Economic valuation and hydrologic analysis in view of sustainable watershed management: The case of Sigi catchment in Tanzania

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Introduction

Importance of watershed resources

Livelihood (>86% people)

- Cultivation
- Grazing
- NTFP collection

Welfare

- Income provision
- Food supply
- Energy
- Shelter

Vital input for poverty reduction strategy

sustainability

Conservation

Ensure resources are in good condition

Development

Ensure welfare of users is improved

Current generation and future generation

Current situation

Absence of Coordination

Resource managers

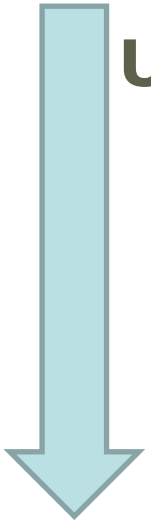
Forestry authorities

Basin Water authorities

Users

Local community

Urban water authority

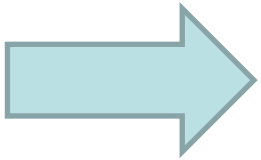


No platform for joint strategies

consequences

Policy conflict

Development
VS
Conservation

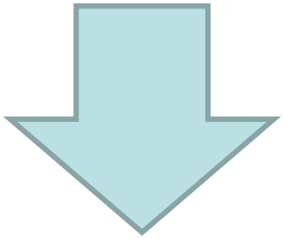


Unsustainability

Degraded watersheds

Food insecurity

Poverty problem



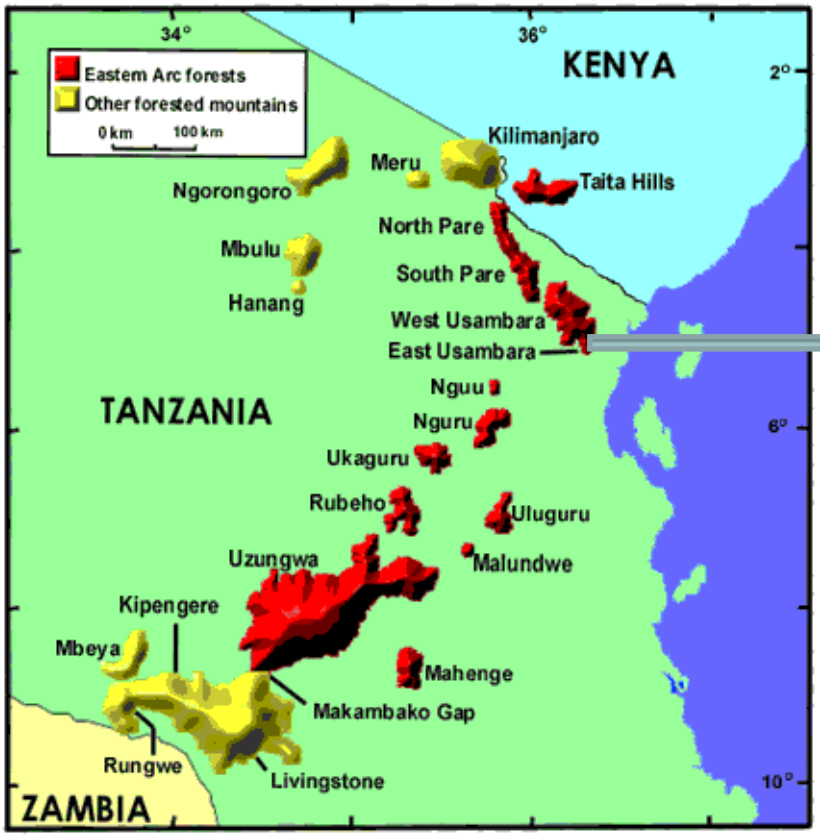
Action: To bridge the policy gap

Objective

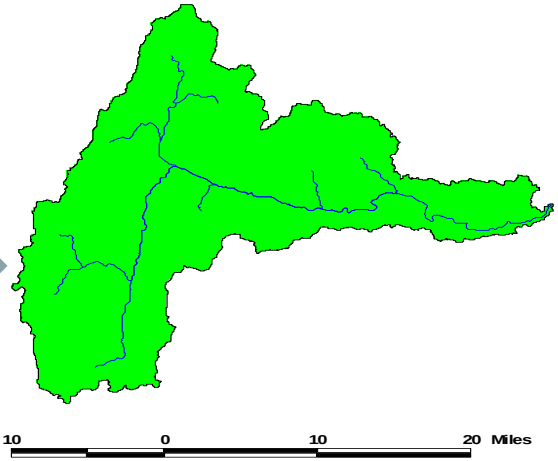
Methodology development

- To bridge the policy gap above
  - ✓By means of an integrated assessment model (ECONHDRY)
  - ✓ By identifying the hotspot areas for conservation and development
  - ✓By specifying means for win-win

