



CLASSIFICATION OF ECOSYSTEM SERVICES IN OMO BIOSPHERE RESERVE AND THE PROVISIONAL SERVICES

*Ayodele A.A., Oyelowo O.J, and Olatidoye O.R.

Forestry Research Institute of Nigeria, P.M.B. 5054, Ibadan, Oyo State, Nigeria

* Correspondence Author Email: adekemitog@gmail.com; +234 703 825 4651

ABSTRACT

This review examined ecosystem services in Omo Biosphere Reserve, Nigeria. The review explored the identified provisional services from the forest resources in this rich ecosystem. The identified forest resources in Omo Biosphere Reserve were listed according to their provisional benefits. This includes 72 different species as sources of food; River Omo serve as the major source of freshwater and supplying other streams within the ecosystem; 8 fiber plant sources and 287 forest plants used as bio-chemicals for medicines and chemical used in soaps making and phytochemicals products. It was concluded and recommended that further studies should be carried out on how to effectively harness the indigenous knowledge behind the utilization of these resources by rural populace and look at ways of introducing some of these products into urban ecosystem and also promote the use of these organic products to help mitigate food insecurity and pollution of the environment from inorganic products.

Keywords: Ecosystem Services, Provisioning Services, Omo Biosphere Reserve

INTRODUCTION

Ecosystem which is a complex interaction between communities of living things and their non-living counterpart performs various functions depending on the context in which it is being viewed and all these functions are interwoven. Human beings are indispensable factor of the ecosystem as they depend on the services provided by the biosphere (Millennium Ecosystem Assessment, 2003).

According to the Millennium Ecosystem Assessment(2005) proposal, ecosystem services are the benefits humans derive from ecosystems which are categorized into provisioning services, regulating services, cultural services and supporting services (Millennium Ecosystem Assessment, 2005). The concept of ecosystem services is broad and is dependent on the objectives and purpose of use. Ecosystem services have been used to explore the roles of biodiversity, policy making, conservation, economic development and human well-being among others.

The European Commission's Science for Environment Policy (2011) stated that healthy ecosystems supports human life and through proper management of the Earth's ecosystems in a sustainable manner, it can continue to provide many services, including the provision of food, fibers, freshwater and fuel, the regulation of climate and water, supporting soil formation and nutrient cycling and enhancing recreational opportunities and increasing human wellbeing. It is important to identify the various services that are available in each ecosystem as this will help to properly plan interventions to mitigate the possible effects that could arise from lack of adequate resources that such ecosystem is expected to provide. Also, understanding the classification of ecosystem services will guide in policy making and better utilization of natural resources.

Omo Biosphere Reserve is an internationally recognized ecosystem with rich biodiversity including the humans who live in enclaves surrounding the forest reserve. The interaction of

people with this reserve cannot be under-estimated as the rural communities solely rely on the natural resources from the forest for source of livelihood and the provision of food. Several stakeholders have developed projects to help mitigate the effects of anthropogenic activities of the enclaves on the forest and the forest natural resources to ensure sustainability. However, there have been limited information or data on the available ecosystem services being utilized by the enclaves. This paper reviewed the past surveys carried out in Omo Biosphere Reserve to assess the utilization of the forest resources and categorize them into different ecosystem services.

Omo Biosphere Reserve

The Biosphere Reserve located in the Ijebu area of Ogun state, a south western state in Nigeria between

latitudes 6° 35” to 7° 05” N and longitudes 4° 19” to 4° 40” E and covers an area of about 130,500 hectares. (Ojo L.O, 2004). The area was constituted in 1925 as a Reserve and a portion of it was established as a Strict Nature Reserve (SNR) in 1946 (Isichei A. O., 1995). Omo Biosphere Reserve is comprised of several communities in forms of small camps or villages dispersed around the whole Forest Reserve (UNESCO MAB, 1999). The Reserve is a rich ecosystem whose natural resources have been harnessed uncontrollable over the years despite all the efforts of various bodies like UNESCO and the Federal Government to control the degradation and indiscriminate use of the natural resources in this ecosystem.

