

**Global
context**

**What means
sustainability ?**

**Where ? Why in
tropical grasslands...**

**How, with which
initiatives ?**

**What future
direction ?**

Tropical Grasslands: Sustainable Intensification in a Pivotal Agro-Ecosystem

Maryline BOVAL, Valérie ANGEON & Tom RUDEL

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Tropical Grasslands: Sustainable Intensification in a Pivotal Agro-Ecosystem

The Global Food demand



The climate change & CHG emissions



The agricultural commodity prices volatility



The biodiversity losses



A vision of **sustainable** agricultural **intensification**

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**3 major concepts used, according to the
literature Review by Wezel, 2015
241 publications analysed**

SUSTAINABLE INTENSIFICATION

Widest used, imprecisely defined

- Increased production
- Minimized environmental impacts
- Best management of inputs and outputs
- Environmental services, natural resources/capital

ECOLOGICAL INTENSIFICATION

- Increased production
- Minimized environmental impacts
- Resource use efficiency
- Ecological processes and ecosystem services

AGROECOLOGICAL INTENSIFICATION

- Social and cultural perspectives
- Farmer's knowledge
- System approach

A vision of **sustainable** agricultural **intensification**

requires 2 other important concepts

in our multidisciplinary view , animal science, economist, ecologist



Tropical grasslands: A pivotal place for a more multi-functional agriculture

Maryline Boval  , Valérie Angeon, Tom Rudel

Perspective

First Online: 12 July 2016

DOI: 10.1007/s13280-016-0806-5

Cite this article as:

Boval, M., Angeon, V. & Rudel, T. Ambio (2016). doi:10.1007/s13280-016-0806-5

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Views

Ecosystem services

i.e. the valuing of the nature's service decision systems,

...another perception of the relations between humans and nature

Joint initiative of economist and ecologists (Ehrlich & Ehrlich, 1981)

Multi-functional agriculture going beyond production of food & fibre

Agenda 21 – Rio Earth Summit (UNCED, 1992)

Global context

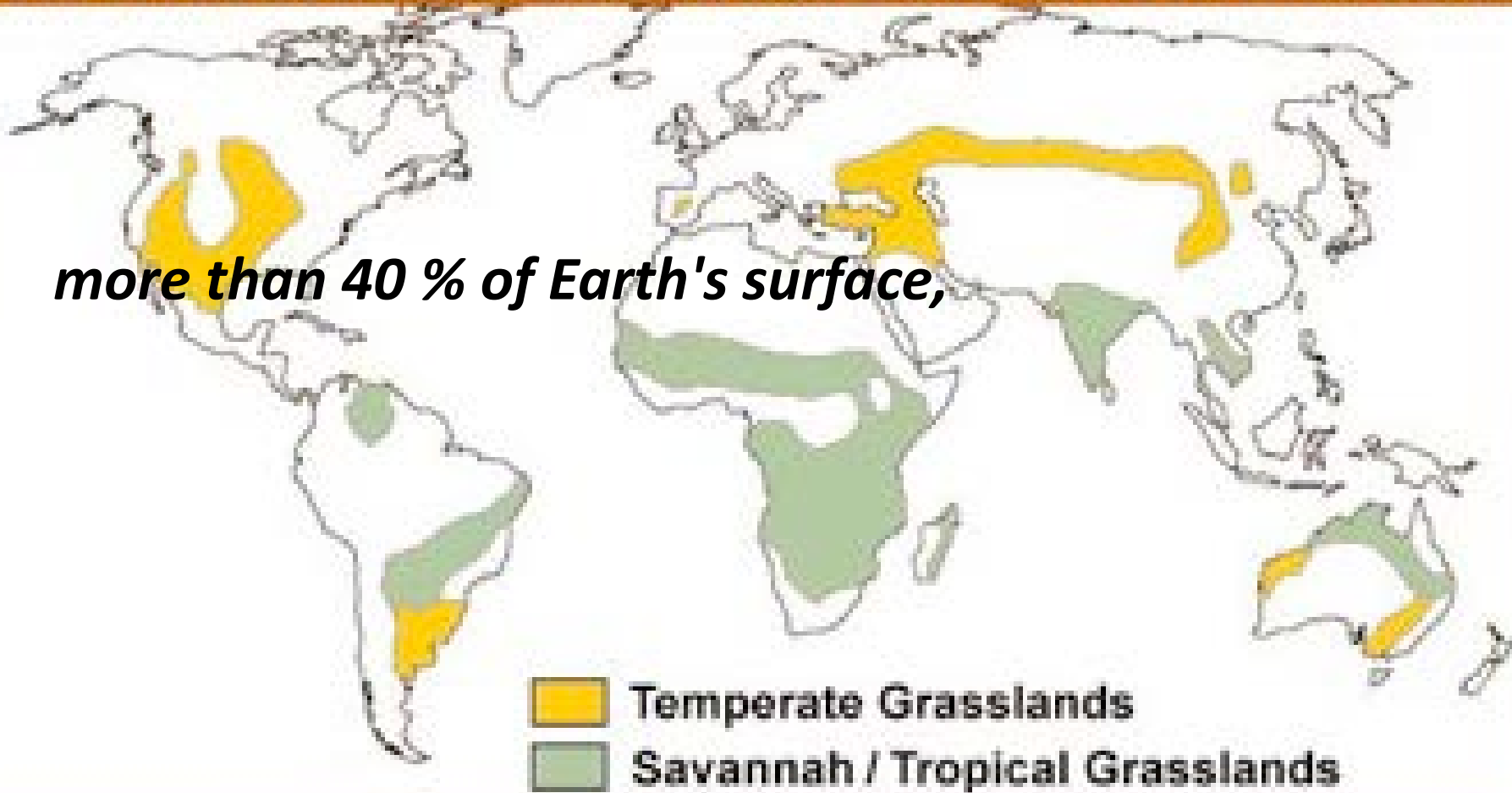
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WHERE IN THE WORLD ARE GRASSLANDS? MAP ADAPTED FROM MULTIMEDIA PANDORA, INC.



