The implications of land use and land cover changes on natural resource base in Central Malawi: A case of Dedza District

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Overview

- Background information

- Materials and methods

- Results and discussion

- Recommendation

Background information

- Studies of land use and land cover (LULC) changes have become vital in managing natural resources and monitoring of environmental change.

- Anthropogenic activities such as mining, deforestation, fires, human settlements and agricultural intensification have been reported as the major drivers to changing land use and land cover (LULC) locally, regionally and globally

Background information Cont'd

- These changes have directly or indirectly contributed to a decrease in the availability of natural resources, which have ultimately compromised the ability of the ecosystem to provide goods and services for human sustenance

- Dedza District like any other District in Malawi has experienced tremendous LULC changes

Background information Cont'd

- To date, the impacts/implications of the changing LULC in Dedza District on natural resources are not well-known

- An in-depth understanding of the implications of the changes taking place in the study area on natural resources and is important for decision-makers in order for them to develop strategies and interventions that will assist rural communities to cope with the changing LULC in the study area as well as sustainably manage the natural resources.

Study area

Figure 1. Map of Dedza District
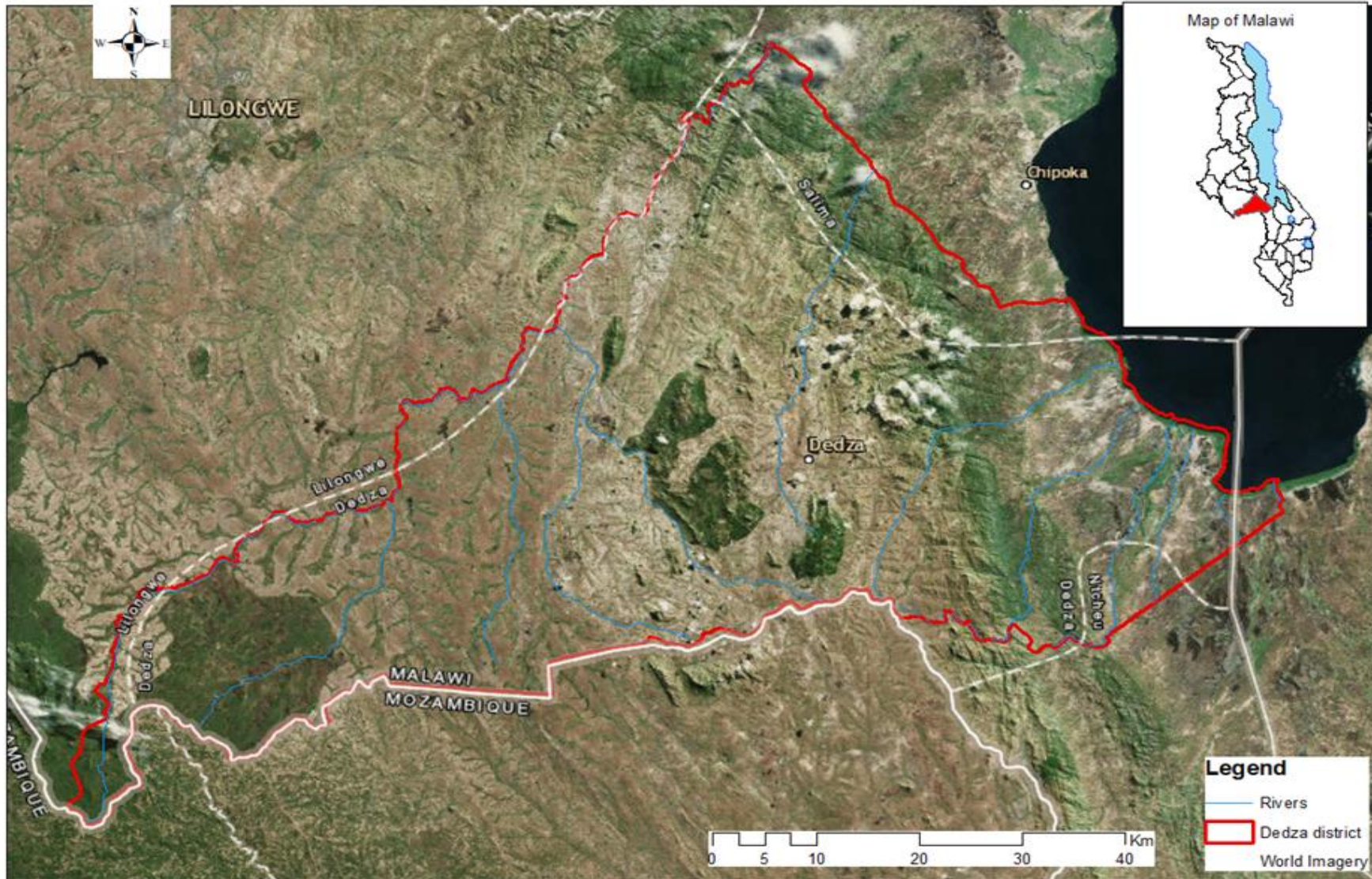
- Area = 3,624 km²