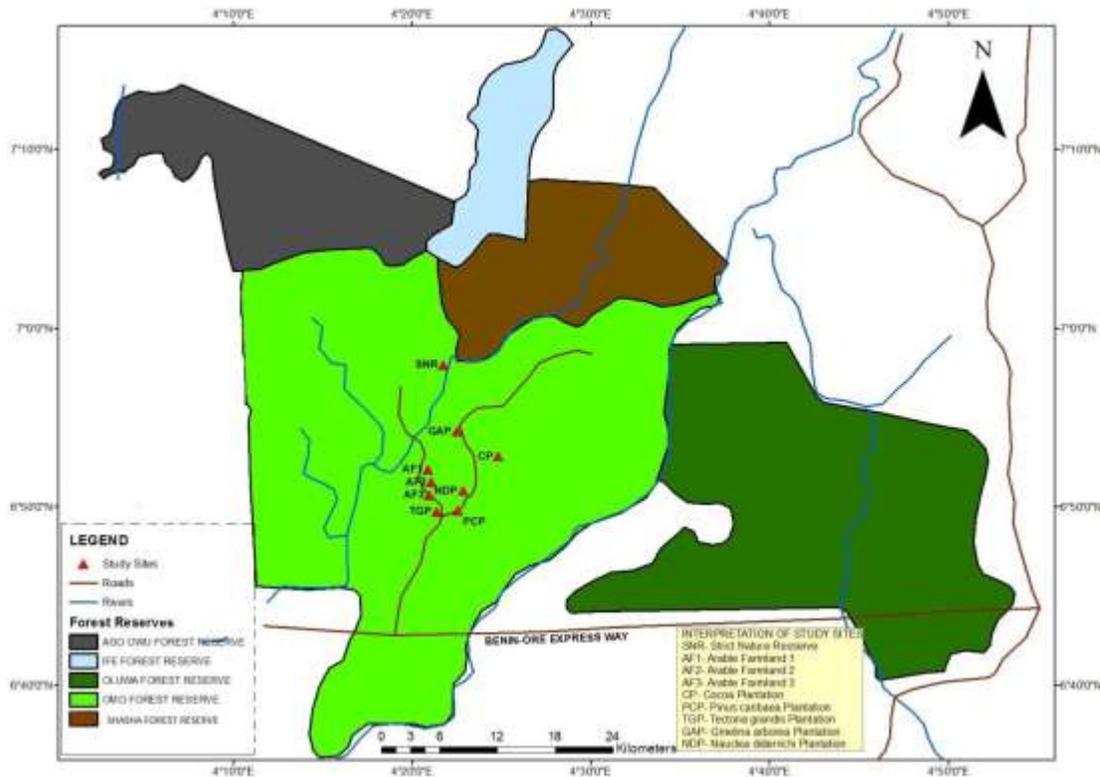


Figure 1: Map of Omo Biosphere Reserve and the surrounding Reserves
 Source: Adapted from Chima, and Ihuma, (2014)

Provisional Ecosystem Services of Omo Biosphere Reserve

Ecosystem services have been termed as the several benefits people obtain from the ecosystem and categorized into provisional, regulating, cultural and

supportive services (Millennium Ecosystem Assessment, 2005). This review is focusing on provisional services and Table 1 provides detailed information on the components of this service and its benefits.

Table 1: Categories of Ecosystem Services

Ecosystem Services	Definition	Benefits
Provisional services	These are products humans obtained from ecosystems	<ul style="list-style-type: none"> • Food • Fresh water • Fuel wood • Fiber • Bio-chemicals • Genetic resources

Modified from: Ecosystem and Human well-being (2003): A Framework for Assessment

According to BRAAF report (UNESCO MAB, 1999) and Isichei (1995) the Omo Forest is a major provider for both humans and animal populace of the Reserve. The forest provides both timber resources and non-timber resources commonly referred to Non-Timber Forest Products (NTFPs). The common services provided by Omo Biosphere Reserve enclaves is detailed below:

a) Food: the survival of any organism is dependent on adequate food and for an individual or household to be food secured, they must have access to

sufficient and safe food at all times. The surveys carried out in Omo Biosphere Reserve enclaves shows that the population have access to some Non-Timber Forest Foods which have been grouped into plant food sources and wild animal food sources as shown in tables 2 and 3 below. There were about 16 fruit plants frequently consumed, 7 leafy vegetables, 9 condiments used in meal preparation, 7 Agro-food crops, 4 edible seed, 22 varieties of wild animals and 6 commonly consumed fishes from the Reserve by host communities.

