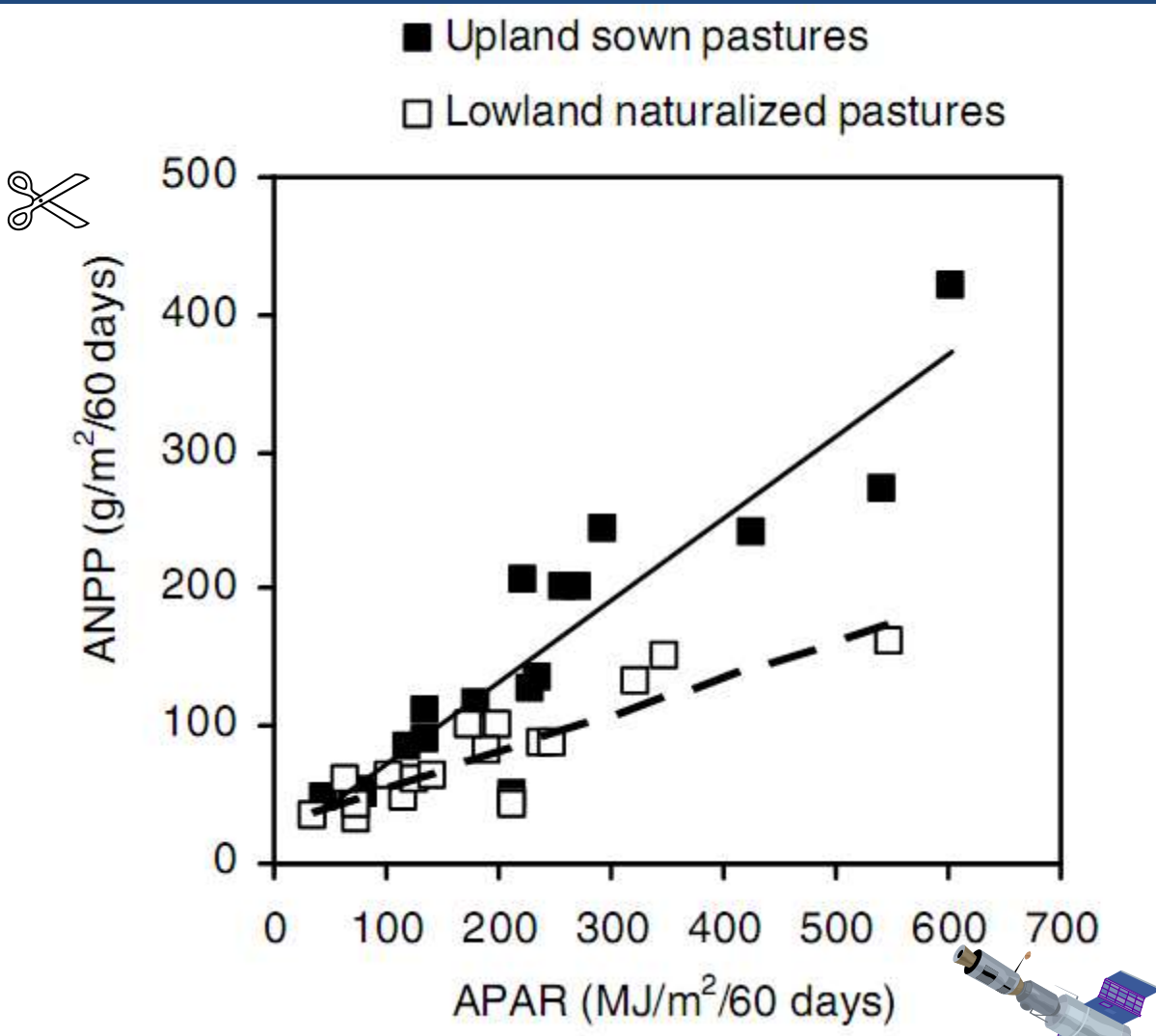
**X**

**Radiation Use  
Efficiency**



↓  
Estimated from  
biomass harvests





Grigera et al. 2007

# Monitoring system of forage production

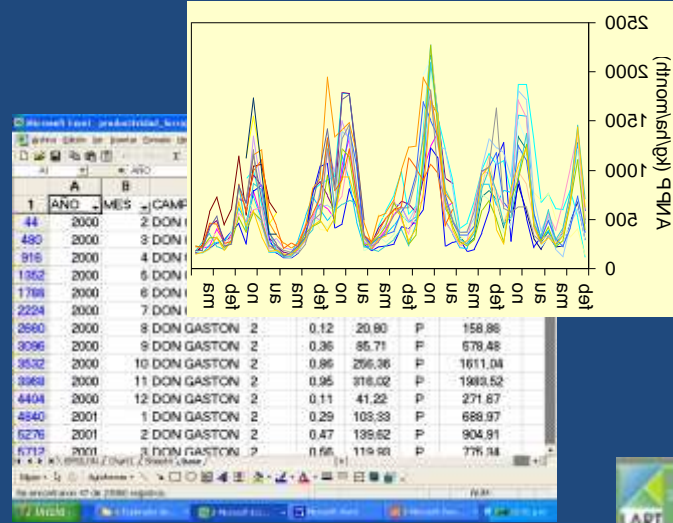
## How does it work?



