Could land taxes be a tool for rangeland conservation?

Application of bio-economic modeling for on farm conservation in southern Namibia

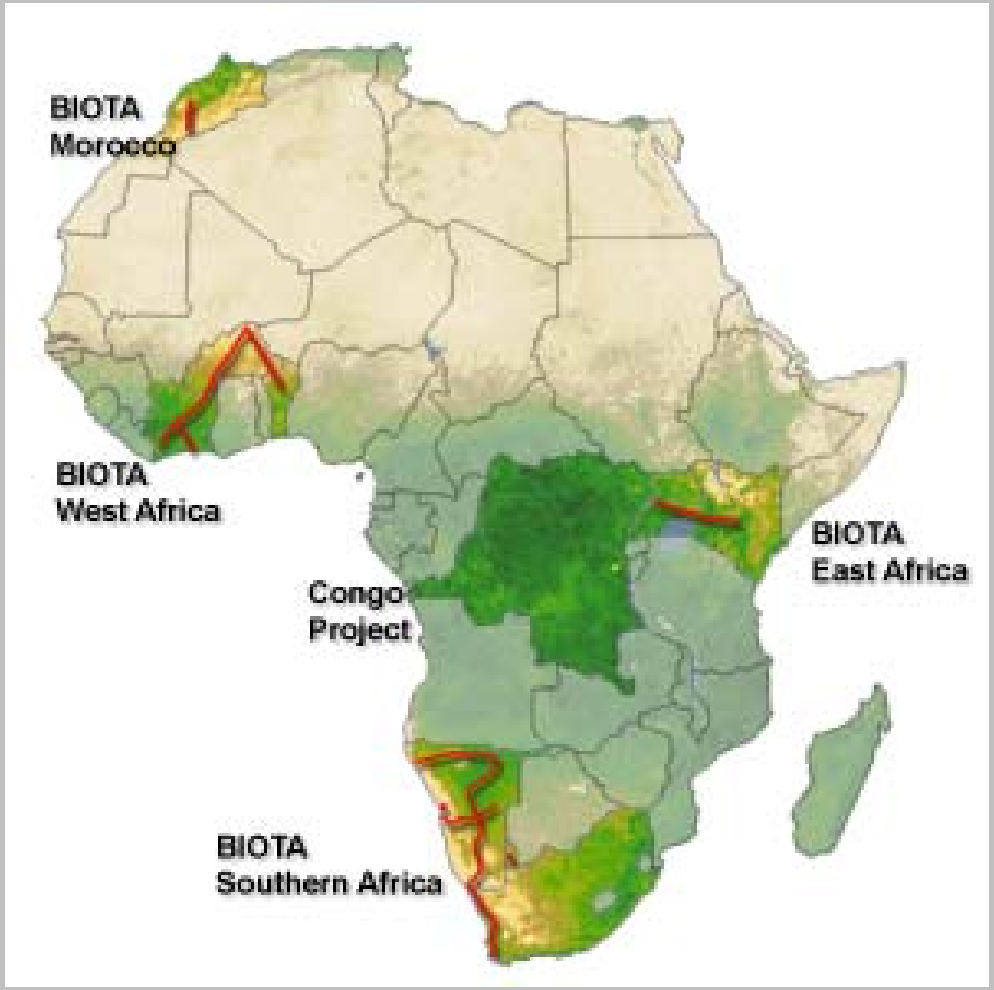
Stéphanie Domptail,

Ernst-August Nuppenau

Institute of Agricultural Policy and Market Research

University of Gießen, Germany

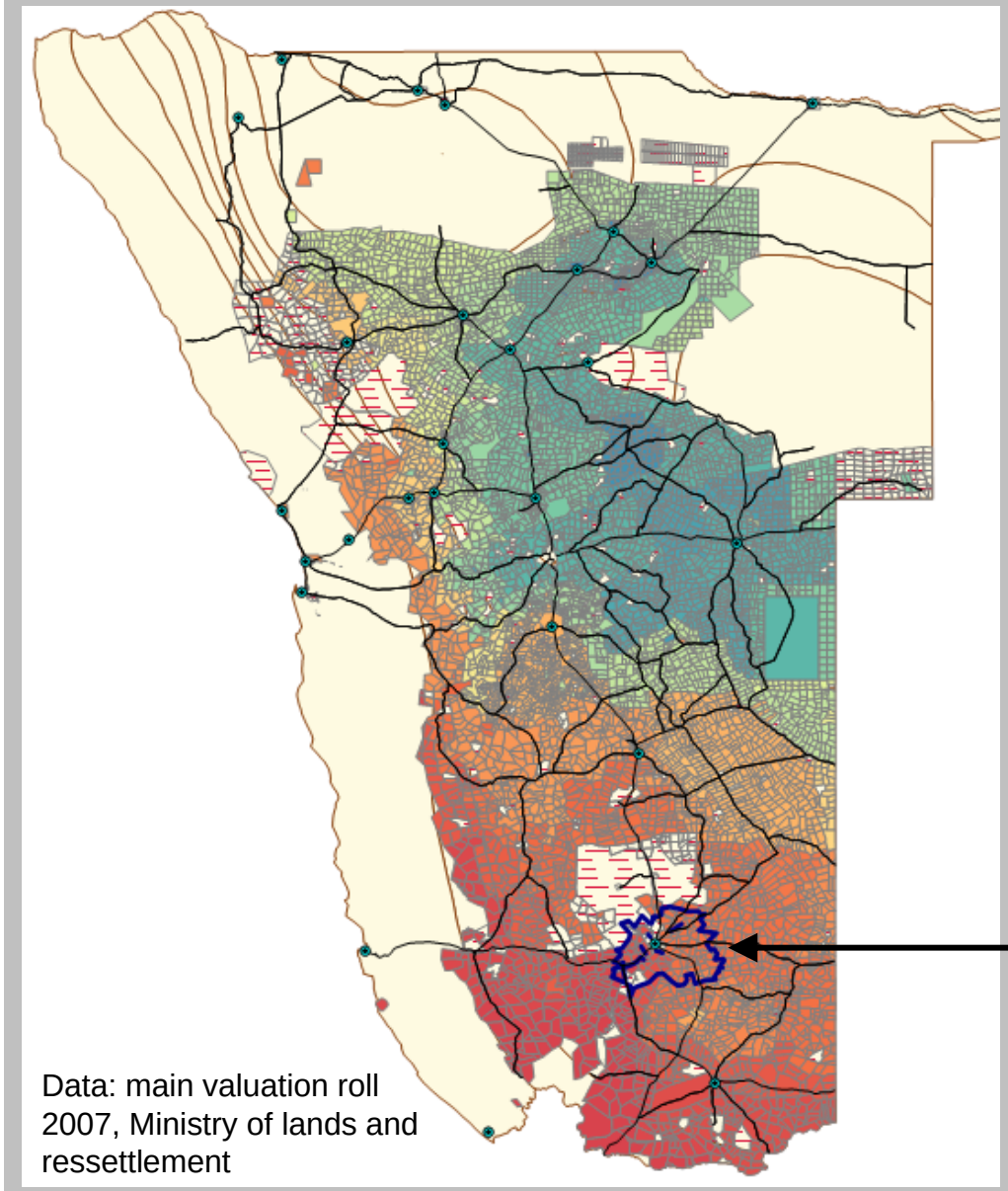
Outline



- Introduction
- A land tax based on the health of rangelands for rangeland conservation
- Model results on tax and alternative tax designs
- Implementation dilemma: is it really impossible?

1. Introduction

Land tax in Namibia



Data: main valuation roll 2007, Ministry of lands and ressettlement

Classic land tax:

- Aims:
  generate state revenue
  encourage agricultural use
- Low tax rate
- Valuation based on potential production

Unimproved Site Value (USV)

Namibia: 15 to 420

Study area: 15 to 46 NAD

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Towards an eco land tax?

Fostering adapted stocking rates and specific management practices is important to avoid degradation