where actual yields are considerably lower than potential..



Grasslands...a key contributor for **LIVELIHOODS**
of over 800 million people, providing

- Income, social-cultural needs, well-being, social protection
- Local supply of manure and skins (leather goods, musical instruments)
- ...Of cultural importance



havens of BIODIVERSITY

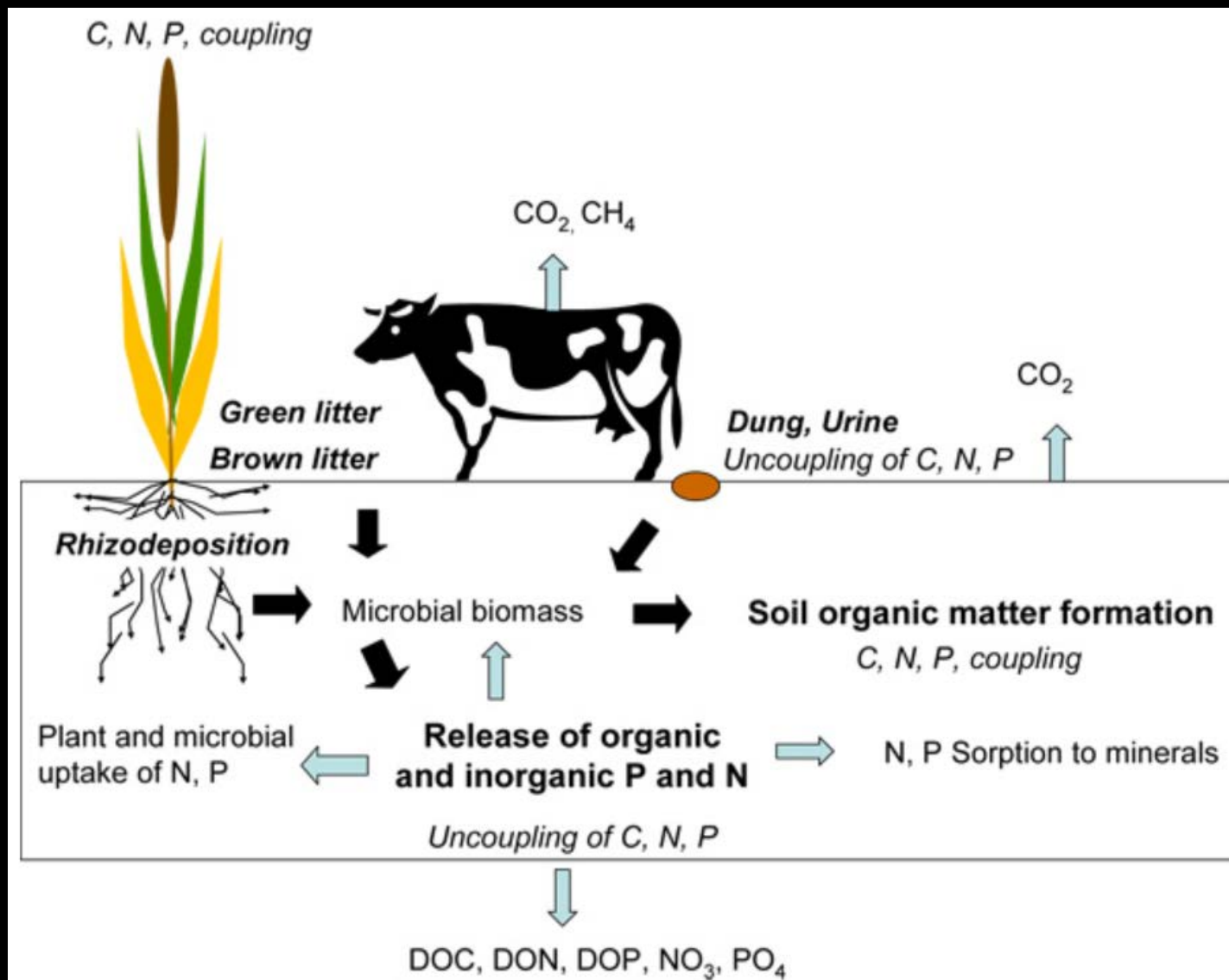
large variety of species



A key contributor in the interactions between

ATMOSPHERE-HYDROSPHERE LANDS

That drive
→ global change environmental risks,
→ sequestration of Carbon



Processes leading to coupling and uncoupling of C, N and P cycles in grasslands soil

Rumpell et al, 2015; Soussana & Lemaire, 2014; Miltner et al, 2012...

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A large range of management strategies of grasslands have been explored

and reviewed by Minson, 1990, Humphreys, 1991, Poppi et al, 1997, Lemaire, 2009, Boval, 2012...

- **In perspective of ANIMAL PRODUCTION**
- **in specific conditions, limiting generalization, appropriation**