Study area



SIGI catchment 1100 sq.km



Water to >500,000

Methods

Hydrologic model (SWAT)

- Water balance
- Simulation of crop yield

Economic valuation

- Crop output and revenue
- Welfare analysis

Overlay of values

- Aggregation of crop values at household level to HRU level
- Weight index is constructed from simulated crop yield
- Index is used to distribute crop values into HRUs

Data

- Biophysical (SWAT model)
  - DEM (SRTM), land use (GLCF), Soil (FAO)
  - Weather for 1995 - 2005 (TMA & ECJRC)
- Socioeconomic(Econ valuation)
  - Household survey (2008/09)
  - NBS (2008)

Results

SWAT model performance

- Calibrated (1997-2001) and validated (2002-2005)

	daily	monthly
NSE	0.67	0.77
PBIAS	3.4%	1.5%

- 18 HRUs were formed
  - Simulated yield
    - Minimum ton/ha = 0.3
    - Mean ton/ha = 1.7
    - Maximum ton/ha = 5.6

Aggregation of value at HRU

We obtain HRU value by using equation below

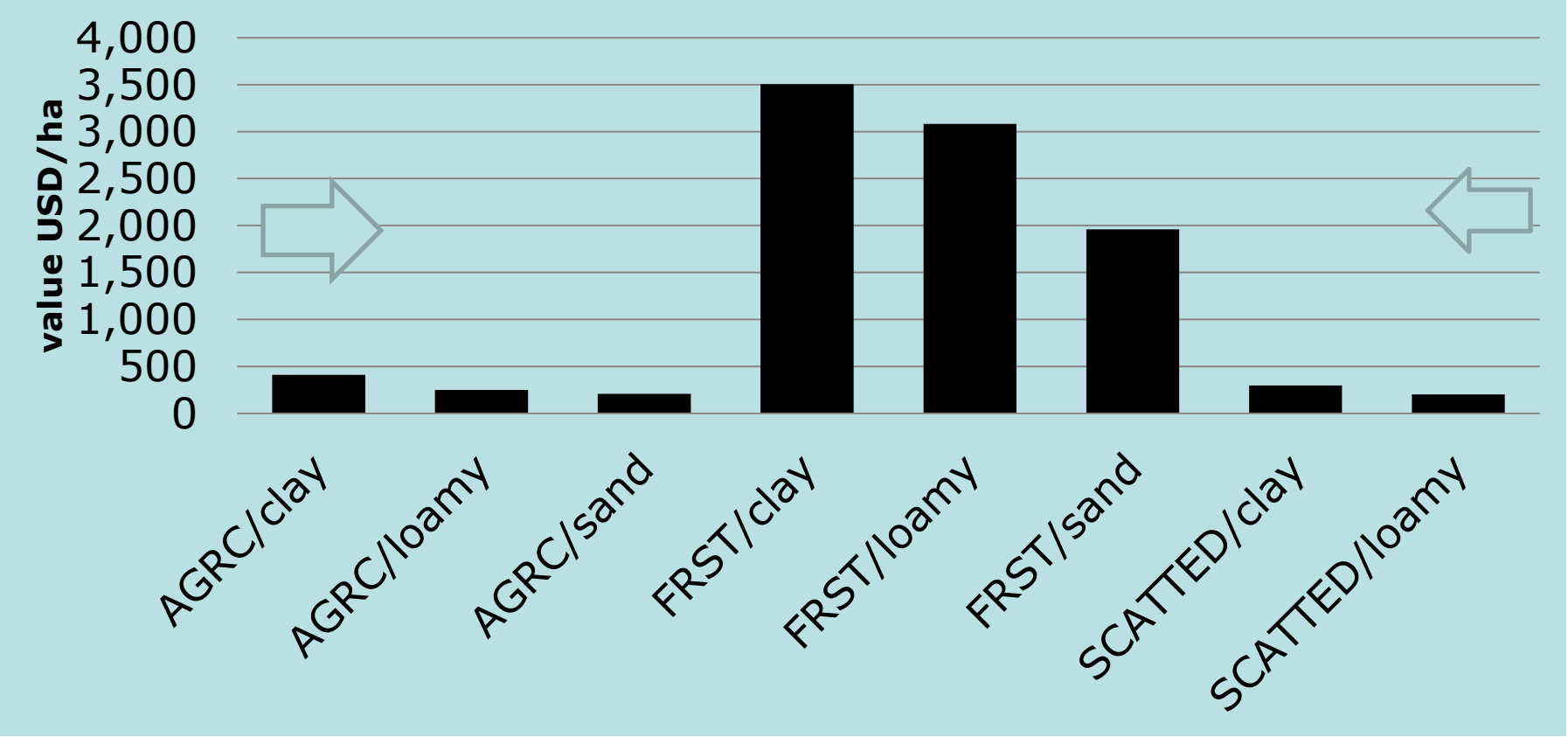
$$VHRU_i = CYI_i * VCROP$$

CYI_i is the weight index from the normalized simulated crop yield

Crop value at HRU level

HRU	Yield kg/ha	Value/ha (USD)
FRST/clay	5,453	3,500
FRST/loam	4,794	3,000
FRST/sand	3,049	1,900
AGRC/clay	637	410
AGRC/loam	388	250
AGRC/sand	323	210
SCATTED/clay	464	300
SCATTED/loam	314	200