<u>Generate revenue:</u>

Per ha tax

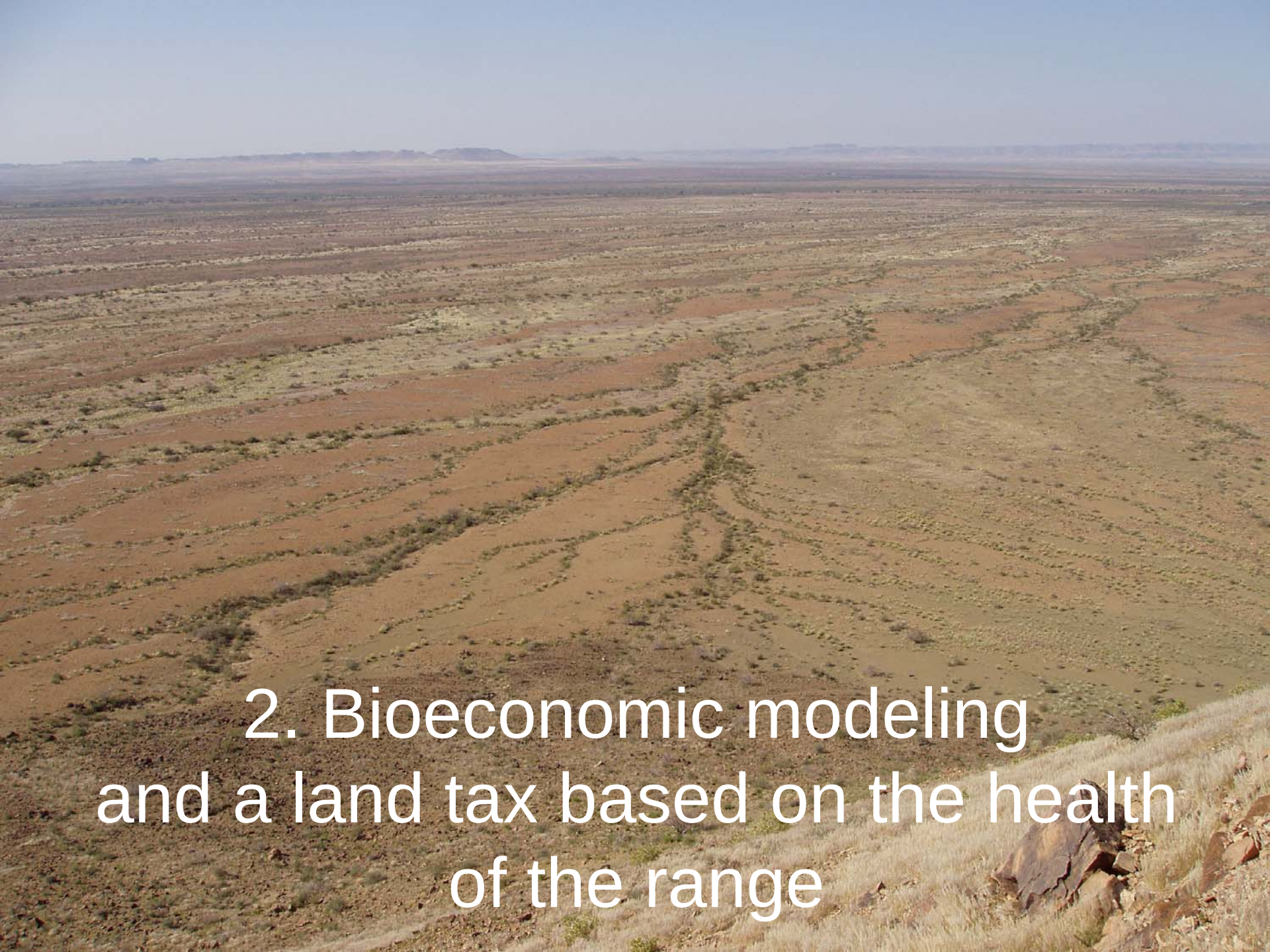
<u>Foster conservation:</u>

PES: Payment for Environmental Services

Tax negative externalities

Differentiated Land Tax accounting for the condition of the rangeland

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research



2. Bioeconomic modeling and a land tax based on the health of the range

Schematization of the bio-economic model

Rangeland condition S&T

Biomass (grass/bush)

Rainfall

Stocking density

T+1

Tax

Variable costs

Fixed costs

Lamb sales

Income

Picture 2006

States-and-transition model for Gellap

Good condition
Balance – S1

Good condition
More grass– S3

More annual
Grasses – S4

Dense shrub
Cover – S2

Bare land
few grasses
and shrubs- S5

S6- Bare

Transitions
depend on:
- **Breed used**
- **Stocking rate**
- Rainfall

Recursive Linear Programming optimization model (GAMS)

How do different land tax scenarios (settings) impact on strategies and rangeland condition?

Resources

Total farm size

Rangeland Condition/state

Labor / time

limit →

← change

Objectives

Veld conservation
Income generation

Possible **activities**

Stocking rate
Breed
Resting rangeland

SHADOW PRICE (SP) : **How much more would I earn if I would have one unit (ha) more of rangeland ?**

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Shadow Prices (SP) of the land in different states