- **with inappropriate criteria, due to methodological difficulties to measure in grasslands,**

Strategies are essential to balance the benefits and constraints of grazing



Two Kind of strategies to implement

1-Elementary strategies, i.e. implemented alone

2-Complex strategies = plurality of

Elementary strategies

- Stocking rate
- Herbage allowance

→ **AMOUNT OF FORAGE/ANIMAL**

- Stage of regrowth...
- Fertilization,

→ **AMOUNT & QUALITY OF FORAGE**

- Duration of grazing
- Frequency of grazing

→ **AMOUNT & QUALITY OF FORAGE**

for example

ROTATIONAL GRAZING, MIXED GRAZING

An example of elementary strategy

+ A vision of **sustainable intensification**

Vermicomposting applied in natural grasslands

Preparation of compost (Sierra et al, 2013)

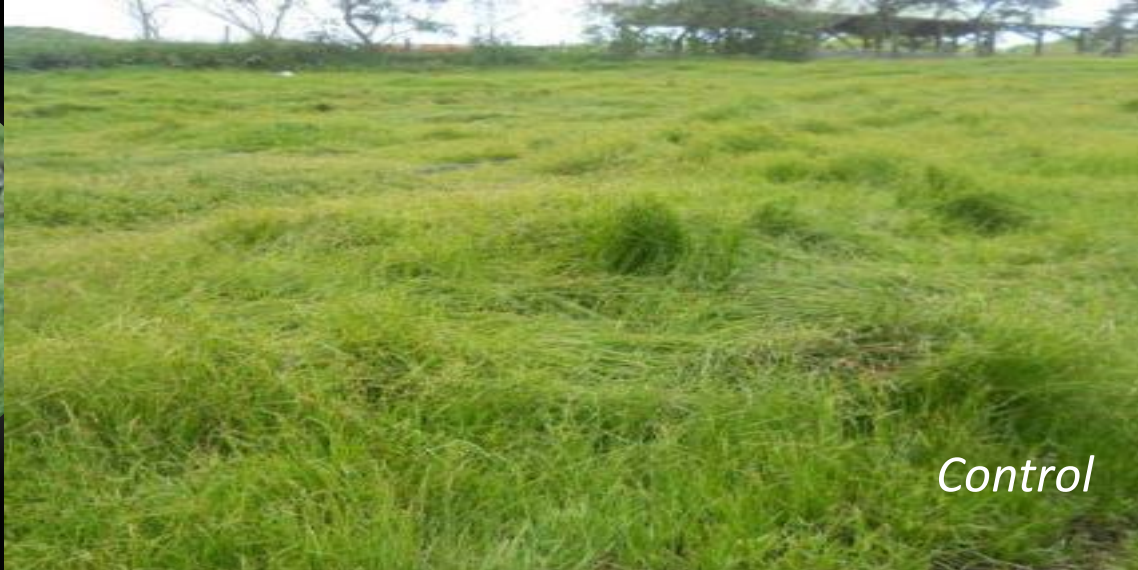
Vermiculture with *Eisenia fetida* & *Eudrilus eugeniae*

Application in furrows (500 g DM/ m²)



*Grazing by ewes infested with gastro intestinal strongilae
i.e. Haemonchus contortus*





Control



With vermicompost

- ❑ Animal gain doubled
- ❑ Parasitism reduced by -33 % ,
- ❑ Different floristic composition

