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1. Introduction

- Landscape modifications in south-western Ghana (Multiple pressures on the landscape)
- Consequences on landscape patterns, ecosystems services, and landscape sustainability
- Need to advance the multifunctionality and sustainability of the landscape

Objective

- Assess the landscape structural dynamics and ecological processes against sustainable outcomes

2. Method

Adopted the Geodesign approach integrated with the concept of ecosystem services for sustainable outcomes

- Land-cover classification using Geo-information techniques
- Stakeholder workshops
 - Identify local ecosystem services
 - Identify transitional rule-set for spatial simulations
 - Spatially explicit modeling of perceptions on land use patterns
 - Identify alternative land use options
- Impact assessment and decision-making

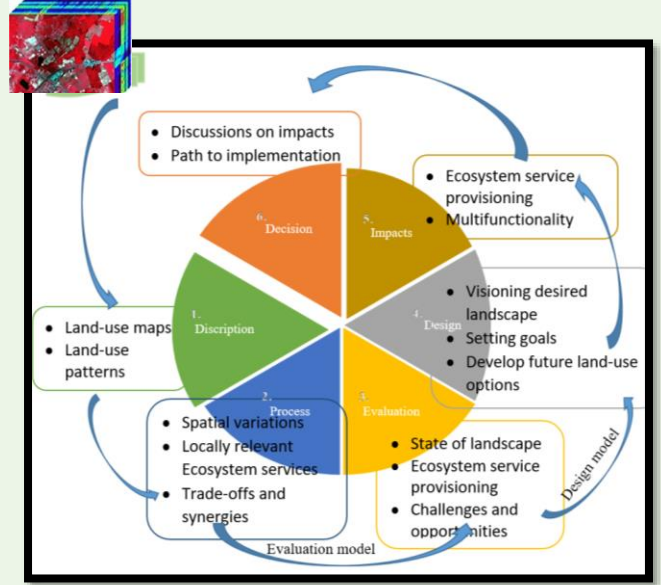


Fig 1. Geodesign approach, (Steinitz, 2012; Tran et al., 2020)

3. Results

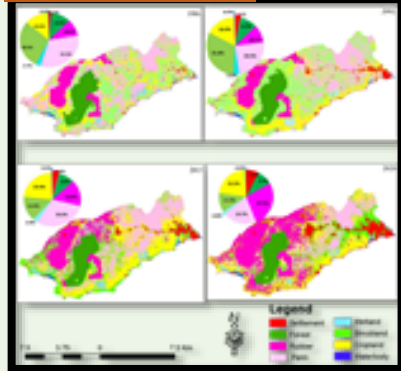


Fig 2. Land cover map

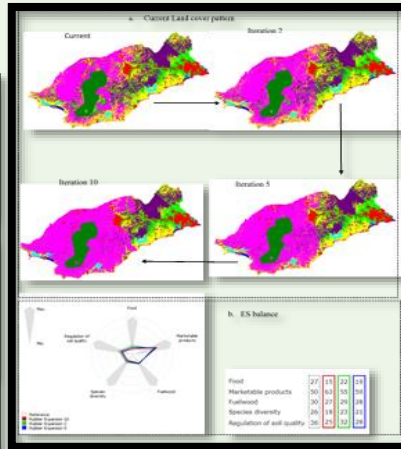


Fig 3. Impact of rubber expansion on ecosystem services under business-as-usual scenario

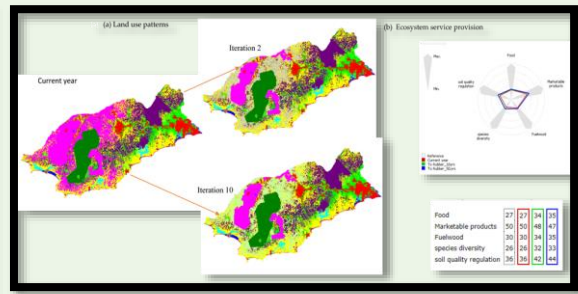


Fig 4. Impact simulation of alternative land use scenario on the provision of ecosystem services

Table 2. Land use options

Land-use options	Description
Urban greens	Integrating home gardens, and vertical farming, in residential areas
Open space restoration	Retrieving open spaces for green restoration
Rubber mixed stands	Conversion of mono-cropping rubber into rubber agroforest, intercropping with other food crops and economically viable crops
Selective land preparation	Retaining trees and shrubs on land during land preparation for farming and establishing a rubber plantation
Mangrove restoration	Restoration of degraded mangrove sites
Soil conservation	Practicing mulching, composting, earthworm circulation
Cropping sequence	Practicing relay intercropping

Table 1. Percentage change in land cover types from initial size

Year	1986	2002	2015	2020	Percentage change			
					1986-2002	2002-2015	2015-2020	1986-2020
LULC types	Ha	Ha	Ha	Ha				
Settlement	802.44	1867.41	2282.04	4412.88	132.72	22.20	93.37	449.93
Forest	6341.49	5663.79	5217.66	5315.04	-10.69	-7.88	1.87	-16.19
Rubber	5846.13	5915.88	9309.24	15939.54	1.19	57.36	71.22	172.65
Palm	18866.25	14264.64	17479.26	11491.56	-24.39	22.54	-34.26	-39.09
Wetland	1561.32	1869.21	1671.03	1174.86	19.72	-10.60	-29.69	-24.75
Shrub land	16820.55	18557.82	8684.55	6676.29	10.33	-53.20	-23.12	-60.31
Cropland	7699.95	9874.35	13348.80	12962.43	28.24	35.19	-2.89	68.34
Waterbody	355.59	280.62	301.14	321.12	-21.08	7.31	6.63	-9.69
Total	58293.72	58293.72	58293.72	58293.72				

4. Discussion

- Expansion in rubber and settlement is due to rubber outgrower schemes and oil discovery developments respectively
- Drivers of land use change pose a risk of a decline in ecosystem services on the landscape and a threat to landscape sustainability
- Locally identified alternative land use options are capable of advancing the multifunctionality and sustainability of the landscape
- The geodesign approach assisted local land users to
 - Asses the structural dynamics and ecological process
 - Identified locally adaptable land use options for sustainability outcomes



Photo credit @ Kwabena Amankwa

5. References

- Steinitz, C. (2012). A framework for geodesign: Changing geography by design.
- Tran, D. X., Pearson, D., Palmer, A., & Gray, D. (2020). Developing a landscape design approach for the sustainable land management of hill country farms in New Zealand. *Land*, 9(6), 185.