Table 2: Plant food sources from Omo Biosphere Reserve to host communities

Plant food source	Scientific Name	Common/Local Name
Fruit plant	<i>Anonidium manii</i> (Oliv. Engl. & Diels)	
	<i>Canarium schweinfurthii</i> (Engl.)	
	<i>Carpolobia lutea</i> (G. Don)	
	<i>Chrysophyllum albidum</i> (G. Don)	African starapple/agbalumo
	<i>Dialium guineensis</i> (Willd.)	Awin
	<i>Saba florida</i> (Berth) Ballock	
	<i>Landophia owariensis</i> (P. Beauv.)	
	<i>Sorindea warnekei</i> (Engl.)	
	<i>Trichoscypha acuminata</i> (Engl.)	
	<i>Dissotis grandiflora</i> (Sm.) Benth.	
	<i>Dacryodes edulis</i>	Ube (African pear)
	<i>Irvingia gabonensis</i> (ex Lanen)	Bush mango (oro)
	<i>Lecaniodiscus cupanioides</i> (Planch ex Benth)	
	<i>Myrianthus arborea</i> (P. Beauv.)	
	<i>Spondias mombin</i> (Linn.)	
<i>Napoleana vogelii</i> (Hook & Planch)		

Leafy Vegetables	<i>Boerhavia diffusa</i> (L.) <i>Portulaca oleracea</i> (Linn.) <i>Ceiba pentandra</i> (Linn. Gaertn) <i>Cyrtosperma senegalense</i> (Engl.) <i>Asystacia gangetica</i> (L., T. Anders.) <i>Gnetum africana</i> <i>Emilia sonchifolia</i>	
Spices and Condiments	<i>Piper guineensis</i> (Schum & Thonn.) <i>Monodora tenuifolia</i> (Benth.) <i>Aframamum melegueta</i> (K. Schum) <i>Aframamum daniellii</i> (Hook f., K. Schum) <i>Xylophia aethopica</i> (Dunal, A. Rich.) <i>Pentaciethra macrophyla</i> (Benth.) <i>Gongronema latifolium</i> (Benth.) <i>Brachystegia spp.</i> <i>Irvingia gabonensis</i> (Baill ex Lanen)	Bush mango seed (oro)
Forest Agro-food crops	<i>Musa paradisiaca</i> (L.) <i>Manihot esculenta</i> (Grantz.) <i>Dioscorea alata</i> (Linn) <i>Colocasia esculentum</i> (Linn., Schott.) <i>Elaeis guineensis</i> (Jacq) <i>Zea mays</i> <i>Cucumis melo</i>	Plantain Cassava Yam Cocoyam Palm tree (palm oil plant) Maize Melon
Edible seeds	<i>Garcinia kola</i> (Heckel) <i>Eribroma oblonga</i> (Mast., Pierre ex A. Chev) <i>Tetracarpidium conophorum</i> (Mull. Arg., Hutch. & Dalz)	Bitter kola Okoko African walnut

Adapted from Isichei A.O.(1995) and BRAAF report, UNESCO MAB (1999)

Table 3: Animal food sources from Omo Biosphere Reserve

Animal food sources	Scientific Names	Common Names
Wild Animalspecies	<i>Syncerus caffer</i>	Buffalo
	<i>Tragelaphus scriptus</i>	Bush buck
	<i>Potamochoerus porcus</i>	Red river hog
	<i>Cephalophus maxwelli</i>	Maxwell duiker
	<i>C. rufilatus</i>	Red flanked duiker
	<i>Cephalophus</i> spp.	Duikers
	<i>Viverra civetta</i>	African civet
	<i>Manis</i> spp.	Pangolin
	<i>Dendrohyrax dorsalis</i>	Tree hyrax
	<i>Trichechus senegalensis</i>	West African manate
	<i>Anomalurus beecroftii</i>	Fly squirrel
	<i>Idiurus macrotis</i>	Pygmy fly squirrel
	<i>Epixerus epli</i>	Palm squirrel
	<i>Rattus rattus</i>	Common rat
	<i>Cercopithecus mona</i>	Mona monkey
	<i>Cercopithecus</i> spp.	Monkeys
	<i>Colobus badius</i>	Colobus monkey
	<i>Pan troglodytes</i>	Chimpanzee
	<i>Thryonomys swinderianu</i>	Grasscutter
	<i>Galago senegalensis</i>	Bushbaby
<i>Vananus niloticus</i>	Monitor lizard	
<i>Erethizon dorsatum</i>	Porcupine	
<i>Achachatina maginata</i>	Snails	
Fish species	<i>Bagrus docmac</i>	Catfish
	<i>Chrysichthys nigrodigitatus</i>	Obokun
	<i>Gymnarchus</i> Spp	Eja Osan
	<i>Tilapia zill</i>	Tilapia
	<i>Ctenopoma kingslyae</i>	Ekiki
	<i>Sarotherodon galilaenus</i>	Wesafun

