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Greening a Tropical Abijata-Shala Lakes National Park, Ethiopia - A Review

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Abstract

The aim of this review is to assess and document the status of Abijata-Shala Lakes' National Park (ASLNP), to investigate the possible causes for the water level reduction of Lake Abijata and to promote sustainable utilization of the Park. The Park was established to protect and conserve large number of water birds that use Lake Abijata as feeding and Lake Shala as nesting and breeding grounds. Actually, Lake Shala is the continent's most important breeding colony of great white pelicans. The Park also provides wintering ground and maintenance station for large number of birds including from Southern African, Sub-Saharan and Palaearctic species. Consequently, the Park was submitted to the Ramsar Convention on wetlands as an international important candidate site. However, this natural heritage is currently deteriorating due to human encroachment, grazing by cattle, uncontrolled water abstraction and other anthropogenic activities. Since the 1980s, the water level of Lake Abijata has significantly dropped, fishery has totally collapsed, and birds such as Lesser Flamingo (*Phoeniconaias minor Geoffroy*) and Great White Pelican *(Pelecanus onocrotalus roseus)* have been migrating to nearby lakes. Briefly, the lake is shrinking (so far greater than about 100 km^2) and facing imminent threat of collapse obliterating the existence of the Park. As a result, the Park is one of IBAs (Important Bird and Biodiversity Areas) in danger sites, which are priority sites for immediate action. To improve this deteriorating condition of the Park, I demonstrate resources use of the Park within the framework of green economy, which protects ecosystem services and utilizes natural resources sustainably. Lastly, a few recommendations for management measures are outlined as mechanisms to protect the ecosystems and the park.

Keywords: Eco-tourism; Green economy; Lake Abijata; Bird; Rift valley lakes; Soda ash

Introduction

About 97% of the world's water is found in oceans while continental waters cover only about 3% (Figure 1), of which the direct usable inland freshwater is tiny when compared to water resources available on the planet. Emblematically, if all of the world's water is represented by the length of a football stadium, the water essential for human life can be represented by a length of approximately 1 cm of the field. Although tiny, this is the fraction that is easily used, rapidly renewed, essential to life, and a key to viable industries and domestic supply [1]. Interestingly, inland waters contain a richness of useful biodiversity disproportionate to its area coverage, of which <5% has been discovered and described, while a substantial fraction is disappearing [2]. In developing countries such as in Ethiopia, the biodiversity of the inland waters is poorly known while the rate of degradation of the environment is very high [3]. Water quality degradation and pollution is wide-spread in the country. Eutrophication, for example, is a key water quality problem in some water bodies like Lake Koka where Microcystis aerogenosa form frequent bloom affecting domestic consumption and its recreational scenery. Moreover, factories or industries drain their effluents into the nearby aquatic ecosystems, apparently with little treatment [4].

Habitat and ecosystem losses are also prevalent in the country. In actual fact, Ethiopia has painful experience regarding total loss of Lake Alemaya and other less popular ponds/lakes, streams and wetlands. The "death" of Lake Alemaya was as a result of unbalanced and misuse of the fresh water that was overused mainly for drinking and irrigation, but also used for fishing, recreation and washing. All these services have collapsed primarily due to human use [5,6] and the local community has suffered from shortage of fresh water subsequent to the collapse of the lake. Besides, the biodiversity and its beautiful scenery have gone forever. The ecological structure and functioning of lakes provide a wide range of services that can be valued in conventional monetary terms. However, many values, such as scenic, cultural, and biodiversity values, are more difficult to monetize or even quantify [7] and may be considered less during societal development.

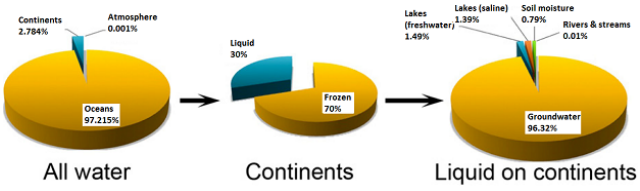

Figure 1: Distribution of earth's water [1].

