PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
J Hum Ecol, 48(2): 313-319 (2014)
DOI: 10.31901/24566608.2014/48.02.12

Unpacking the Ecological Remnants of Zimbabwe's Land Reform Using the Ecological Footprint Tool

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KEYWORDS Land Use. Ecological Resources. Resettlement. Environmental Sustainability. Resettlement

ABSTRACT Land ownership is a central issue to the livelihoods of the predominantly rural population of Zimbabwe. Since 1980, Zimbabwe instituted land reforms to redress colonial land policies. A successful land reform programme should incorporate land use options that galvanise ecological sustainability. Striking a balance among land redistribution, productivity and ecological sustainability is one of the vexing challenges that policy makers in Zimbabwe face. Critics of Zimbabwe's land reform have often characterised this challenge as a remnant of the government's move from the willing buyer willing seller to the accelerated approach. Through case studies and applying the Ecological Footprint tool, this paper scrutinises the ecological implications of land reform in Zimbabwe's resettled areas. Both primary and secondary sources in Chirumanzu District of Zimbabwe provided data for this paper through household questionnaires and key informant interviews. The Ecological Footprint (EF) results portray ecological sustainability. The research concludes that the major shift in the land reform approach since the year 2000 has till retained environmental sustainability.

INTRODUCTION

Zimbabwe is a predominantly rural country where access to productive land resources is essential for social and economic development. However, between 1893 and 1980, the colonial government passed segregatory and discriminatory legislation such as the Land Husbandry Act of 1930, which deprived the majority of the Africans of the right to own productive land. This divided the country into prime land for minority Europeans and largely infertile and inhospitable land as "Native Reserves" for the African majority. The result was that 3 per cent of the population got entitlement to about 39 per cent of the national total arable land (Chitsike 2003; Moyo 2005; Mushimbo 2005). African economic and social development was, therefore, stunted. It is against this background that the new government implemented land reforms after independence from Britain in 1980 to address these anomalies. However, land reform in Zimbabwe has been described as piece-meal and reactive in approach (ZERO 2005) culminating in environmental sustainability challenges.

Land reforms aim to promote noble ideas central to human livelihoods such as food security. Musyoki (1999) and Mohamed-Katerere (2000) observe that a successful land reform programme should incorporate land use options not only addressing social and economic viability, but environmental sustainability as well. Environmental sustainability issues are among a host of vantage points taken by Zimbabwe government critics when it abandoned the intensive package approach in 2000. The intensive package approach entailed the provision of adequate basic support services such as access roads, water, and sanitation facilities, dipping tanks, clinics, schools and rural service centres, before or as soon as settlers had occupied the redistributed land (Moyo 1995; ZFU 1995; Clover and Eriksen 2009). The associated comprehensive planning done before the settlers' relocation ostensibly guaranteed environmental sustainability.

The new approach adopted in 2000 entailed an accelerated relocation of settlers to new settlement areas before basic social services and infrastructure had been established (Land Reform Task Force 1999). It became known as The Fast Track Land Reform Programme (FTLRP). It was viewed by many analysts as a radical and controversial exercise. Existing landowners were sometimes forcibly removed from their hitherto farms. Methods of land acquisition, beneficiary selection and resettlement support changed to a completely command-driven approach (Chiremba and Masters 2010). Beneficiaries occupied farms before any provision of basic infrastructure and Government officials followed at a later stage to "demarcate" the land (Muyengwa and

Sango 2008). Critics viewed this approach as retrogressive and a recipe for serious ramifications on, among others, the sustainability of the environment in resettled areas. As a result there is a host of publications debating the land reform programme in Zimbabwe.