- Population: 830,512 Dominant land cover features: agricultural fields, forest, water and settlements

Methodology

A. **Land use and land cover dynamics**

- Hybrid procedure using both supervised and unsupervised classification was employed to generate LULC maps

- The study area was classified into six (6) LULC classes

- Accuracy assessment was achieved through a combination of Google earth professional images, ancillary data, field surveys conducted in October 2017 and the researcher's knowledge of the study area.

Methodology Cont'd

B. Primary data collection and analysis

Primary data was collected by means of:
- ❑household surveys (HHs)
- ❑focus group discussions (FGDs)
- ❑key informant interviews

C. Data Analysis

- Change detection was done using ArcMap 10.5.
- The socioeconomic data derived from the questionnaire were analysed using SPSS v25

Methodology Cont'd

Responses by the respondents regarding the impacts of LULC dynamics were ranked. The ranking exercise was computed using the principle of a weighted average ranking index as adopted in Musa et al. (2006) and Solomon et al. (2018). For this approach the following equation was applied:

$$Index = \frac{R_n C_1 + R_{n-1} C_2 \cdots + R_1 C_n}{\sum R_n C_1 + R_{n-1} C_2 \cdots + R_1 C_n}$$

where R_n = value given for the least-ranked level (for example, if the least rank is the 5th, then R_n = 5, R_{n-1} = 4, R_1 = 1; C_n = counts of the least ranked level (in the above example, the count of the 5th rank = C_n, and the count of the 1st rank = C_1).

RESULTS

LULC dynamics

Figure 2: LULC Maps for 1991, 2001 and 2015
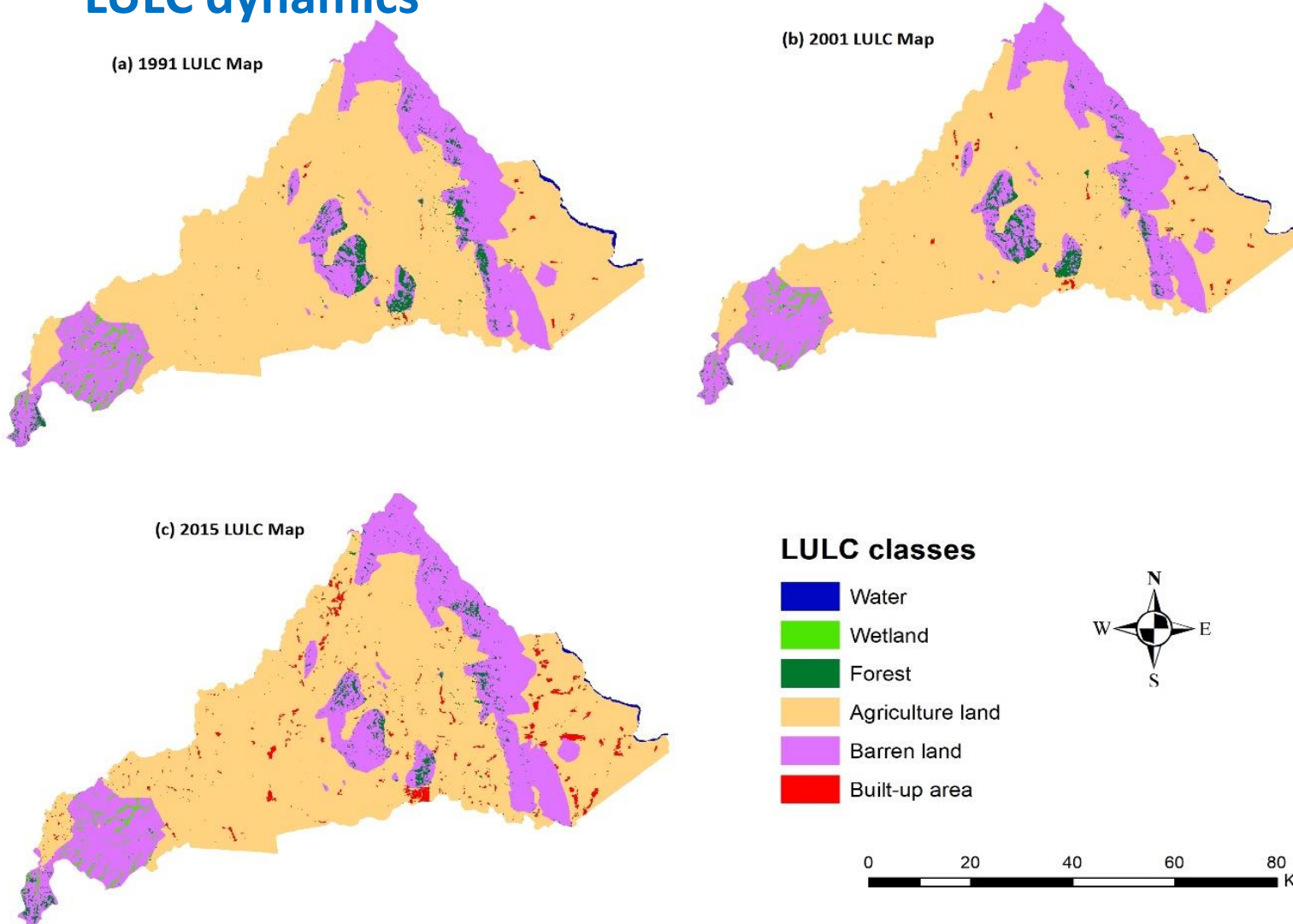
LULC Class	1991		2015	
	Area (Ha)	%	Area (Ha)	%
Water	1380.60	0.37	899.55	0.24
Wetland	3626.73	0.96	2680.29	0.71
Forest	9939.15	2.64	6237.63	1.66
Agriculture	267,977.43	71.3	260,879.31	69.41
Barren	92,185.38	24.53	97,174.62	25.85
Built-up	761.67	0.2	7999.56	2.13
Total area	375,870.96	100	375,870.96	100