Inland water was the most strategic resource in the past, is now, and will also be in the future [1], and hence the country should not afford to lose any other aquatic systems as their importance are tremendous to the growing human population and are unique resources. However, it seems that the country is now on the verge of losing lakes Abijata

and Shala, which are officially protected by its National Park status. The ASLNP was established in the first place to protect and conserve the large number of water birds (e.g., great white pelicans, greater and Lesser Flamingo) that use Lake Abijata as feeding and Lake Shala as nesting and breeding grounds [8]. The islands of Lake Shala are one of the few nesting and breeding sites of pelicans found in Africa [9]. The Park provides wintering ground and maintenance station for large number of terrestrial and aquatic birds including from Southern African, Sub-Saharan and Palaearctic species [10]. Consequently, ASLNP was submitted as an international important candidate site to the Ramsar Convention on Wetlands [11].

Environmental valuation is used to monetize non–priced green goods and services, and accordingly the value of the Park worth millions of dollars [12]. However, it is currently deteriorating: there are large numbers of households in the Park with large number of domestic animals. Deforestation is pervasive, the water level of Lake Abijata has significantly diminished, fishery has totally disappeared, and birds such as Lesser Flamingo and Pelican have migrated [9,12,13]. The environmental conditions in the Park are worsening and the lake is shrinking eventually facing imminent collapse with all its services and benefits unless appropriate measures are immediately taken [13].

The aim of this review is to assess and document the status of ASLNP as well as account for the possible reasons of the water level reduction of Lake Abijata. The paper briefly discusses and enlightens the 5th Crime against Peace – Ecocide, which is the destruction of large areas of the natural environment especially as a result of deliberate human action. The association of Ecocide and Lake Abijata in particular is discussed. The paper also promotes green economy as a way forward for sustainable utilization of natural resources of the Park. The rich biodiversity of the Park is a highway for Eco-Tourism Industry, Arthrospira production and other non-destructive revenue generating activities. Subsequent to the conclusions, a few recommendations for management measures are outlined as mechanisms to save the ecosystems and the park.

Current Status of Abijata-Shala Lakes National Park

According to IUCN, National Parks are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area. Hence, the primary objective of a National Park is to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation [14]. As a result, these protected public lands are off-limits to illegal hunting, livestock grazing, logging, mining, human residence and other activities that exploit natural resources.

However, the story for ASLNP is different. There are more than 55, 000 human residents in the Park with a density of 10 people per household and consequently more than 40 km^2 of the parkland is converted into agriculture land. On average, each household has 18 domestic animals and overgrazing is visible. The vegetation cover in the Park had been reduced by more than 50% since 1990s and is under severe threat due to demand for agricultural land and fire wood. The biodiversity in the Park has diminished, and much of the savanna, riparian, wetland and dry forest ecosystems have been converted to farm and grazing land [12,15]. The Park services such as food, water and raw materials (construction wood, wood for agriculture tools and household furniture, thatching grass, charcoal wood, fuel wood, animal fodder) are equally exploited by resident in the Park and nearby villagers [15] escalating the adverse pressure on the Park. Agriculture and livestock production are the main stay of the local people and all members of the villages consider the Park as their communal pasture area, and consequently the majority are disappointed by the presence of the Park [16]. ASLNP is one of IBAs (Important Bird and Biodiversity Areas) in danger sites, which are priority sites for immediate action [17].

The area of the Park is 887 km^2 and over half of which was covered by Lakes Abijata and Shala. Nevertheless, the lake has shrunk some 100 km^2 from 194 km^2 in 1973 to 95 km^2 in 2006 (Figure 2). Only between 2000 and 2006, the lake has lost 46% of its surface area [18]. Lake Abijata has lost some 6.5 m height between 1985 and 2006, and 70% (~4.5 m) of the loss has been attributed to human-induced causes [19]. Briefly, the water level of Lake Abijata has significantly dropped since the 1980s, and most probably Lake Abijata will dry up soon unless appropriate measures are taken [12]. Lake Abijata and Lake Shala are "dying" under the eyes of concerned people and decision makers.