Adapted from Isichei A.O (1995) and BRAAF report, UNESCO MA

b.) Freshwater: There are several rivers and streams existing in their natural state in the Omo area and most of the settlements use rivers and stream water available within their settlements as their source of water supply (UNESCO, 2014). The major supply of freshwater comes from the River Omo as shown in the map in figure 2 from the ecological assessment of Riparian forest in Omo Biosphere Reserve (Olatidoye O.R, 2019).

The enclaves derive other benefits through the provisional services of the Omo Forest Reserve aside fuel wood for cooking. There are about eight plants used as fibers sources, over two hundred species of tree plants used for medicinal purposes, ten for soap making and over thirty species used as dye and phytochemicals. These are listed in Tables 4 and 5 below.

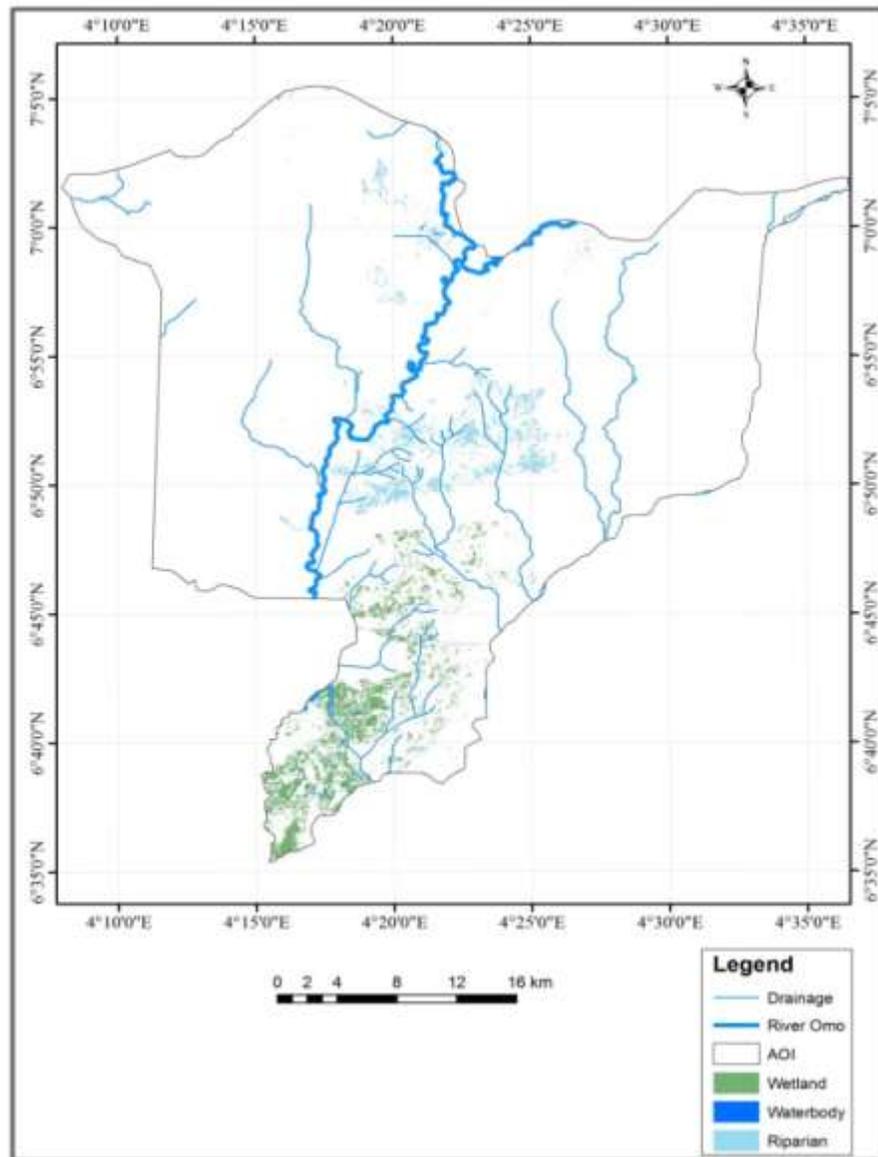


Figure 2: Map of Omo Biosphere Reserve showing major rivers and streams
 Source: Olatidoye O.R., Ecological assessment of Riparian Forest of Omo Biosphere Reserve

Table 4: Fibers from plant sources from Omo Biosphere Reserve

S/No.	Fiber producing plants	Common Name
1	<i>Cleistopholis patens</i>	Salt tree
2	<i>Corchorus olitorius</i>	Jute
3	<i>Corchorus tridens</i>	Horn-Fruited Jute
4	<i>Cola gigantea</i>	Kola nut
5	<i>Dombeya buettneri</i>	Pink ball tree
6	<i>Dracaena mannii</i>	Small leaf dragon tree
7	<i>Entada pursaeta</i>	French entada
8	<i>Elaeis guinensis</i>	Palm oil

Source: Adapted from BRAAF report, UNESCO MAB (1999)

Table 5: Bio-chemical plant sources from Omo Biosphere Reserve

S/No	Bio-chemicals		
	For medicinal use	For soap	For dye and phytochemicals
1	<i>Acanthus montanus</i>	<i>Scottellia corrinsea</i>	<i>Crescentia cujete</i>
2	<i>Asystasia gangetica</i>	<i>Afielia africana</i>	<i>Newbowdia leavis</i>
3	<i>Brilantaisia nitens</i>	<i>Abizia lebbeck</i>	<i>Spathodea companiulata</i>
4	<i>Justicia exilensa</i>	<i>Ricinodendron hendeloti</i>	<i>Bombax buonopozense</i>
5	<i>Acanthaceae</i>	<i>Justicia schimperi</i>	<i>Ceiba pentandra</i>