RESULTS Cont'd

Socioeconomic characteristics of the respondents

Table 1: Household characteristics of the sampled respondents (*N* = 586)

Household attribute	Value
Average household age (years)	39.2
Gender (female, %)	63.3
Head of the family (male, %)	71.7
Marital status (married, %)	78.7
Education (literate, %)	77.8
Occupation (Farmer, %)	81.6
Mean household size (no.)	5.6
Mean land holding size (acres)	2.32
Ethnic group (Chewa, %)	50.7
Mean income (MK/year*)	286,843.26
Sources of income (farming, rank)	1
Domestic stove used for cooking (3-stone open fires, %)	88.2%

Note: * Malawi currency at the time of the study, 1 USD = 721.30.

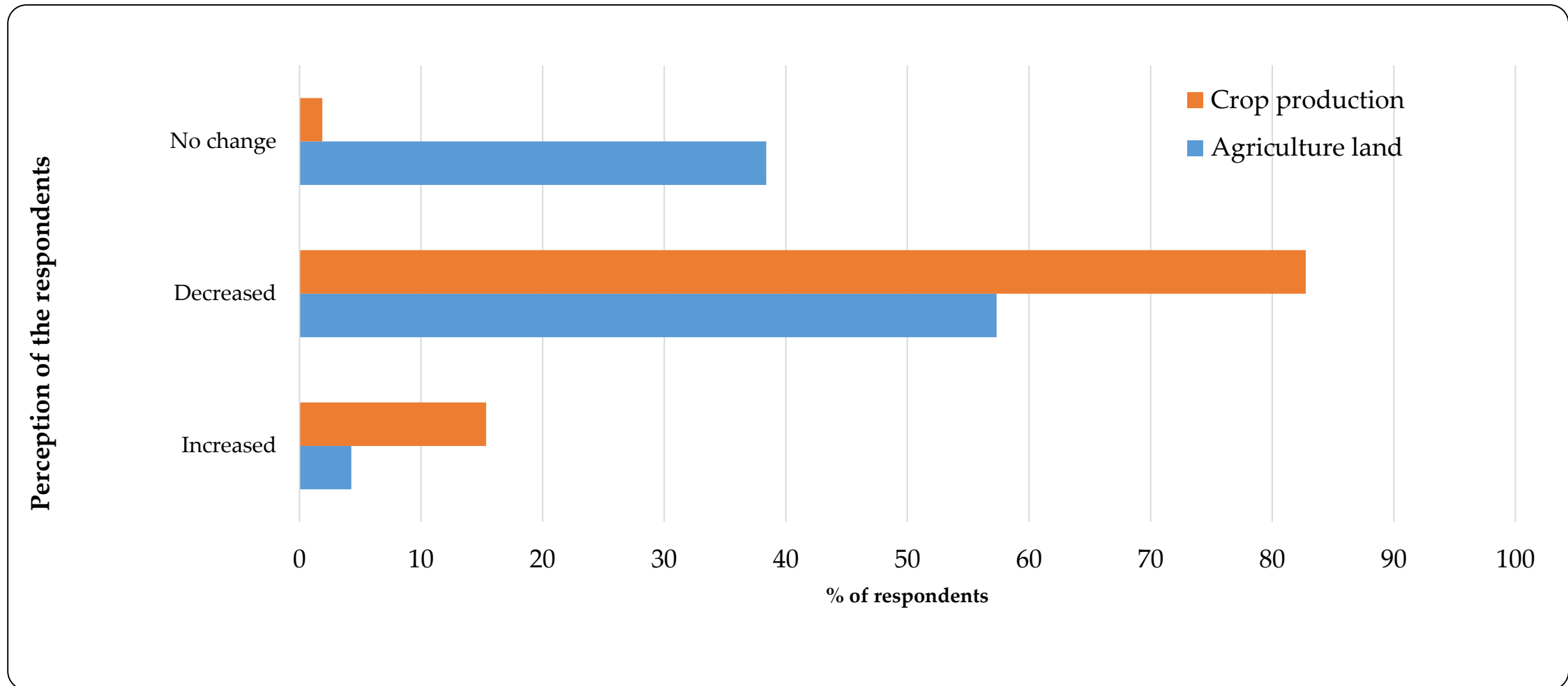# RESULTS Cont'd

Impacts of LULC changes on agricultural land

Figure 3: Perceptions of respondents on agricultural land and crop production

RESULTS Cont'd

Table 2: Causes of declined crop production in the study area

Causes	No. of Respondent Per Rank					Weight	Index	Rank
	1	2	3	4	5			
Soil infertility	141	85	66	33	29	1338	0.216	1
Unreliable rainfall	98	116	54	44	13	1217	0.196	2
Pests and diseases	55	37	50	24	15	636	0.103	6
Limited/inadequate land	9	20	24	25	19	266	0.043	8
Lack of agricultural inputs	46	44	56	29	12	644	0.104	5
Inadequate labour	12	13	8	12	12	172	0.028	10
Low marketing prices	12	19	14	11	9	209	0.034	9
Lack of money for inputs	38	54	57	29	23	658	0.106	4
High cost of agricultural inputs	46	59	51	25	16	685	0.110	3
Poor access to subsidy programme	22	20	17	12	17	282	0.045	7
Soil erosion and waterlogging	5	6	7	8	4	90	0.015	11
Lack of access to information on improved agricultural technologies	0	0	1	1	0	5	0.001	12