S1
SP= 8,6 NAD/ha

S2
SP= 3,5 NAD/ha

S3
SP= 21 NAD /ha

S4
SP= 13 NAD /ha

S5
SP= -23 NAD /ha

S6
SP= -60 NAD /ha

=> Values of the land for a dorper production system

If SP < 0
=> losses

(SP_{st3} -SP_{stx}) = cost of degradation

Taxation scenarios

Fixed tax scenario

Actual taxation scheme	TAX=USV*0,75%

Differentiated scenarios

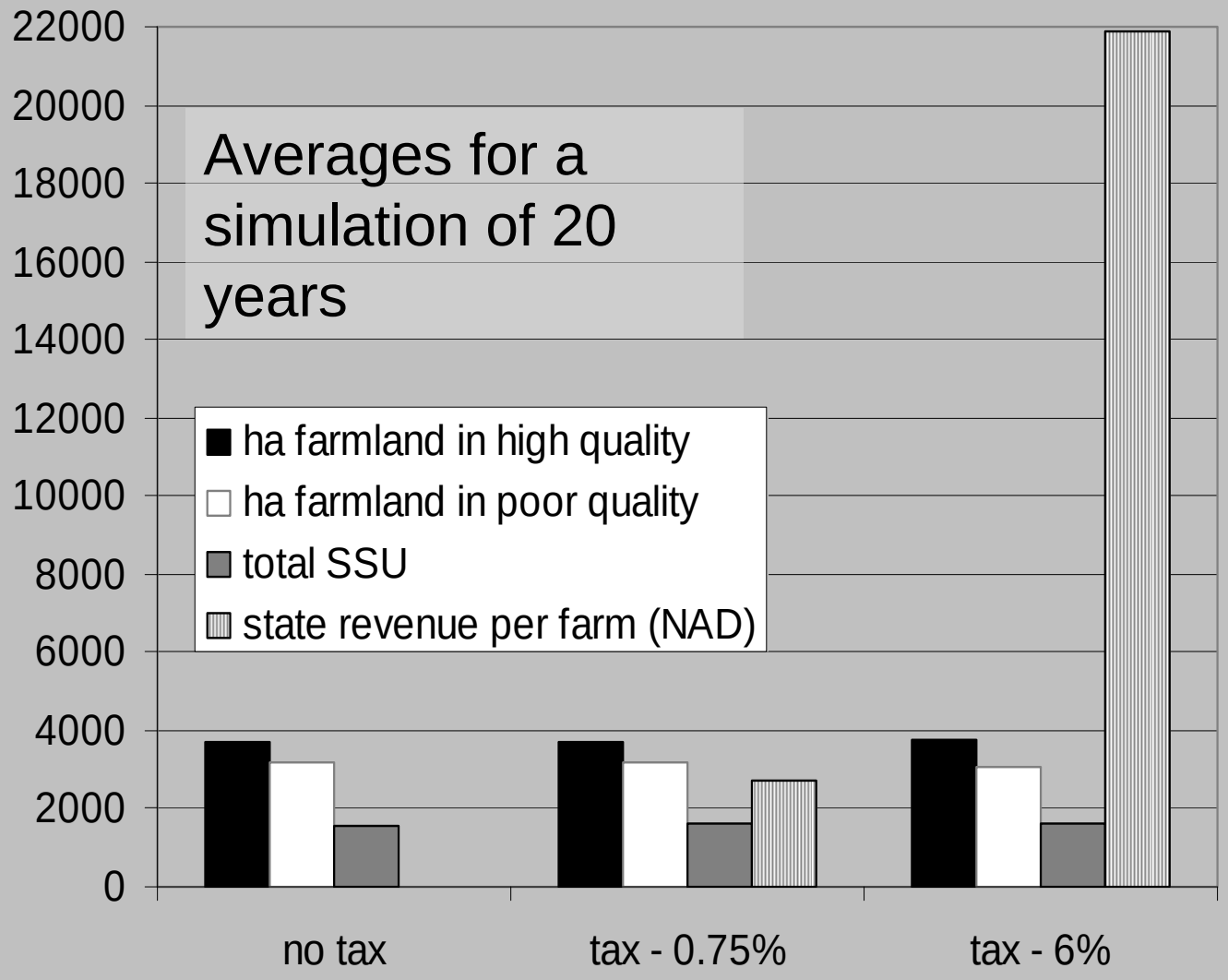
Polluter pays principle	Incentive payments