Environment and Land Reform Debate

Different publications (ZERO 2005; Murombedzi 2004; Manjengwa 2006, 2009) point to environmental sustainability challenges in resettlement areas in Zimbabwe. The Zimbabwe Environmental Research Organization (ZERO) (2004) argues that the post-colonial era in Zimbabwe has been characterised by growing levels of environmental degradation and, to date, land reform has done little to improve the environmental sustainability of rural land use practices. The organisation adds that the pace of environmental degradation has nowhere been quicker than in resettlement areas. Clover and Eriksen (2009) add that despite the stated intention of addressing some of the problems of overcrowding and inequality, land reform in Zimbabwe has paradoxically failed to address overcrowding and resource scarcity on marginal lands, but instead precipitated new ecological, social and economic challenges. Compounding the situation is that environmental sustainability is not mainstreamed in the land reform process (Manjengwa 2006).

Harts-Broekhuis and Huisman (2001) point out that resettlement schemes have been implemented in some comparatively vulnerable and agro ecologically poorly endowed regions of the country. Serious environmental degradation tailed demographic and economic changes that have produced a semblance of communal areas in resettlement schemes (Mukwada 2007; Sikor and Muller 2008). Adopting the fast track approach was, therefore, viewed as a contributory factor in worsening the already bad environmental situation.

Manjengwa (2009: 37) observes that there was "environmental degradation occurring as a result of accelerated resettlement causing conflicts over natural resource use…" This was supported by Murombedzi's (2004:18) observation that "…settlers are …asset strippers, cutting down trees, hunting wild animals and exploiting other natural resources so as to open up new lands for agriculture, reduce competition and protect their livestock from predation, but also to source capital to invest in their new agriculture enterprise." Estimates suggest that resettlement resulted in deforestation ranging between 100,000 and 320,000 hectares per year (Ministry of Lands 2004). Gold panning along Zimbabwe's rivers also mushroomed since the beginning of the FTLRP. Panning takes place uncontrolled and unsystematically, usually on riverbeds, banks and flood plains with no concern for the environment (Manjengwa 2009). The apprehension is the ability of such a scenario to sustain the ecosystem services which humanity will always need for survival.

However, according to a Zanu (PF)'s National Congress Report (2000), one of the objectives of the FTLRP was to reduce pressure on land and enhance environmental sustainability. The Land Reform Task Force (1999:11) identifies the intention to "promote environmentally sustainable utilization of land", as one of the objectives of the FTLR. These are, however largely dismissed as political statements which have not been matched with implementation on the ground.

Most of the arguments raised emanate from the belief that for a sustainable environmental situation to prevail, humanity should extract ecological resources from, and release waste to the environment in quantities that the biophysical environment has the capacity to supply and absorb, respectively. In this context, environmental sustainability is considered in terms of the natural resources available to support life (biocapacity) against what humanity is extracting (Ecological Footprint) from nature. That is the first point of departure for this paper.

While many of the publications cited above allude to obvious human activities ostensibly causing environmental degradation in resettled areas, none of them supports their views with a robust scientific study. This is the second point of departure for this paper. Their main basis is that the FTLRP lacked planning. However, Chaumba et al. (2003) contend that order was never completely lost and that the FTLRP was a planning mishap is media propaganda.

The aim of this paper is to present results of a scientifically robust and transparent calculation of the demands humanity places on the natural environment from a scientific investigation of the resettled areas of Chirumanzu District of Zimbabwe. This would reveal the environmen-

tal sustainability status obtaining before and after the implementation of the FTLRP. The adoption of a natural resource supply and consumption approach affords the accomplishment of this aim as presented in the following section.

METHODOLOGY

There are existing acceptable scientific methods that can be employed to track the majority of the resources people consume and the wastes they produce. The resources consumed and the wastes generated can be measured in physical terms (Monfreda et al. 2004). This paper considers environmental sustainability in terms of the natural resources available to support life, called biocapacity (BC), against what humanity is extracting from, and returning as waste to, the ecosystem, termed Ecological footprint (EF). This is done through tracking the regenerative capacity of an ecosystem in terms of natural resource flows using the Ecological Footprint (EF) tool. These resources and waste flows are measurable in terms of biologically productive area of land necessary to maintain the flows. The unit of measurement for the biologically productive area is global hectare (gha).