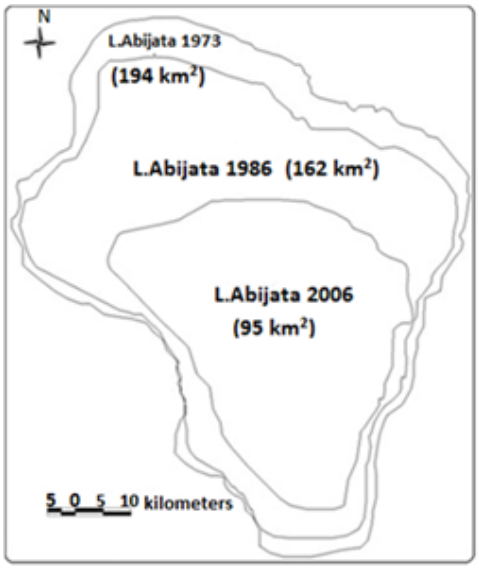

Figure 2: Surface area of Lake Abijata as obtained from satellite imagery (1973-2006) [17].

Possible causes for water level reduction of Lake Abijata

The water level of Lake Abijata has significantly dropped since mid-1980's (Figure 2), which cannot be attributed to natural climatic variability and rainfall record [20]. Recent study showed that some 70% of the water loss from the lake was attributed to human-induced causes [19]. Lake Abijata is a terminal lake, without visible surface water outflow, and is therefore more vulnerable to changes. The water budget of Lake Abijata is dependent on seasonal precipitation, river inflows from Hora Kelo (contributes only about 8% of the total inflows to the lake) and Bulbula river, which was the largest inflowing river into Lake Abijata from Lake Ziway [13]. Hence, any intervention either on Lake Ziway or Bulbula River affects the water budget of Lake Abijata. An irrigation project on the upper reach of the river is ongoing and as the result the water flow in the Bulbula River has significantly reduced [13]. Irrigation is the largest water user activity in the basin [13,18]. Large-scale irrigation agriculture from Lake Ziway, its

tributaries, and the Bulbula River is used in the production of horticulture, vegetables, and flowers [19].

In parallel, Abijata soda ash company could be the second possible anthropogenic causes for the water level reduction [16,21]. The Company was established by the Government of Ethiopia with a large production process that began in 1985 [13]. The factory has limited itself to produce trona ($Na_3H(CO_3)2.2H_2O$). Currently, the factory is producing trona by pumping water from the lake into several concentration ponds about 17 ponds (Figure 3). In this way, each year 13, 000,000 m^3 of water is removed from the lake [13] and the amount of water removed can reach up to 30,000,000 m^3 per year (see below). Since the water extracted from the lake into the ponds does not return to the lake, the shore of Lake Abijata has receded for years. In around July 2002, the pump station was 215 meters away from the lake and only one year later (July 2003) it was 950 meters away from the lake (personal observation). Vilalta [18] reported that Lake Abijata has receded 3 km from pumping station and soda ash production has slowed down because of the loss of water in Lake Abijata (Figures 4 and 5).

Figure 3: Concentration pond of Abijata-Shala soda ash company.

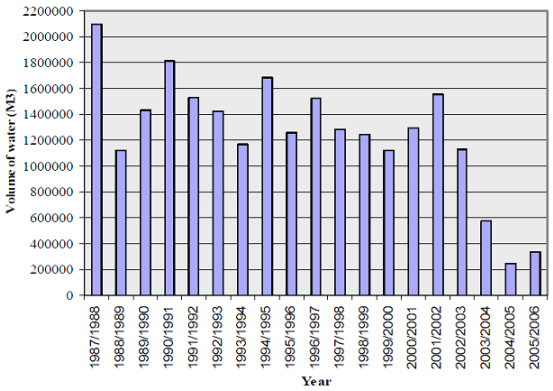

Figure 4: Annual water use of Abijata-Shala soda ash company from Lake Abijata (year 1987-2006) [15].

The Company's adverse impact on the water level would be clear when its production plan considered. On average, the factory produces 4,500 tons of soda ash per year with a water requirement of 150 m^3 per ton of production [18]. The company plans to produce 200 thousand tons of soda ash per year requiring about 30,000,000 m^3 water extractions. Intriguingly, the company is considering increasing the production to as much as 1 million tons per year, which is unrealistic for either Lake Abijata or Lake Shala [18]. Or else, it would result the worst environmental and economic tragedy in the country. Vilalta [18] proposed 10,000 tons soda ash production per year for acceptable lake level decline.