„ The farmer is supposed to care for the land. If he doesn‘t (degradation) he will have to pay for the loss.“	„By caring for the land, the farmer is delivering a service to himself and society. Conservation should be rewarded.“
TAX= [SP_{st3} + (SP_{st3} - SP_{stx})] *0,75%	TAX= (SP_{st3} -SP_{stx}) * 0,75%

pay for what you degrade

get payed for what you conserve

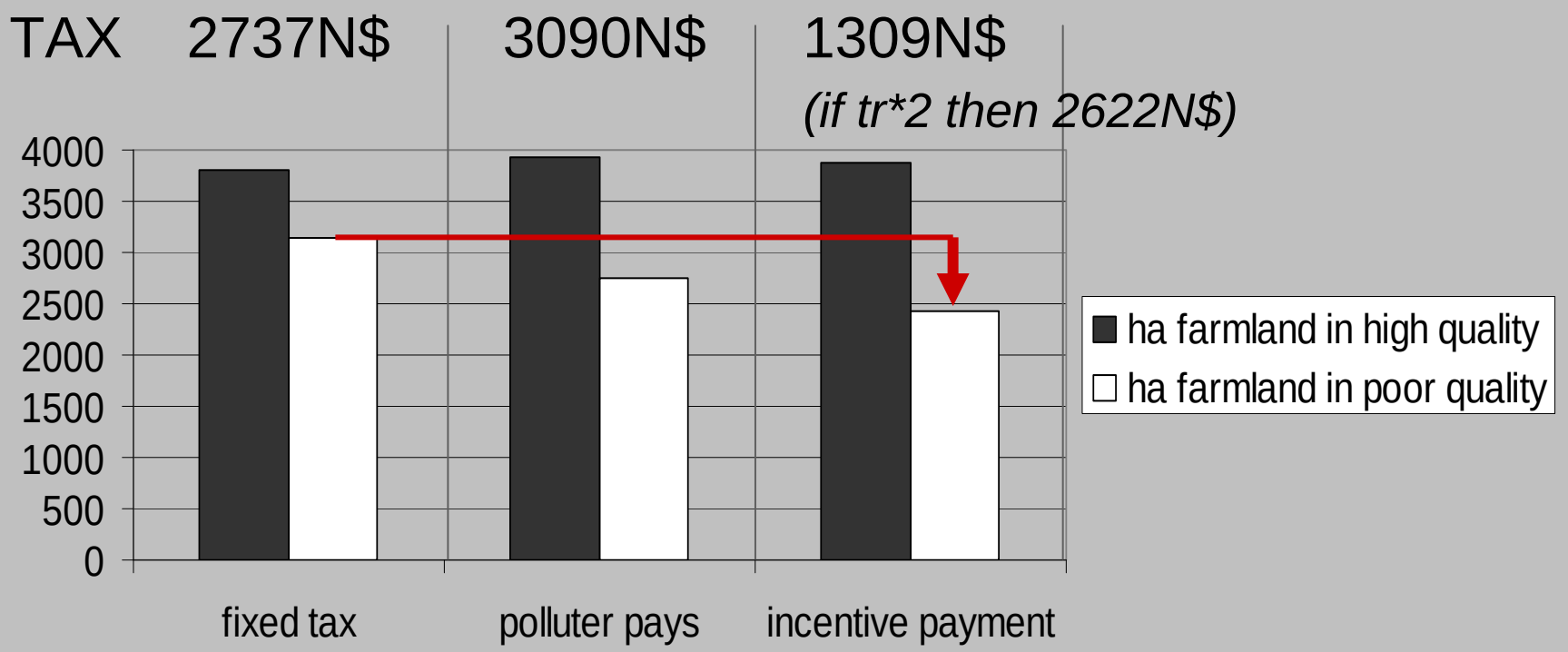
3. Model results on tax and ‘eco’ tax designs