The EF accounts for consumption of the environmentally renewable resources and the waste assimilative capacity by a given population over specified time (Lewan and Simmons 2001; Weidman and Lenzen 2007). The EF is a measure of sustainability. It advocates for, and measures the use of *interest* rather than *capital*. The system compares the demand on ecological services (EF) to the available supply, biocapacity (BC) (Ewing et al. 2008, 2010). The EF is the area of ecologically productive land exploited to maintain a population's consumption patterns and absorb its wastes with the prevailing technology (Wackernagel and Rees 1996, 1997; Wackernagel et al. 2002; Moldan et al. 2004; Mayer 2008). The sustainability of the population's consumptive patterns is determined by the ecological productivity of the said land, termed biological capacity or biocapacity (BC).

The assumption of the EF tool is that all resources consumed by humanity can be traced back to an area of land, in global hectares (gha), on the earth's surface. The EF tool captures natural resource flow and clearly reveals where there are ecological deficits and reserves (Wackernagel et al. 2002). This is done through the calculation of the EF and BC of each land use category. Consequently, there are six land uses whose EF and BC are calculated separately. This research, however, considers four land uses, namely forest, built-up, cropland and grazing land uses. The other two land uses are of inconsequential application to the study area. This is because the study area is rural and has no measurable exploitation of water resources, which the other two land use classes cover.

The disaggregated calculations are condensed into a final consumption (EF) and supply (BC). A comparison between the EF and the BC determines the environmental sustainability status of the specific land use type or the overall area. A BC larger than EF gives an ecological reserve signifying a sustainable environment. Conversely, a BC less than EF give an ecological deficit, signifying an unsustainable environment. Additionally the Ecological Ratio (ER) portrays the extent of the sustainability situation. An ER is determined by dividing the EF by the BC. An ER of one depicts sustainability, greater than one depicts unsustainability while an ER less than one depicts sustainability, as illustrated by formula 1.

$$-s - 1> > ER >1 - s \quad (1)$$

Where

S = sustainability

ER = Ecological Ratio

A fortiori, four land use types - cropland, grazing land, forests for timber and firewood, and built up land (Wackernagel et al. 2002; Ewing et al. 2008, 2010) - are evaluated in this paper. Each land use type has a supply side (BC) computed using formula 2 and demand side calculated by employing formula 3 (Ewing et al. 2008; Kitzes et al. 2008).

$$BC = A \times YF \times EQF \quad (2)$$

Where

A = the area available for a given land use type,

YF and EQF are yield factor and equivalence factor, respectively, for the land use type in question.

$$EF = \frac{P}{YD} + EQF \quad (3)$$

Where

EF = Ecological Footprint

P = the amount of a product harvested or waste emitted

YD = district average yield (t $wha^{-1}yr^{-1}$)

EQF = equivalence factor for the land use type in question.

It is important to emphasize that the EF tool traces resource flows. Therefore, weather the land used to produce goods falls within the physical boundary of the consumer or not, the ecological demand is placed under the consumer. The tool computes land used to produce goods within the resettled areas. It also calculates the land area embodied in the goods imported into or exported out of the district. This culminates in EF of Production (EF_P), Imports (EF_I) and Exports (EF_E) to cater for the ecological land used in the production of goods within the resettled area as well as embodied in imported goods as well as exported goods, respectively. To get the actual ecological land consumed in the district, the EF of consumption (EF_C), production and imports are added together and exports subtracted.

To execute the above calculations, both primary and secondary data were collected for the EF tool to determine environmental sustainability. Primary data were collected through the administration of questionnaires to sampled households in Chirumanzu District. Government offices provided secondary data across all the four land use classes. The EF tool uses a year as a temporal unit of measurement. Therefore, all the data collected for this paper was for the year 2010 as ten years are long enough for human activity to have a measurable influence on the ecosystem.