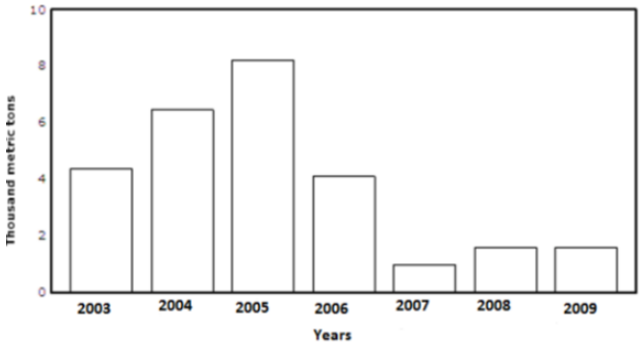

Figure 5: Ethiopia soda ash production by years, **Source: http://www.indexmundi.com/minerals/?country=et&product=soda-ash&graphy=production**

Physico-chemical and biological changes in Lake Abijata

The lake area has shrunk by about 100 km^2 and caused conspicuous physical, chemical and biological changes in the lake. Data since 1926 showed that the salinity has increased by more than 2.6 times (from 8.1 to 26 mg l^{-1}), alkalinity changed from 80 to 326 mg l^{-1}, and pH varied between 9.5 and 10.1 [13,22,23].

The lake was dominated by blue–green algae such as *Arthrospira fusiforms*, *Oocystis* and *Anabaenopsis* during 1960 to 1988 [22,24]. *Arthrospira* was a strongly dominant species usually found forming dense blooms. However, *Arthrospira* was replaced by *Anabaenopsis* and diatoms subsequent to the establishment of soda ash company [24,25]. This compositional switch from *Arthrospira* to non-*Arthrospira* phytoplankton species has affected the vast flock of Lesser Flamingo that depends on *Arthrospira* as primary food source. The numbers of the Lesser Flamingo has been greatly reduced at Lake Abijata as they migrated to the nearby Lake Chittu rich in A*rthrospira* [26].

The lake was full of fish and commercial-scale fishing of Tilapia (*Oreochromis niloticus*) in Lake Abijata, using trucks and nets, was observed [12,17]. However, Abdi [27] noted the disappearance of fish and fishing effort from Lake Abijata in 1993, some 8 years after the establishment of the soda ash company. Currently, there is no fish and fishery activity, which could be due to the declined water level of the lake, high salinity and associated effects (e.g., reduced breeding grounds of tilapia, and osmotic stress as a result of high salt concentrations). Apparently, the number of piscivorous birds has been decreasing because of absence of fish at Lake Abijata [17]. For instance, pelicans that feed on fish have been migrating [9]. Normally, about thirteen native fish species can inhabit lakes [28] but there barely exist species in Lake Abijata.

Ecocide, the 5th Crime against Peace and Lake Abijata

Crimes against Humanity, War Crimes, Genocide and Crimes of Aggression are the existing four international crimes against peace.

The fifth international crime against peace – Ecocide has been proposed to the United Nations [29]. The legal definition of Ecocide proposed is: "The extensive destruction, damage to or loss of ecosystem(s) of a given territory, whether by human agency or by other causes, to such an extent that peaceful enjoyment by the inhabitants of that territory has been severely diminished ".

Humans have been causing ecocide: when we destroy the ecosystems, we are destroying the habitats and biodiversity, and we are also destroying our ability to live in that area. Recent investigation indicated that the fall of Aksumite Empire in Ethiopia could be due to environmental degradation [30]. The "death" of Lake Alemaya and other wetlands in the country are also vivid examples. Unfortunately, Lake Abijata is following the same course and several researchers have projected that Lake Abijata could dry up soon [12]. Ecocide is happening and green economy is a way forward to end the environmental degradation. Green economy initiative could generate substantial amount of money to the government and community but also protect the unique biodiversity of the ecosystems.

Green Economy and Abijata-Shala Lakes National Park

A green economy is one whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services [5]. Greening and green growth is the order of the day and the best known concept for sustainable development. To this end, Ethiopia aims to achieve carbon-neutral middle-income status before 2025 (Ethiopia's Climate-Resilient Green Economy Strategy). Greening should include conserving ecosystems and greening industries as well as reforestation/afforestation program.