RESULTS Cont'd
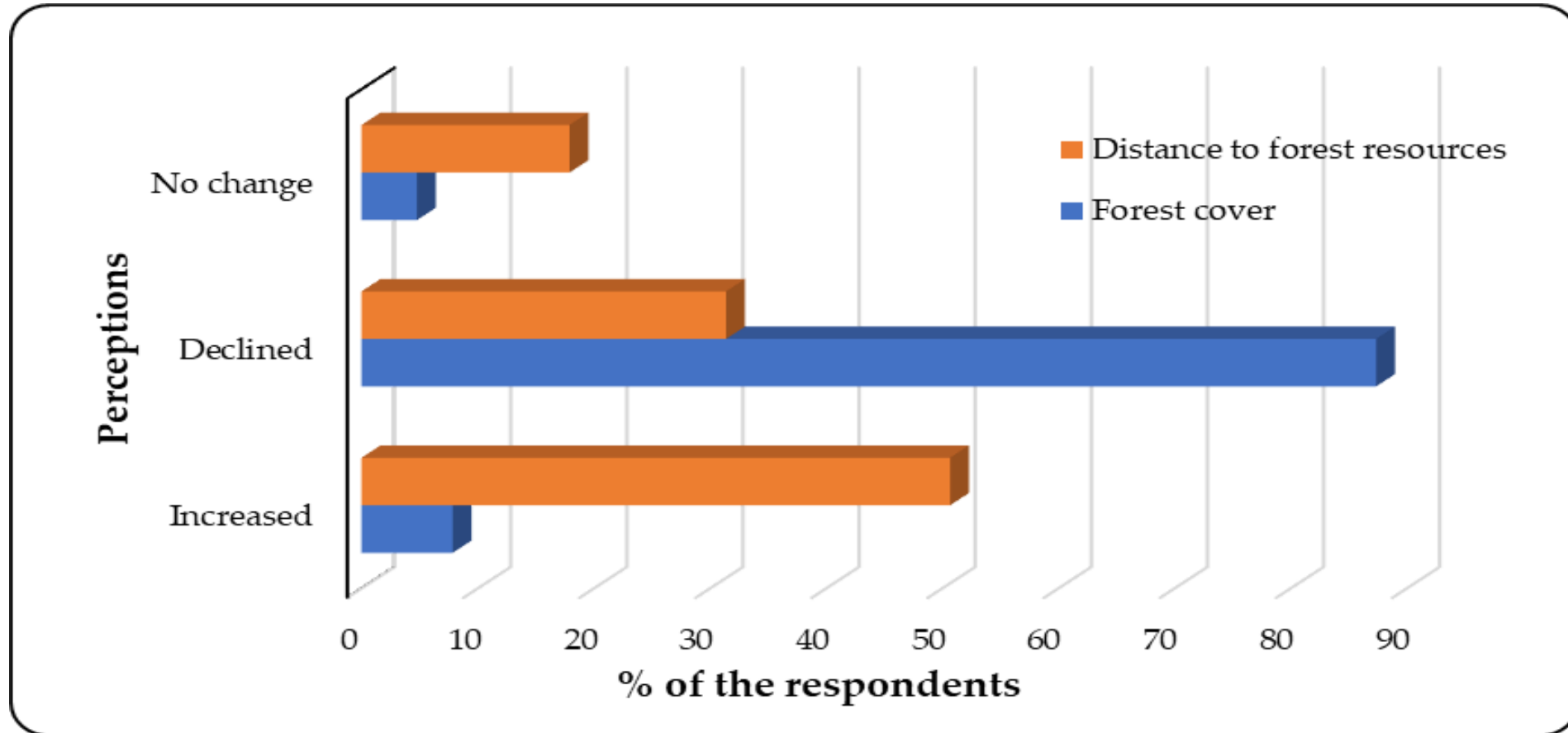
Impacts of LULC dynamics on forest resources

Figure 3: Perceptions of respondents' forest cover and distance to forest resources
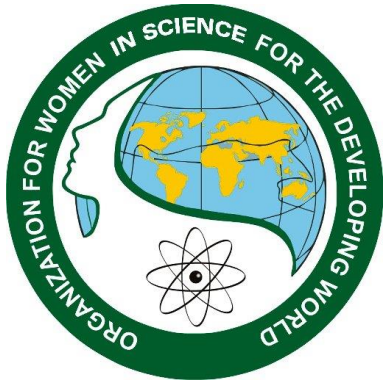
RESULTS Cont'd

Table 3: Impacts of declined forest cover to communities

Impacts of deforestation	No. of Respondent Per Rank					Weight	Index	Rank
	1	2	3	4	5			
Lack of firewood	206	135	89	34	14	1919	0.269	1
Lack of wood for construction	36	112	67	73	30	1005	0.141	4
Floods and droughts	127	72	77	37	19	1247	0.174	3
Depletion of water resources	42	50	53	49	26	693	0.097	5
Decline in scenic value	6	18	31	23	42	283	0.040	7
Loss of soil fertility	74	116	101	56	30	1279	0.179	2
Unreliable rainfall	73	35	27	14	5	619	0.087	6
Heavy winds	2	12	13	2	1	102	0.014	8

Recommendation

- The consequences and undesirable impacts of the changes on natural resources in this study need urgent attention by the natural resource managers, planners and decision makers.

- It is very clear from findings of this study that government and other stakeholders involved in the management of natural resources and welfare of communities need to work on developing and redesigning appropriate , rational, proper, holistic and integrated approaches implementing policies and strategies that promote management, protection, conservation and restoration of natural resources in Dedza landscape.

- This study also recommends positive steps to be undertaken through innovative approaches which combine multi-sectoral approach and commitments of other stakeholders to work closely with communities through participatory natural resource management to reverse the undesirable current LULC change trends and impacts of these on the natural resource base

THANKS FOR YOUR ATTENTION