Consequently a sample size of 150 households represented the 5167 households in the resettlement areas (95% at 7.89 confidence) as at April 2010. The sample was taken from both new and old resettlement areas as shown in Table 1. Systematic sampling at multiple stages and clusters was followed to select households. Resettlement was put into two clusters, namely old and new resettlement. Under each cluster there is extensive, semi-extensive, semi-intensive and intensive settlement scales. Under each scale are different farms which have different villages. Therefore, multiple stages of sampling had to be done before actual households could be sampled.

The household survey solicited for biophysical information from the respondents. Data such as area (ha) put under different land uses, production from different land uses, grazing resources, livestock resources and crop production were gathered using a questionnaire. The questionnaire was designed following the EF requirements.

Key informant interviews with officials from the Ministry of Lands and Rural Resettlement, AGRITEX, Veterinary Services as well as the District Administrator provided additional data to the primary data collected through household surveys. Both primary and secondary data were then captured into Microsoft Excel worksheets for computation of the EF and BC of the resettled areas. Following the application of the above formulae, BC and EF of the old and new resettlement were compared to find the ecological reserve (or deficit as the case may be). The following section deals with the results and their implications on environmental sustainability. In addition the section reveals whether the critics of the FTLRP were correct or off the mark.

RESULTS AND DISCUSSION

The results presented in this section elaborate calculation processes outlined in the methodology section. The overall results present both old and new resettlement areas producing an ecological reserve. However, it is important to delve into the individual land uses to shed more light into the environmental sustainability case at hand. Significant to not, though, is that built up land cannot practically produce an ecological deficit as construction is done on land physically available in the resettled areas. As such not much attention will be directed at the built up land footprint.

While some researchers noted that land reform has increased household crop production and improved livelihoods (Deininger and May 2000; Scoones et al. 2010) and income (Chaum-

Table 1: The sample size

Resettlement type		*Old resettlement*	*New resettlement*	*Total*
Households	Number	861	4306	5167
	Per cent	15.7	84.3	100
Sample size (Households)		24	126	150

ba et al. 2003; Zikhali 2008) the cropland and grazing land EF should not be misconstrued to be referring to that. As such the ecological deficit recorded by cropland use does not mean a drop in crop production. Neither does the ecological reserve recorded in grazing land use mean increased livestock production. The EF is concerned with the exploitation of productive land in relation to its biocapacity. The Footprint refers to the environment's regenerative capacity exploited in the production of the said crops and livestock.

Environmental sustainability is concerned with maintenance of the ability of the ecological environment to continue providing that capacity indefinitely (Goodland 1995). The maintenance of ecological sustainability ensures that resettled farmers will not find themselves living in a land base with ever decreasing biocapacity. Thus, in terms of cropland use, the population is living unsustainably and this may have a negative impact on food security in the future.

Interesting to note is the result showing that both old and new resettlement areas produced an ecological deficit as shown in Tables 2 and 3. This supports the observation by ZERO (2005) that environmental management has always been poor in the resettled areas of Zimbabwe. Worth noting is that many households have extended their arable land in the hope of increasing production. This could be the most plausible explanation for the ecological deficit. This is chiefly because Chirumanzu is in agro ecological region III where conditions for rain fed crop production are not conducive except under irrigation. Rain-fed subsistence farming by the resettled farmers does not produce meaningful crop yields. Many farmers hence resort to arable land expansion in the hope of boosting crop yield compromising environmental sustainability in the process.

An examination of the grazing land footprint can shed some more light on the cropland footprint. The household interviews revealed that only 35% of the sampled households own some form of livestock. Out of that 31% own less than 10 livestock species. The dominant livestock species are fowl and goats, which exploit very little biocapacity. As such, it is arguable that the low livestock ownership record is an indication of the farmers' inclination towards crop cultivation. This can be argued to have contributed to the large ecological reserve in grazing land use.