6	<i>Justicia schimperi</i>	<i>Spondia mombin</i>	<i>Heliotropium indicum</i>
7	<i>Lenkesteria elegans</i>	<i>Vernonia conferta</i>	<i>Ananas lomosus</i>
8	<i>Nelsonia canescens</i>	<i>Ceiba pentandra</i>	<i>Sanitiria trimera</i>
9	<i>Ruella tuberosa</i>	<i>Palisota hirsuta</i>	<i>Thevetia nerlifolia</i>
10	<i>Amaranthaceae</i>	<i>Jatropha curcas</i>	<i>Alstonia boonei</i>
11	<i>Alternanthera sessilis</i>		<i>Strophanthus insipidus</i>
12	<i>Cyathula prostrata</i>		<i>Momodora tenuifolia</i>
13	<i>Celosia argentea</i>		<i>Veronia conferia</i>
14	<i>Amaranthus spinosus</i>		<i>Synedrella modiflora</i>
15	<i>Anacaribiaceae</i>		<i>Hunteria umbellata</i>
16	<i>Lannea welwitschii</i>		<i>Xylophia aethiopica</i>
17	<i>Pseudospondias microcarpa</i>		<i>Lannea Nelwitschii</i>
18	<i>Spondias mombin</i>		<i>Pseudospondias microcarpa</i>
19	<i>Annonaceae</i>		<i>Spondiss mombin</i>
20	<i>Senegalebsis pers</i>		<i>Annona senegalensis</i>
21	<i>Suaveolens verde</i>		<i>Greeniroyadendron suave</i>
22	<i>Isolona campanulata</i>		<i>Holarrhena floribunda</i>
23	<i>Monodora myristica</i>		<i>Pierlina nitida</i>
24	<i>Monodora tenuifolia benth</i>		<i>Voaeanga africana</i>
25	<i>Xylophia acutiflora</i>		<i>Crinus joingus</i>
26	<i>Xylophia aethiopica</i>		<i>Ageratum conyzoides</i>
27	<i>Xylophia vuintasii</i>		<i>Venonia amygdalina</i>
28	<i>Euphorbiaceae</i>		<i>Thonningia Sangiunea</i>
29	<i>Alchornea cordifolia</i>		<i>Sccamone afzeli</i>
30	<i>Antidesma membranaceum</i>		<i>Culasia scandens</i>
31	<i>Bridelia grandis</i>		<i>Rauvolfia vomitoria</i>
32	<i>Bridelia micrantha</i>		<i>Strophanthus sarmentosus</i>
33	<i>Discoglypemna calo</i>		<i>Londrolphia drulcis</i>
34	<i>Drypetes chevalieri</i>		
35	<i>Drypetes floribunda</i>		
36	<i>Euphorbia heterophyla</i>		
37	<i>Jatropha curcas</i>		
38	<i>Macaranga barteri</i>		
39	<i>Mallotus oppositifolius</i>		
40	<i>Euphobiaceae</i>		
41	<i>Manihot esculenta crants</i>		
42	<i>Margaritaria discowlea</i>		
43	<i>Phyllanthus meulleria</i>		
44	<i>Ricinodendron huede</i>		
45	<i>Spondianthus preussi</i>		
46	<i>Tetrorchidium didymo</i>		
47	<i>Diospyros barteri itiern</i>		