- An intensification, with higher conversion of herbage mass/ha
- No anthelmintics, better meat quality
- Economical interest, deriving from previous... lower expenses

...in progress

Example of complex strategy,

+ A vision of **sustainable intensification**

MIXED GRAZING of goats & cattle ● 2 years experimentation,

d'Alexis et al, 2014, Animal

...of sheep & cattle ● Quantitative analysis of literature,

d'Alexis et al, 2014, J.Agric Science





❑ Benefits on **ANIMAL PRODUCTION, feeding, health and herbage use**

+ 15g of LW/day/animal

+ 30 % gain per hav

❑ Parasitism reduced by -33 % ,

❑ Better use of grass by sheep

➤ An intensification, with higher conversion of herbage mass/ha

➤ No anthelmintics, better meat quality

advantage for dog attacks and flight

➤ Economical interest, deriving from previous... lower expenses

...in progress

Mixed

Control

Control

Mixed

A clear difference in homogeneity of the different paddocks

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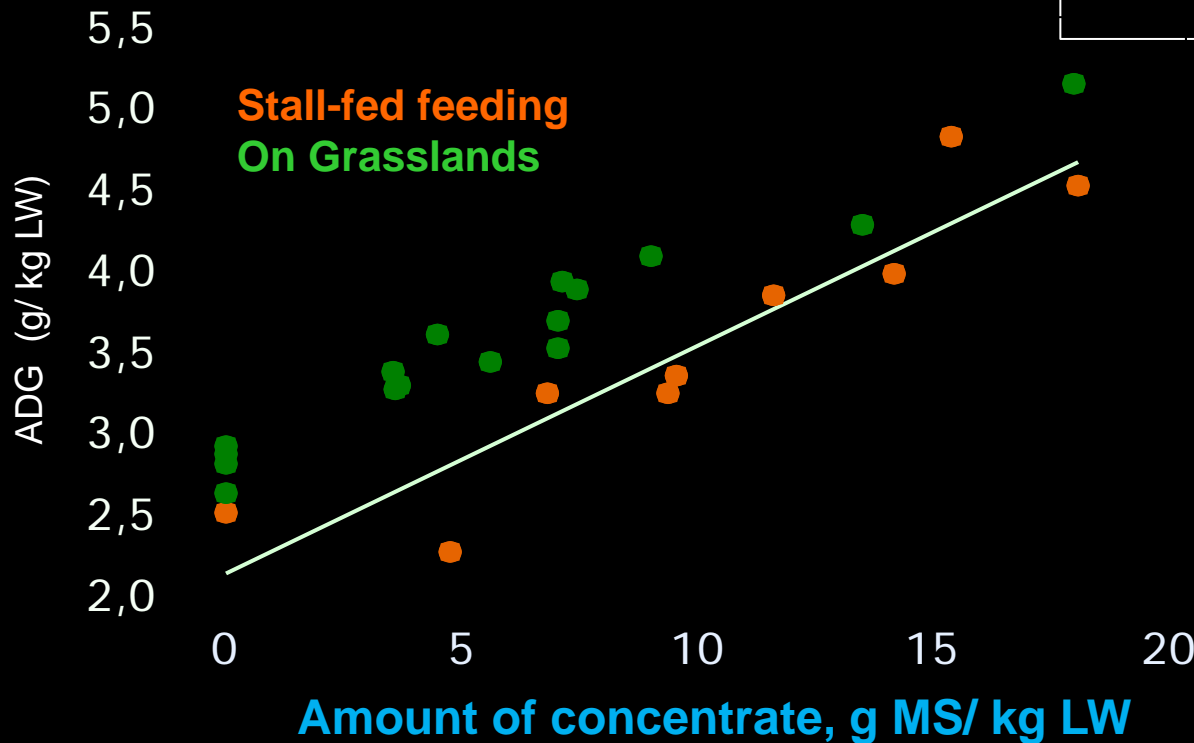
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A Classical orientation

Animal Productivist model
Reference= stall-fed feeding in intensive conditions, but...



→ADG may be similar in stalls or on Grasslands

→ADG depends primarily on the amount of concentrate distributed,

Meta analysis, n=108 publications, *Agastin et al, 2014, JAS*

~~A Classical orientation~~

Animal Productivist model

- Transition to operate with
- different actors
 - in various ways
 - at different levels
 - at appropriate scales of a

→ To be more innovative,
with a **new vision**

→ Revisiting strategies
& previous studies...

Data base and Meta-analysis

→ Methodological progress for
appropriate criteria...
to better assess and adapt strategies

Reorienting the agricultural sciences

A more agro-ecological model
with multiple direct and indirect
contributions to SOCIETAL WELL-
BEING & ECOLOGICAL PROCESSES

In addition to production



Mèci en pil...