Additionally, the government demands that beneficiaries in both new and old resettlement take effective occupation' of the allocated land. Effective occupation is personified by activities on the land. Therefore, the beneficiaries without livestock resort to crop cultivation and illegal arable land extension as a sign of effective occupation. Consequently this eats into the cropland biocapacity while leaving out a large ecological reserve in the grazing land use. Subsequently, the grazing land ecological reserve can be termed *livestock limited* environmental sustainability.

Table 2: Chirumanzu District old resettlement ecological footprint account

Demand type [-]	*EF_P [gha]*	*EF_I [gha]*	*EF_E [gha]*	*EF_C [gha]*	*Biocap [gha]*	*BC-EF_C [gha]*	*ER* [-]*
Cropland	54358.39	1329.59	1847.61	53840.36	11007.64	-42832.72	4.9
Grazing land	1367.18	391.52	418.87	1339.83	190073.52	188733.69	0.01
Forest land	314.36	0.00	0.00	314.36	2408.33	2093.97	0.13
Built up land	13994.23	-	-	13994.23	15554.04	1559.82	0.9
Total	70034.15	3823.32	4515.54	69341.93	219043.53	149701.60	0.32

*ER = Ecological ratio. EF_C/Biocap

Table 3: Chirumanzu District new resettlement ecological footprint account

Demand type [-]	*EF_P [gha]*	*EF_I [gha]*	*EF_E [gha]*	*EF_C [gha]*	*Biocap [gha]*	*BC-EF_C [gha]*	*ER [-]*
Cropland	72889.53	1329.59	2891.93	71327.18	59104.71	-12222.47	1.21
Grazing land	16121.69	2493.73	2667.93	15947.49	190073.52	174126.02	0.08
Forest land	1966.48	0.00	0.00	1966.48	2408.33	441.86	0.82
Built- up land	1527.24	-	-	1527.24	15554.04	14026.80	0.1
Total	92504.94	3823.32	5559.86	90768.39	267140.61	176372.21	0.34

The EF proved to be an effective tool to trace resource flows. A comparison of the grazing land imports and exports reveals that both the old and the new resettlements export more grazing land than they import. This exported biocapacity is considered under the importing areas and not the exporting. Such a scenario could also have contributed to a larger ecological reserve in the grazing land use. The large grazing land ecological reserve contributes significantly to the overall ecological reserve revealing the overall environmental sustainability of the resettled area.

A further examination of the results also shows a similar trend of environmental performance in both the newly resettled areas and the old ones. Both have an ecological deficit in cropland use and a large ecological reserve in grazing land use. It can be argued therefore, that, the new resettlements are a continuation of the old resettlement system in as far as environmental resource consumption pattern is concerned. At the end both resettlement schemes depict a *livestock limited* environmental sustainability situation.

A more discreet picture is painted by the ecological ratio. New resettlement areas reveal a more sustainable land use pattern than the old resettlement. The cropland use figure is telling revelation where the old resettlement ratio is larger than the new resettlement ratio. Even the total ratios favour the new resettlement areas. Consequently some conclusions can be derived from such results.

CONCLUSION

Many publications have attempted to capture the environmental issued related to Zimbabwe's land reform. The majority of them, however, did not back their arguments with robust scientific results, especially in relation to environmental sustainability. That is the major point of departure for this paper. Findings that livelihoods, crop production and household income have improved and order was never completely lost in the new era of resettlement may not need robust scientific research. Employing the EF tool, this paper has revealed that there is a generally environmentally sustainable situation prevailing in both the old and the new resettlement areas.

A perusal of the results shows that the introduction of the FTLRP was not as detrimental to the environment as the popular view puts it. The EF tool produced and painted a better environmental sustainability picture of the new resettlement areas than the old resettlement areas. It is concluded that adopting the FTLRP did not result in the environmental sustainability being compromised. Rather environmental sustainability that prevailed in the old resettlement areas was generally retained.

ACKNOWLEDGEMENTS

The author acknowledges the help from Prof. A. Musyoki and Dr. N. S. Nethengwe for their guidance during the execution of this research. The provision of research funds by the University of Venda, Department of Research and Innovation is also acknowledged.

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