ASLNP is worth to protect for green economy as well as biodiversity conservation. If we consider the ecosystem services and goods provided by the Park and convert it into monetary terms, the overall value ranges between US$ 15.9 million to US$ 308.5 million per year [12]. I will briefly discuss the significance of natural resources and benefits of the Park to the local and national economy from the framework of green economy.

Ecotourism industry

Sustainable development is an approach to economic planning that attempts to foster economic growth while preserving the quality of the environment for future generations. One of the most important areas of the law of sustainable development is ecotourism. Ecotourism is defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" [31].

Tourism is usually called smokeless industry. Being a smokeless industry, tourism equals other competing activities in creating added value, but is much less destructive and disruptive to the natural and human environment. In actual fact, the business volume of tourism equals or even surpasses that of oil exports, food products or automobiles. Tourism has become one of the major players in international commerce, and represents at the same time one of the main income sources for many developing countries [32].

Tourism can be a source of economy for Ethiopia, and the government and public should work hand in hand to develop the sector as the country has historical, cultural and natural heritages. Eco-tourism is in line with the government's policies, because Ethiopia aims to achieve carbon-neutral middle-income status before 2025 while developing a green economy, which allows protecting and conserving tourism destination places such as Abijata-Shala Lakes National Park.

In the Park, a total of 436 bird species (among which 114 species are wetland birds) have been recorded including Lesser Flamingo *Phoeniconaias* minor, Greater Flamingo *Phoenicopterus roseus*, Northern Shoveler *Spatula clypeata*, Pied Avocet *Recurvirostra avosetta*, Eastern Yellow-billed Hornbill *Tockus flavirostris*, Great White Pelican *Pelecanus onocrotalus roseus* [15,17]. It is also a stopover site for large number of birds that migrates from Africa and Europe. The Park was absolutely a paradise.

Of the birds, Lesser Flamingo is a major tourist attraction [33,34]. This species feeds primarily on *Arthrospira*, algae which grow exclusively in very alkaline lakes such as Lake Abijata. Hence, Lake Abijata is a source of food (*Arthrospira*) while Lake Shala is a breeding ground for Lesser Flamingo. Lake Shala, the deepest Lake in Ethiopia (with 266 m of maximum depth), is the continent's most important breeding colony of great white pelicans [17,35]. Stephenson [36] considered Lake Shala the second-most important of eight regular pelican breeding grounds of the whole Africa. In fact, the lake has eight islands including Pelican Island which indicate its breeding site. For successful breeding, fish food and an inaccessible breeding site are prerequisite and these conditions are met at the Lake Shala colony [35].

The magnificent views of the lakes together with the biodiversity (such as abundant number of bird species and mammals) as well as other component of the Park seduce visitors. More importantly, the proximity of the location to Addis Ababa (Ethiopian capital), its short drive from the main road, its position alongside with other touristic destinations such as Lake Langano, Hawassa, Arba-Minch (Nechi-Sar Park) are some of the underlying factors that attract visitors even though the Park is not well managed.

Visitors	Number	Total revenue (in birr)
Students	8,005	2,322,769
Adults	39,037	
Foreigners but resides in Ethiopia	15,912	
Foreigners	33,805	

Table 1: Number of visitors and total revenue of Abijata-Shala National Park from year 1988-2000. Source: Ethiopian Wildlife Conservation Authority (EWCA).

Name of Parks	Number of visitors	Revenue
Awash National Park	9363	604,589
Abijita-Shala National Park	8611	359,599
Bale Mountain National Park	3955	347,014
Simien Mountain National Park	14016	3,154,216

Table 2: Number of visitors in different national parks and total revenue in 2010/11. Source: Ethiopian Wildlife Conservation Authority (EWCA).

The number of visitors and revenue is comparable with other national parks (Tables 1 and 2). Estifanos [15] analyzed the number of visitors from 1999/2000 to 2006/07 and found that the revenue has increased by approximately three folds. This demonstrates that if the condition of the Park is improved and appropriate services are installed (currently there is no service at all), the revenue from the Park could upsurge significantly. Eco-tourism is not only a lucrative but also sustainable and environmental friendly business. Furthermore, ecotourism allows research and educational tour. Estifanos [15] found out that 71.4% of the foreigner and 28.4% of the local visitors visited or would like to visit the Park for research purpose. Several students have also visited through educational tour programs.