48	<i>Diospyros canaliculata</i>
49	<i>Diospyros gabonensis</i>
50	<i>Diospyros mombutten</i>
51	<i>Diospyros discatoria</i>
52	<i>Diospyros soubreana</i>
53	<i>Guttiferae</i>
54	<i>Garcinia afzeli</i>
55	<i>Garcinia gnetoides</i>
56	<i>Garcinia kola</i>
57	<i>Harungana madagas</i>
58	<i>Afzeli africana smith</i>
59	<i>Anthonotha macro</i>
60	<i>Berlinia confusa</i>
61	<i>Bracchystegia eurycoma</i>
62	<i>Senna alata</i>
63	<i>Senna occidentalis</i>
64	<i>Senna obtusifolia</i>
65	<i>Caesalpinia bonduc</i>
66	<i>Daniella ogea</i>
67	<i>Dialium guineese</i>
68	<i>Dismonanthus</i>
69	<i>Apocynaceae</i>
70	<i>Alstonia boonei</i>
71	<i>Baissea axillaris denth</i>
72	<i>Hollarhena floribunda</i>
73	<i>Candolphia dulcis</i>
74	<i>Landolphia dulcis</i>
75	<i>Landolphia owariensis</i>
76	<i>Piramila nitida</i>
77	<i>Pleiocarpa pycnontha</i>
78	<i>Rauwolfia vomitoria</i>
79	<i>Saba florida</i>
80	<i>Strophanthus sarmentosus</i>
81	<i>Strophanthus hispidus</i>
82	<i>Amaryllibaceae</i>
83	<i>Crinum jagus</i>
84	<i>Anchomanes differmis</i>
85	<i>Culcasia saxatis</i>
86	<i>Culcasia scandens</i>
87	<i>Tubernaemontana</i>
88	<i>pachysiphon</i>
89	<i>Thevetia nerifalia</i>
90	<i>Voacanga africana</i>
91	<i>Crytosperma senegalense</i>
92	<i>Rhaphidophora africana</i>
93	<i>Rhelctophyllume mirabile</i>
94	<i>Assciepiabaceae</i>
95	<i>Gongronema latifolium</i>
96	<i>Seramone afzelii</i>
97	<i>Asteraceae</i>