Bio-economic model results: impact of fixed tax on strategies



No impact on strategies

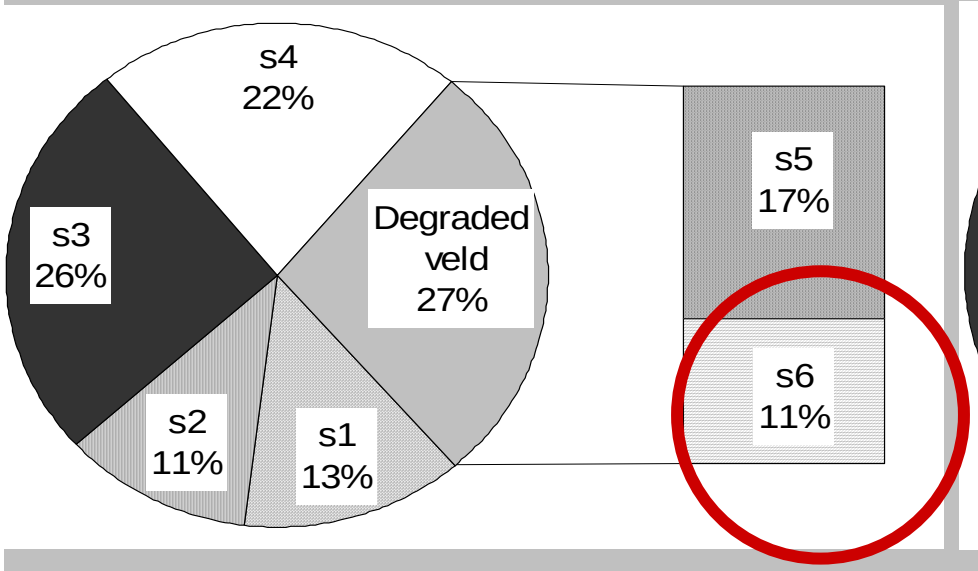
Fixed tax rate vs. differentiated tax rate

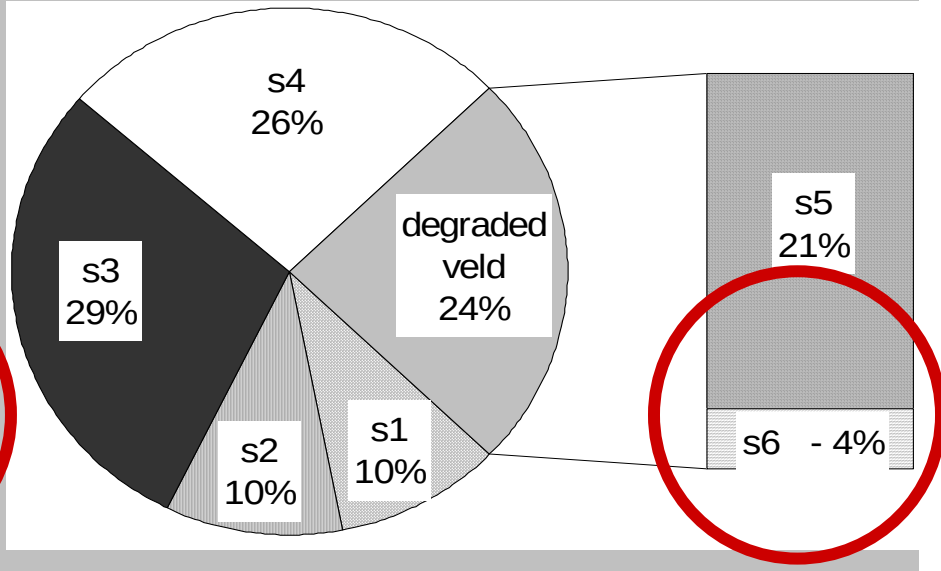


- Reduction of 16% of poor condition range
- Reduction of 70% in S6
- More resting: especially states 3 and 4