MODIS server



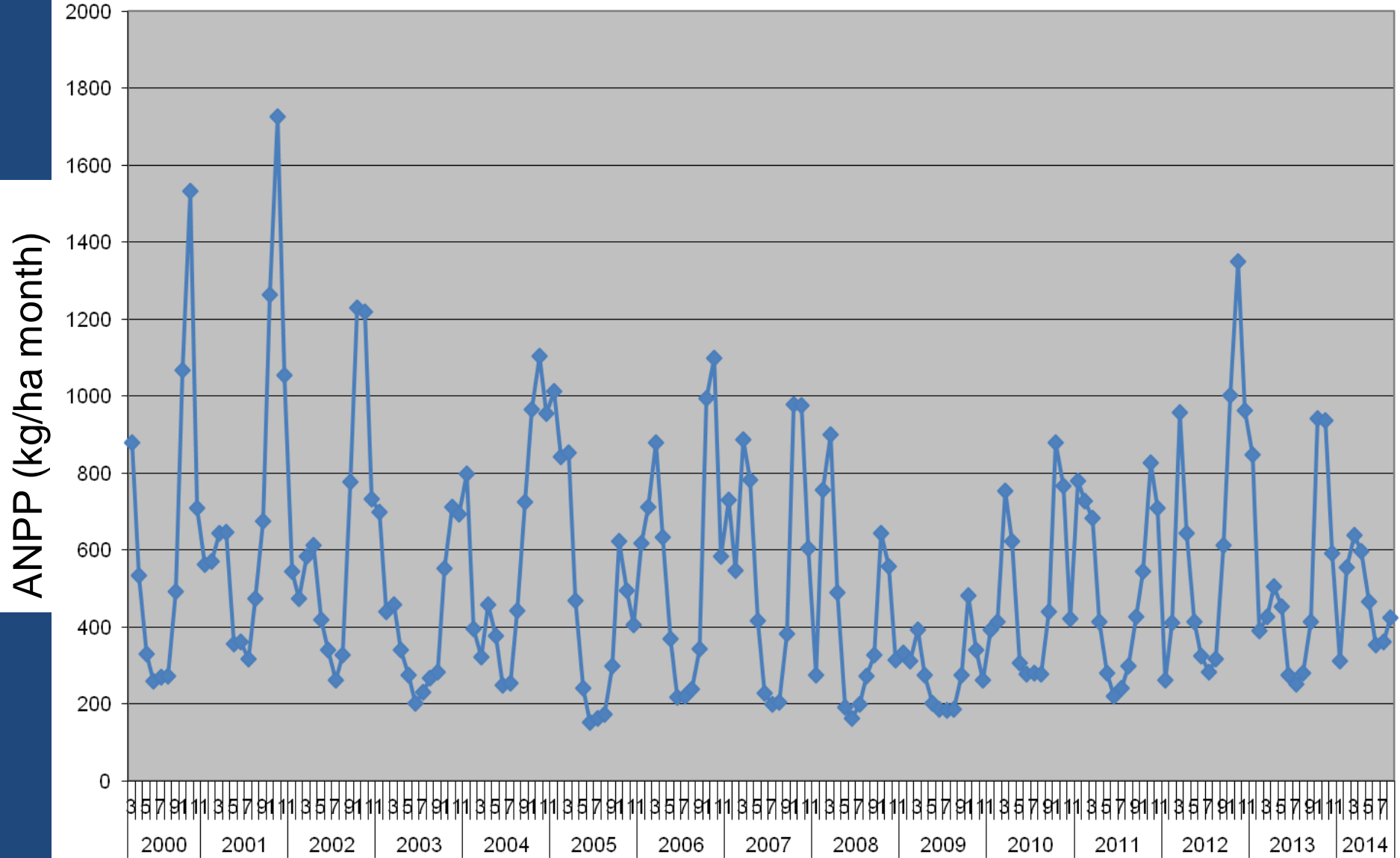
Farmer, at the beginning of each month



ANPP monthly estimates at paddock level, from 2000 to present



# Sown pasture





### Lowland naturalized pastures

Mes	PPNA (Kg/ha)	N (potreros)	Desvío estándar espacial (Kg/ha)	N (años promedio)	Desvío estándar interanual promedio (Kg/ha)
1	409	598	88,3	10	22
2	376	598	66,5	10	36
3	444	598	78,9	10	69
4	362	598	58,5	10	118
5	252	599	26,6	10	169
6	207	598	17,6	10	124
7	209	600	16,5	10	138
8	232	600	23,5	10	87
9	299	600	44,3	10	106
10	458	600	90,3	10	84
11	500	600	106,0	10	37
12	416	600	73,0	10	29
<b>Total</b>	<b>4163</b>				
<b>CV (%)</b>	<b>30</b>				

# Conclusions

- ANPP can be estimated from biomass harvests or from absorbed radiation
- This second approach allow us to monitor ANPP with remote sensing at paddock level from 2000 to present
- We developed a monitoring forage production system for farmers' decision making
- We are extending the system to other regions of Argentina and Uruguay



Thanks to...