98	<i>Ageratum conyzoides</i>
99	<i>Aspilia africana</i>
100	<i>Chromolaena odorata</i>
101	<i>Conyza sumatrensis</i>
102	<i>Melanthera scandens</i>
103	<i>Mikania cordata</i>
104	<i>Synedrella nodiflora</i>
105	<i>Vernonia amygladina</i>
106	<i>Vernonia cinerea</i>
107	<i>Vernonia conferea</i>
108	<i>Balanophraceae</i>
109	<i>Thonningia sanguinea</i>
200	<i>Bignoniaceae</i>
201	<i>Newbouldia seem</i>
202	<i>Spathodea campanulata</i>
203	<i>Bombacaceae</i>
204	<i>Bombax buonopozense</i>
205	<i>Ceiba pentandra</i>
206	<i>Boraginaceae</i>
207	<i>Cordia millenii</i>
208	<i>Hetiotropium indicum</i>
209	<i>Bromeliaceae</i>
210	<i>Anans comosus</i>
211	<i>Burseraceae</i>
222	<i>Buchholzia coriacea</i>
223	<i>Cercropiaceae</i>
224	<i>Musanga cecropioides</i>
225	<i>Myrianthus arboreus</i>
226	<i>Celastraceae</i>
227	<i>Musanga cecropioides</i>
228	<i>Celastraeae</i>
229	<i>Hippocratea pallens</i>
230	<i>Salacia ereta</i>
231	<i>Salacia nitida</i>
232	<i>Chrysobalanaceae</i>
233	<i>Parinari excelsa sabine</i>
234	<i>Combretaceae</i>
235	<i>Combretum comosum</i>
236	<i>Fabaceae (cesalpi)</i>
237	<i>Erythrohleum suavealens</i>
238	<i>Mezoneuron benthamianum</i>
239	<i>Acacia ataxacantha DC</i>
240	<i>Acacia pennata</i>

Source: Adapted from BRAAF report, UNESCO MAB(1999)

CONCLUSION AND RECOMMENDATIONS

The review of the provisional services in Omo Biosphere Reserve as one of the many ecosystem services enjoyed by enclaves of this ecosystem have shown that there are several forest resources that is being utilized by rural communities located in these areas that can be extended to other urban communities to help improve food security through adequate provision of nutritive food, and also plants that can be furthered exploited by pharmaceutical industry for development of drugs

and other industries for soap making and other organic chemical uses.

Also, further studies should be carried out on how to harness indigenous knowledge on the utilization of these resources among populace of these rural ecosystems and look at ways to introduce some of these non-timber forest products to urban ecosystem to assist in mitigating the problems of food insecurity and promote use of organic raw materials instead of inorganic chemicals that can cause harm to the ecosystem

REFERENCES

- Isichei A. O. (1995). Omo Biosphere Reserve, Current Status , Utilization of Biological Resources and Sustainable Management, Nigeria. Working Paper No. 11, UNESCO, South-South Cooperation Programme, Paris, France. Pp 1-52.
- Chima, U.D. and Ihuma, J.O. (2014). Natural Forest Conversion and Its Impact on Populations of Key Livelihood Tree Species in Omo Biosphere Reserve, Nigeria. *Journal of Research in Forestry, Wildlife and Environmental*. Pp 2141 – 1778.
- European Commission for Environment Policy (2011). "Science for Environment Policy":
- European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol. European Commission DG ENV News Alert Issue 262 17 November 2011.
- GEBR (2014). Biodiversity Inventory of Omo Biosphere Reserve. GEBR Project Report. Nigeria National MAB Committee Abuja. Edited by B.A. Ola-Adams. Pp7-65.
- Millennium Ecosystem Assessment (2003). *Ecosystems and Human Well-being: A Framework for Assessment*. A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment. Island Press, Washington, DC.
- Millennium Ecosystem Assessment, (2005). *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.
- Ojo, L.O. (2004). The fate of a tropical rainforest in Nigeria: Abeku sector of Omo Forest Reserve, *Global Nest*, 6(2):116 – 130.
- Olatidoye, O.R. (2019). Ecological Assessment of Riparian Forest in Omo Biosphere Reserve Ogun State Nigeria. (Phd Thesis Unpublished) Obafemi Awolowo University. Pg 116.
- UNESCO MAB (1999). Biodiversity Inventory of Omo Biosphere Reserve, Nigeria. Country Report on Biosphere Reserves for Biodiversity Conservation and Sustainable Development in Anglophone Africa (BRAAF) Project. Edited by B.A. Ola-Adams. ISBN 978-31078-3-6. Pp 1-341.
- UNESCO (2014). Report of Socio-Economic Survey of Eleven Communities within Omo Biosphere Reserve, Ogun State, Nigeria. National MAB Committee. Edited by B.A. Ola-Adams. UNESCO Abuja. Pp16.