$\Rightarrow$ Avoiding irreversible degradation

Polluter pays vs. incentive payment



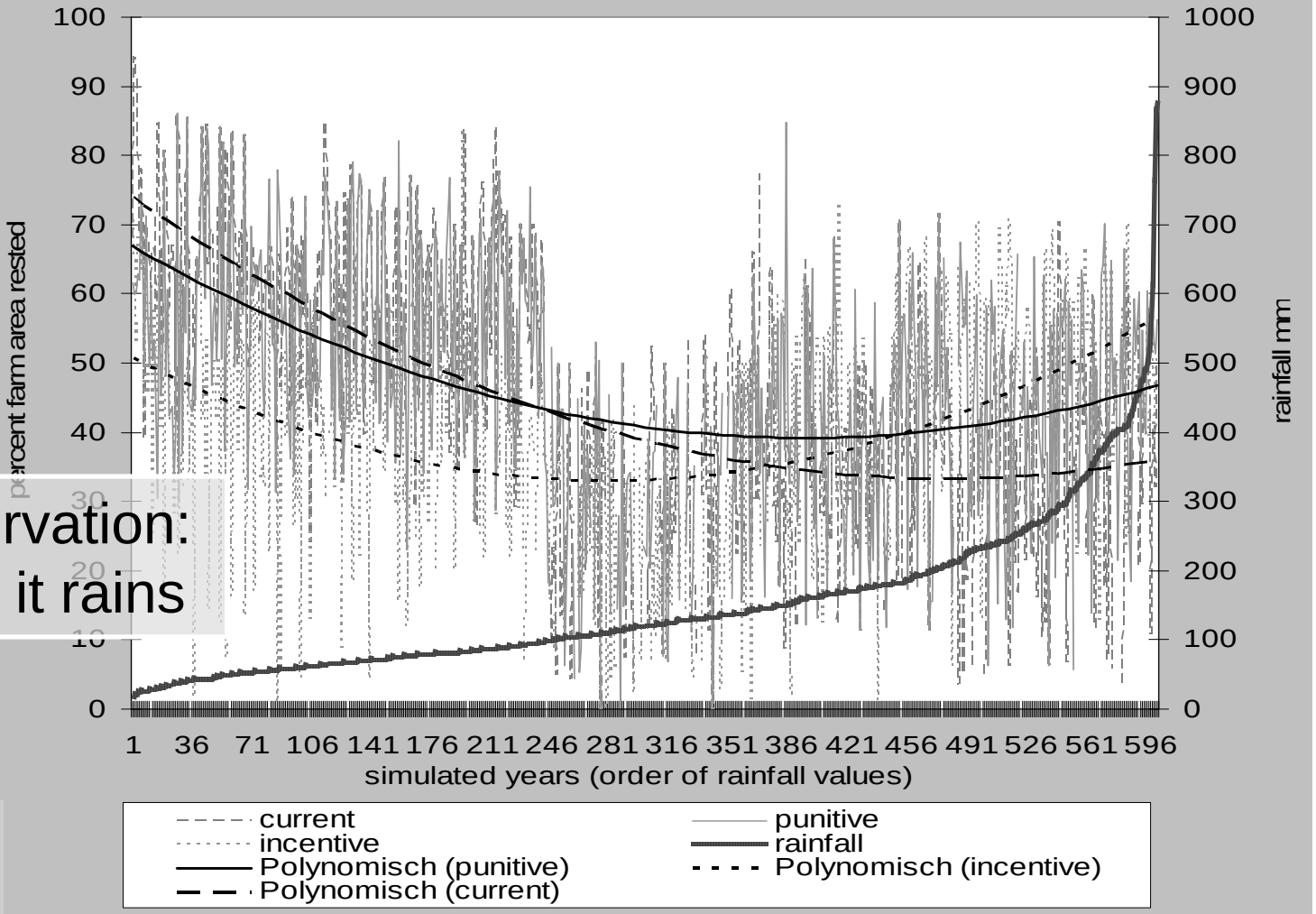


HOW?

- slightly lower stocking rate
- more purchase and less ewes lambs kept
- more strategical resting in the RAINY season

Strategical resting

Percentage of farmland rested (not grazed for a year) under each scenario and rainfall



Key for conservation:
Resting when it rains

See also
Müller & al. 2007

4. Implementation dilemma: is it really impossible?

Ecological challenges

•‘In an arid non-equilibrium system, the state of the system is also defined by rainfall patterns’

⇒ System characterized by variation – extreme events of severe drought or very high rainfall are seldom
⇒ System characterized by perennial vegetation

•‘It is not possible to conduct the valuation often enough to be fair’

⇒ Changes can be fast but they don’t occur every year.
⇒ Evaluation every 3 to 4 years reasonable
⇒ Every farmer has to pay the tax

Transaction costs

- Assets of Namibia

⇒ Much work dedicated to GIS and satellite use for vegetation monitoring at MAWF at BIOTA level (Vogel, 2006)
⇒ State and transition already exists for middle Namibia (Joubert & al, in press)

- Assets of the incentive scheme

⇒ can be voluntary (benefit for the farmer; see AEM in Europe)
⇒ Good for the ego (identity of good managers)
⇒ Misevaluation: can't be worse than fixed tax

- Potentials: extension service and valuation department may profit from each others work

Conclusions

1. **The land tax at its actual level would not lead to changes in the land use strategies of farmers**

2. **Degradation has a cost: -60N$/ha of state s6!!**

3. **Incentive tax design can bring the same amount of income to the state and foster on-farm conservation**

4. **It seems worth to think about such a system or to get inspired from it and to consider its potential to address multiple issues: conservation, valuation, education, monitoring.**

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Thank you for your attention and to

BMBF and BIOTA for funding and support

All interviewed farmers for their collaboration

Johan van der Merwe
Hendrick Knouds
Giel Bronkhorst
Leon van Wyk

for their interest, help and advises

Challenges for rural development in Namibia

- Namibia's Green Plan (1992): importance of rural development

- National Development Plans (1 to 3)

Sustainable rural development

6th objective of the third National Development Plan for 2007-2013:

„*Ensure the development of Namibia's natural capital and its sustainable utilization for the benefit of the country's social , economic and ecological well-being*“

Good condition

-

High number of species expected

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Intermediary conditions

(states)

-

Annuals or bush dominated

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Degraded veld

-

Low cover and low diversity expected

Differentiated taxation

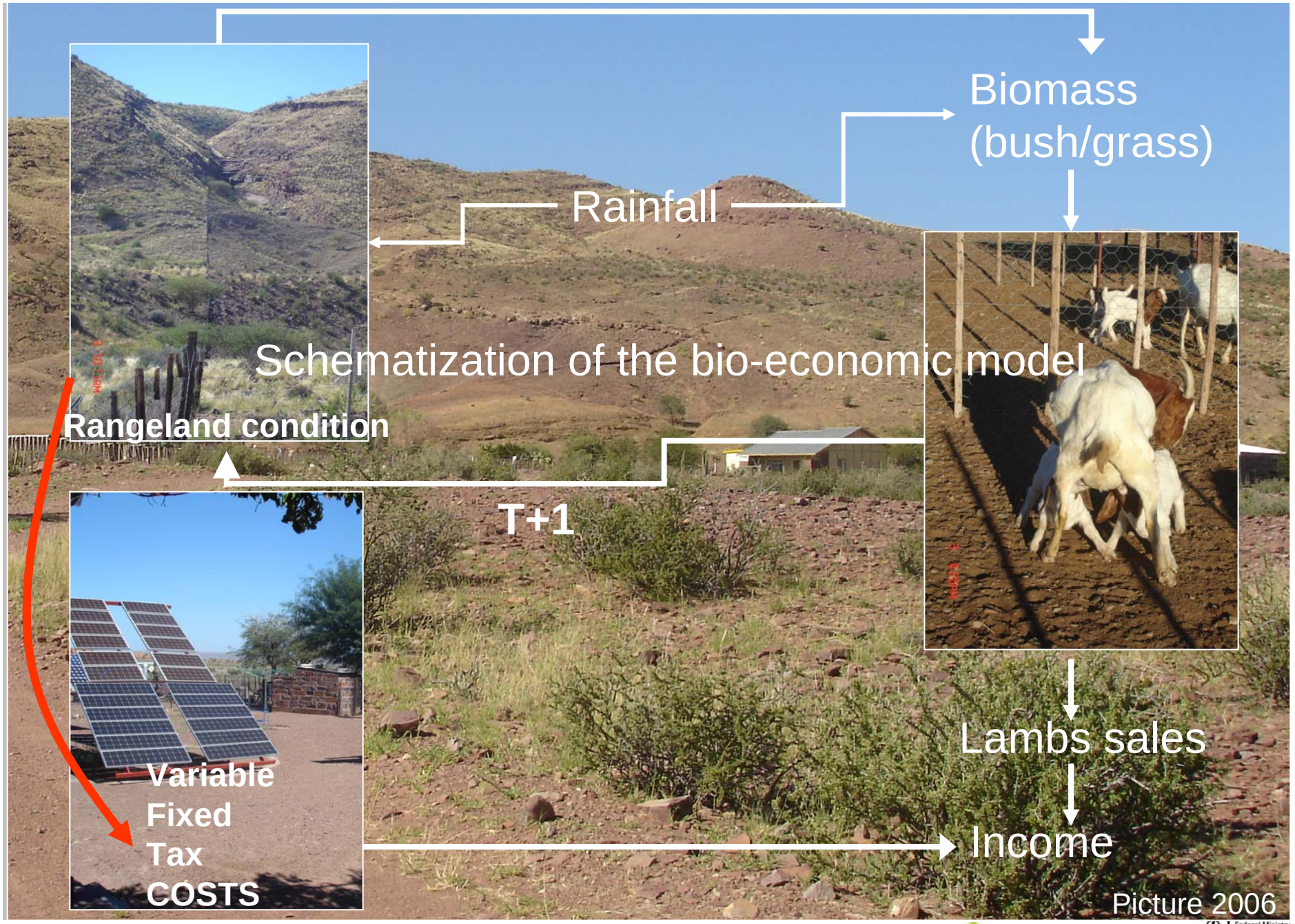
	Actual tax design	Differentiated tax design
Based on	USV	Other value: „Shadow price“
Represents	The potential productivity value of the land	The actual productivity value of the land (degraded vs healthy)

Is it possible to design the tax into an veld conservation tool ?