Where to Conserve & develop

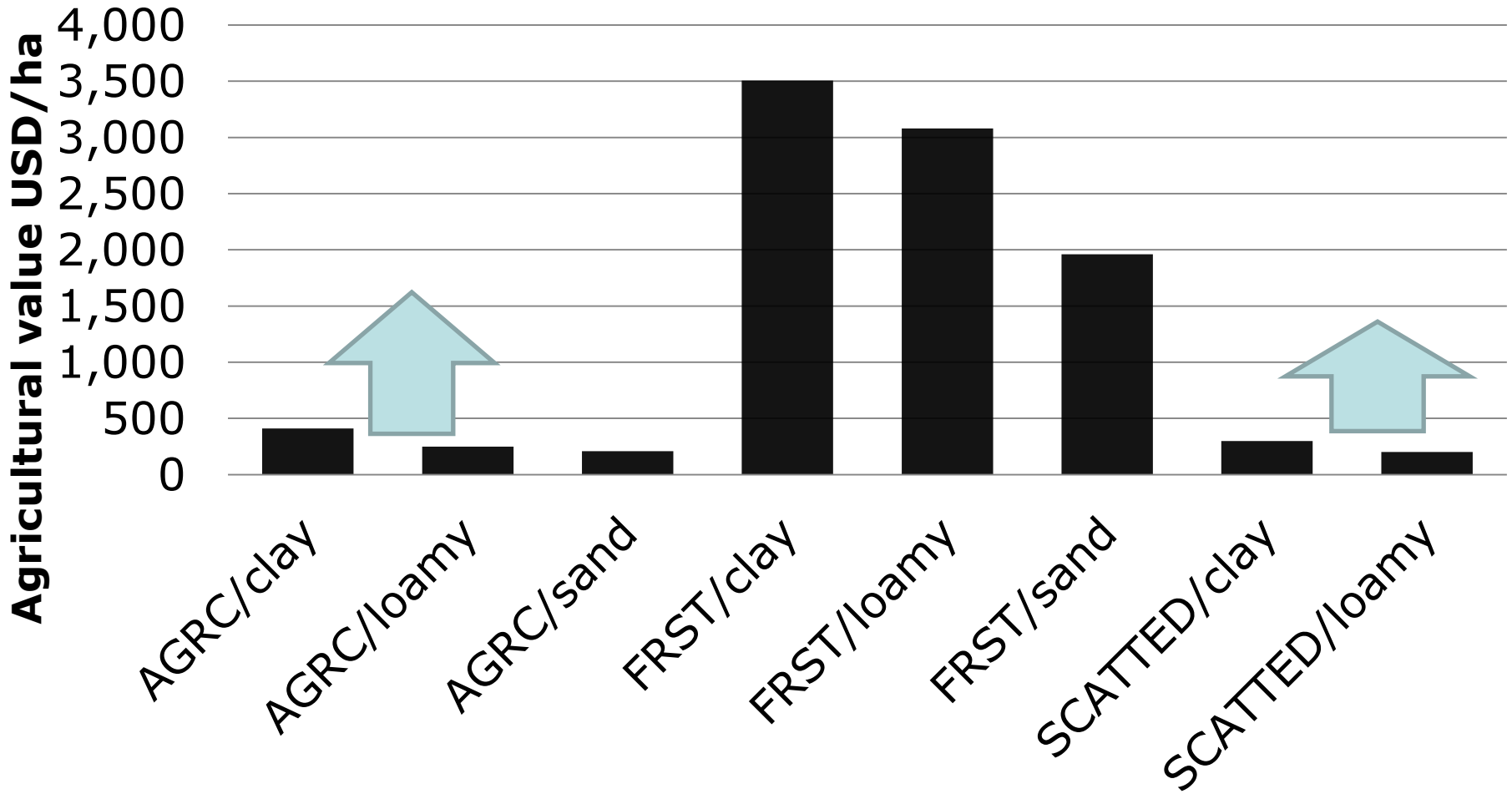


How to conserve and develop

Conservation by development

- Food security
- Reduced poverty
- Health forests
- Cost effective

Conservation by development



Conclusion

- SWAT simulated crop yield fits well as link variable between the biophysical and socioeconomic attributes in the watershed
- Integrated economic valuation and SWAT model supports sustainable watershed management.

- Improving the crop productivity in the study area would bring about the win-win situation between conservation and development goals.

Thank you!