The practice of ecotourism and sustainable tourism has the potential to assist in conserving natural areas, alleviating poverty and revenue generation, empowering women, enhancing education, and improving the health and well-being of local communities. World tourism is recognized as the world's largest industry with US$6 trillion in 2011 globally. It is also the world's largest employer, generating 260 million jobs, or nearly 1 out of every 12 jobs globally [37], which demonstrate that the ASLNP can offer lots of jobs and absorbs large number of employees other than employees from soda ash company. Unfortunately, the contribution of tourism to economic well-being depends on the quality and the revenues of the tourism offer [37]. Hence, ASLNP should be off-limits from human residence, livestock grazing, logging, mining (soda ash), and other activities taking place in the Park. Furthermore, the Park demands rehabilitation and conservation programs, which can be performed by the government together with the community and the professionals.

Arthrospira production

Arthrospira fusiformis are characteristic of soda lakes in tropical Africa forming persistent and almost uni-algal blooms [26,33,38]. It has been a focus of interest among researchers due to its overall nutritional qualities and commercial importance to humankind as a source of protein (60 to 70% of dry weight), fatty acid (gamma-linoleic acid-GLA), essential amino acids, and vitamins (high B12 content). The species has also therapeutic effects against hyperlipidemia, nephrotoxicity, diabetes, obesity and hypertension [39,40]. As a result of all these benefits, it is considered as a 'health food' as well as declared as best food to combat hunger and malnutrition in developing countries [41]. This alga forms a dominant population in the saline-alkaline lakes of Ethiopia particularly lakes Abijata, Chittu and Arenguade. *Arthrospira* was the most abundant algae in Lake Abijata [24].

Arthrospira is also the major food source for the large number of Lesser Flamingo and accordingly the species were considered as non-toxic alga for a long period of time [42,43]. However, Ballot et al. [44] observed toxic and non-toxic *Arthrospira* while Krienitz et al. [45] found toxic strains of *Arhrospira fusiform* is isolated from Kenyan lakes. Many Lesser Flamingo have died in East African saline-alkaline lakes of Kenya (30, 000 have died in Lake Bogoria, [46] and Tanzania (43, 800 in Lake Manyara, [47]). The toxicity of *Arthrospira* was the cause for these deaths, because this is the major food of Lesser Flamingo. To my best knowledge, there never occurred a massive death of Lesser Flamingo in Ethiopia suggesting non-toxicity of the Ethiopian strains.

Producing *Arthrospira* is green economy and can be produced both for commercial purpose in mass culture as well as for combating hunger and malnutrition in small scale farms. Mass culture of *Arthrospira* exists in USA, Thailand, India, China etc. For example in China, 19 080 tons of *Arthrospira* was first produced in 2003 and rose sharply to 41 570 tones in 2004, worth around US$ 7.6 million and US $16.6 million, respectively [48]. In Ethiopia, the cost of nutrient media for biomass production can be significantly reduced by using lakes water. In a recent laboratory experimental study, Ogato et al. [49] demonstrated that 25% and 50% supplemented Lake Shala water can be preferably used to produce Arthrospira biomass, thereby reducing the cost of nutrients by 75% and 50%, respectively. Mass cultivation of Arthrospira has been ongoing on the shore of Lake Shala [12], which can be scaled-up to a meaningful extent.

Methane for energy production

Lake Shala is the least investigated and understood lake in the country and exceptionally deep soda lake in Africa (max. depth of 266 m). Solar radiation vertically reaches few meters depth and the euphotic depth of Lake Shala is about 5 m [50] leaving large part of the lake dark. Organic matter in this dark region produces methane (CH_4) due to anaerobic biological organisms. Biogenic methane is produced by the activities of methanogens, a strictly anaerobic metabolic group belonging to the *Archaea* [51]. Electricity from methane is now produced in Rwanda directly from Lake Kivu and Rwanda is the first country to harness energy in such a fashion [52]. Since Lake Shala was not yet studied, it is not known whether the lake has enough methane for energy production. But this is one reason why we should maintain and protect ecosystems, not to lose ecological services without recognizing their presence [53].