Purposes of land tax (not exhaustive):
- income generation for land reform
- encourage agricultural use

Additional goal: encourage **on-farm conservation**

Concept of a *differentiated* land tax
⇒ **A tax that is based on a land value which takes into account whether the veld is degraded or not**


Biomass
(bush/grass)
Rainfall
Schematization of the bio-economic model
Rangeland condition
T+1
Variable
Fixed
Tax
COSTS
Lambs sales
Income
Picture 2006

Rangeland condition / states - Biodiversity

Good conditi

More grass–

Bare land

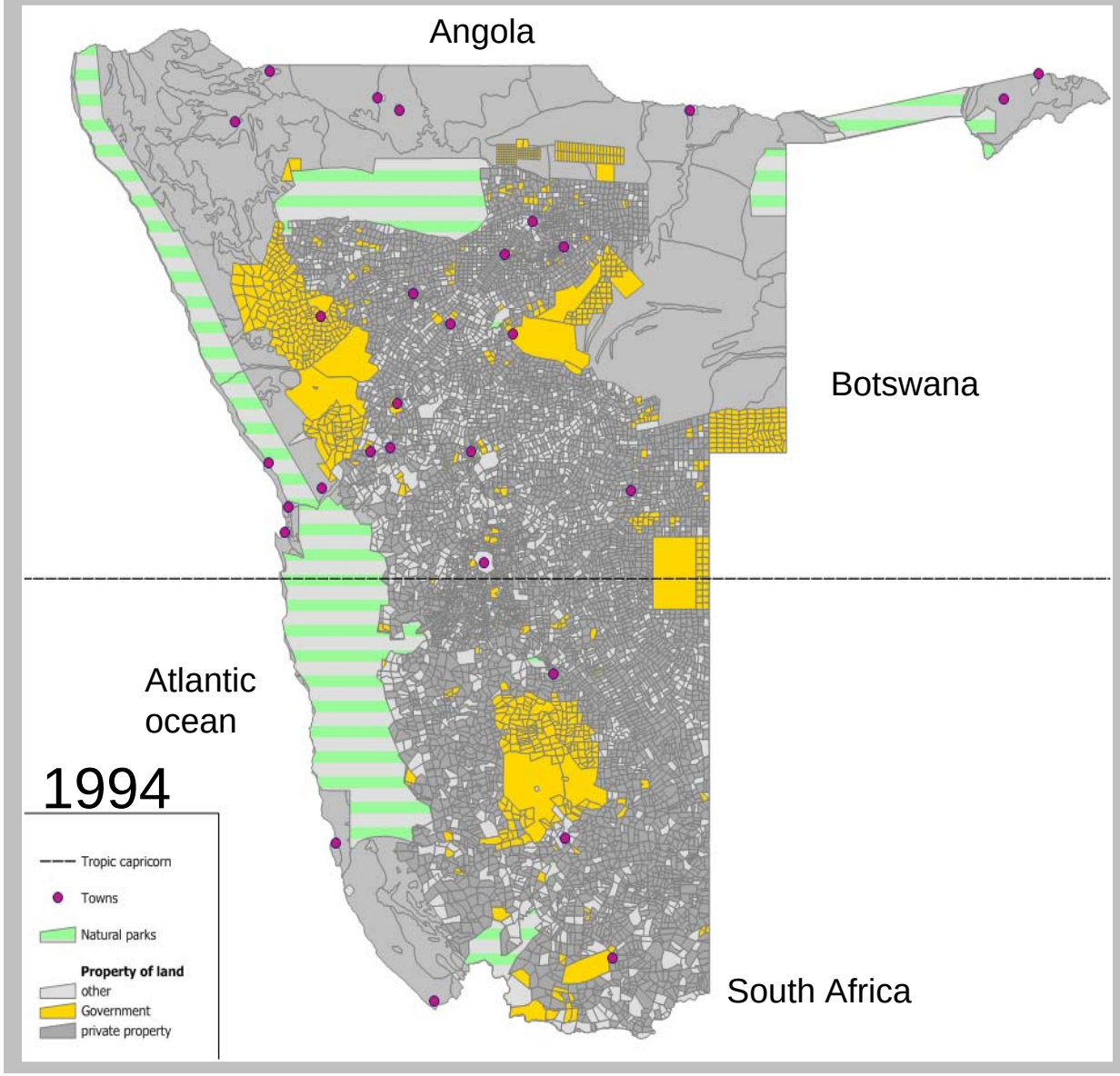
few grasses

and shrubs- S

citation frequency	Afrikaans and botanical names of shrubs and bushes associated with "bad" range
5	Driedorn (*Rhigozum trichotomum*)
4	Skilpadbossies (*Zygophyllum pubescens* or *dregeanum*)
4	Soetdorring (*Acocacia Nebrownii*)
2	Gabbabos (*Catophractes alexandrii*)
1	Noeniebos (*Eriocia foetida*)
1	Vermeerbos

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN
BIOLOG
BIOTA Southern Africa
pt Projektträger im DLR
Federal Ministry of Education and Research

Challenges for rural development in Namibia



Land redistribution

2 million people

And about 4500 ranches (mostly Afrikaans and German)

Challenges for rural development in Namibia

Rangeland degradation

- Busch encroachment
- Desertification

Modeling decision making under uncertainty

Rangeland condition

Rainfall ?

Biomass (grass/bush)

Bio-economic feedback

Stocking density

S. Domptail

Costs

Lamb sales

Income

Price ?

Transition Probabilities
Vegetation model
-> impact of grazing on
Rangeland condition

Mathematical programming model

- **Dynamic** optimization over 30 years (***indicative*** – not predictive)
- **Bio-economic**
- **Recursive (uncertainty)** with expectations for prices and rainfall

Parametrization: farm data (2005-2006) and literature

Schematization of the bio-economic model

Rangeland condition S&T

Biomass (grass/bush)

Rainfall

Stocking density

T+1

Tax

Variable costs

Fixed costs

Lamb sales

Income

Picture 2006