Conclusion

The condition of ASLNP is deteriorating largely due to anthropogenic intervention: human residence, grazing by cattle, uncontrolled water abstraction and other activities. The water level of Lake Abijata has significantly dropped, about 100 km^2 receded, reducing the total lake's size to about half of its original size. Consequently, the physico-chemical and biological variables have changed and even some organisms have vanished. The phytoplankton species composition has switched from *Arthrospira* to non-*Arthrospira*, tilapia fish abundance has declined and fishery had terminated, and subsequently lesser Flamingo and Pelican have migrated.

Protecting and conserving the Park is protecting biodiversity, habitats and nature as well as protecting the economy: sustainable, smokeless and green economy. The ecological services of ASLNP include provisioning services (food, freshwater, raw materials and medicinal resources), regulating services, supporting services and cultural services [17]. The Park's living resources have been valued at US$ 15.9 million to US$ 308.5 million per year [12]. However, activities in the Park are not in line with sustainable utilization of the resources.

Restoration can only be possible before the ecological damage has reached to its irreversibility threshold but even then it demands time, energy and money. The Government of Ethiopia has policies, strategies, proclamations and development programs to promote sustainable and equitable utilization of the available water resources [18]. Therefore, the country should practice and implement its novel ideas and policies and should protect and conserve all water resources at large and lakes Abijata and Shala in particular so as to pass them to the next generations. This paper provides baseline information on the

condition of ASLNP and could initiate action to save Lake Abijata and the Park.

Recommendations

Some recommendations for management measures are outlined below as a mechanism to save the ecosystems and the park.

- Environmental Impact Assessment should be conducted for the soda ash company as it describes the overall environmental impacts of the project. This will be the baseline data for any decision to make. To my best knowledge, EIA was not conducted
- The soda ash company is planning to use Lake Shala as the water level of Lake Abijata has reached to a point where pumping is not possible. This destroys the gift of nature as Lake Shala is the least investigated lakes in Ethiopia and water life of the Park and should be stopped not to reiterate the tragedy mistake of Lake Abijata
- Uncontrolled water abstraction from Lake Ziway and the irrigation scheme on the River Bulbula significantly affects the water level of Lake Abijata [13]. Hence, the minimum water flow on river Bulbula should be maintained. To this end, integrated water resource management on a basin-wide scale should be a cornerstone of saving Lake Abijata
- It is essential to assess all possible driving factors and acknowledge all stakeholders with different interests and promote sustainable utilization of the resources
- The Park should be forbidden to livestock grazing, logging, mining, human residence, illegal hunting, and other activities that exploit natural resources so as to endorse its park status
- Ecological restoration of the Park in general and Lake Abijata in particular should start as soon as possible as it assists the recovery of an ecosystem that has been degraded, damaged, or destroyed [50]. Then, Eco-tourism becomes ecologically and economically feasible.
- Agriculture and livestock production are the main stay of the local people [16] and any eviction of the inhabitants from the Park should be for the better-off. Substitute arable land, establishment fund, infrastructure and transportation should be provided for compensation
- Convert soda ash company to museum
- The establishment of eco-lodges and eco-friendly recreational centers (eco-restaurant, earthen swimming pool and eco-terraces) within the reach of the Park is necessary as "green jobs" to soda ash company employee and local community, and revenue to the State increases

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አብጃታ-ሻላ ሀይቅ ፓርክን በአረንጓዴ ኢኮኖሚ ማልማት

የሰነዱ ወይም የጽሑፉ አላማ አብጃታ-ሻላ ሀይቅ ፓርክ አሁን ያለበትን ሁኔታ በመረጃ አስደግፎ ማቅረብ፤ የአብጃታ ሀይቅ የውሃ መጠን የቀነሰበትን መነሻ ምክንያት መገምገም እና ፓርኩን በዘላቂ ሁኔታ የምንጠቀምበት ዘዴ መጠቆም ነው፡፡ ፓርኩ በዋነኛነት የተቋቋመው ብዛት ያላቸውን አእዋፋትን ለመንከባከብና ለመጠበቅ ሲሆን እነዚህ አእዋፋት ከአብጃታ ሀይቅ ምግባቸውን ሲያገኙ ሻላ ሀይቅ ደግሞ መራቢያና ማደሪያ ቦታቸው ነው፡፡ ፓርኩ ቅዝቃዜን ሸሽተው ከተለያየ አህጉር (ከደቡባዊ አፍሪካ፤ ከአውሮፓ) የሚመጡ የተለያዩ አእዋፋት በሀገራቸው የቅዝቃዜው ወቅት እስኪያልፍ ድረስ መቆያ ቦታ ጭምር ነው፡፡ በዚህ የተነሳ ፓርኩ አለማቀፍ ጠቀሜታ ካላቸው ቦታዎች እንዲመደብ ለራምሳር ኮንቬንሽን ማመልከቻ ገብቷል፡፡ ይሁን እንጂ ይህ ብዙ ጠቀሜታ ያለው የተፈጥሮ ሀብት በአሁኑ ሰአት እየተጎዳ፤ እየተመናመነና እየጠፋ ይገኛል፡፡በፓርኩ ውስጥ ሰው ይኖራል፤ ለብዙ የቤት እንስሳቶች የግጦሽ ሥፍራ ነው፤ ውሃ ያለቁጥጥር ከገባር ወንዞቹና ከሀይቁ ይቀዳል፤ ይባክናል ወዘተ፡፡ ባጭሩ ከ1970ዎቹ ጀምሮ የአብጃታ ሀይቅ የውሃ መጠን በከፍተኛ ሁኔታ ቀንሷል ‹እስከ 100 ካሬ ኪ.ሜ መሬት ሸሽቷል›፤ አሳ ማምረት ሙሉ በሙሉ ቁሟል (የአሳ መራቢያው ቦታ የሆነው የውሃ ዳር ስለጠፋ እና/ወይም የውሃው ጨዋማነት ስለጨመረ ሊሆን ይችላል)፤ አእዋፋት በተለይም ፍላሚንጎ እና ነጭ ፔሊካን እየተሰደዱ ነው (ምግባቸው አልጀና አሳ በመጥፋቱ ሊሆን ይችላል)፡፡ ይህም ፓርኩ እንደ ፓርክ እንዳይቀጥል በውስጡ ያሉትም ብዙሃ-ህይወት ሊጠፉ እንደሚችል ያመለክታል፡፡ በእርግጥ ይህ ፓርክ ሊጠፉ ከሚችሉ ፓርኮች አንዱ መሆኑን በጉዳዩ ላይ የሚያጠና አለም አቀፍ ድርጅት የጥናት ውጤቱን መሰረት አድርጎ ዘግቧል፡፡ ፓርኩ አሁን ካለበት ሁኔታ ለማሻሻል እና የአብጃታ ሀይቅን ከመጥፋት ለመታደግ በፓርኩ ውስጥ ያሉ ሀብቶችን (የተፈጥሮ ፀጋዎችን) በዘላቂ ሁኔታ በተለይ ከአረንጓዴ ኢኮኖሚ አንጻር ማልማት እንደሚያስፈልግ በዳሰሳየ አመልክቻለሁ፡፡ አረንጓዴ ኢኮኖሚን መሰረት ያደረገ ልማት ለመንግስት ገቢ ለሀገሪቱ ደግሞ የተፈጥሮ ፀጋዋን ሊያተርፍ እንደሚችል ጠቁሜአለሁ፡፡ በመጨረሻም ተግባራዊ ቢሆኑ ፓርኩ ሊሻሻል፤ ሊስተካከል ይችላል ብየ ያሰብኳቸውን አስተያየቶች አስፍሬአለሁ፡፡ የኢትዮጵያ ህዝብና መንግስት በጋራ ተረባርበው ይህንን ሀጋዊ ከለላ ያለውን የተፈጥሮ ፀጋ አትርፈው ለሚቀጥለው ትውልድ ማስተላለፍ ከተፈጥሮና አካባቢ ጉዳይና ዘላቂ ልማት አንጻር ቀዳሚ የትኩረት አቅጣጫ ሊሆን ይገባል እላለሁ፡፡