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CONFERENCE PROCEEDINGS

Özgür Öztürk DAKAM YAYINLARI
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CONTENTS

ENCOURAGING CLIMATE CHANGE METHODS TO THE STUDENTS AND TEACHERS THROUGH THE NATURE TRAINING CAMP

NURETTİN ATEŞ, REYHAN TUNA

Nurettin Ateş, Principal, 1. Hava İkmal Bakım Merkezi Primary School
Reyhan Tuna, Teacher, 1. Hava İkmal Bakım Merkezi Primary School

Abstract

Industralisation, deforestation and consumption habits have revealed the problem of climate change which is among the biggest problems of the 21st century. This problem has taken a global dimension in struggling against the climate change which is concerning the future of the World. Researches which has been made till now demonstrates the importance of human factor and education in reducing the negative effects of climate change. Although environmental education studies have been carried out in schools, the expected results have not been achieved so far. It has become an important requirement for the school to take an active role in creating awareness about climate change, creating participatory solutions and taking a holistic and sustainable approach.

The purpose of this study is; to gain tree-climate change relationship, which plays a key role in combating climate change, through different activities enriched by the target audience in nature education camp. In this research, the processes and outputs of our project have been used of our project 'İzimiz Ağaç Olsun İklim Değişmesin' supported by the project number 118B502 within the scope of TÜBİTAK 4004 Nature Education and Science Schools Project.

In this context; a nature education camp was held on 26-30 June 2018 with the participation of 30 school staff and 72 students from elementary school 1, 2 and 3. The aim of the camp was to teach the importance of afforestation in reducing the effects of climate change, bringing the students together with nature to gain an ecological vision and environmental protection awareness, and to convey the scientific facts comprehensively.

In nature education camp, support is provided by experts, trainers and guides; In the forest, sports, online interactive competitions, experiments, nature walks,

nature and art activities, environmental nature trips, groups and workshops were held, seminars were given, nature games were played, nature books were read and evaluation studies were done. In the event; excursion, observation, workshop-field studies, experiment, online interactions, art, sports, drama, group work, research-examination, play, evaluation methods were used.

Qualitative research method was used in the research data. Content analysis was done in data analysis. Informations about the students were taken before and after the camping and their content analysis was made by using the question-answer method and focus group interview method.

As a result of the research; in the target group, in the reduction of the effects of climate change, awareness of climate change, tree and forest relationship is increased, the project and process-oriented holistic approach, out of traditional environmental education, through comprehensive activities, rational environmental awareness and ecology vision.

Key Words: Climate change, environmental education, basic education, ecology

Introduction

The extraordinary temperature rising that has never seen so far during the human history and being experienced of this rising on a global scale with other environmental problems, threaten the life on earth. As a result of the researches, it is pointed out that the world is under threat in the very near future and the problems that can be realized, with the increase of temperatures. Scientists state that the most important factor behind this increase is human activities (Desonie, 2008). People's consumption habits and deforestation cause climate change by increasing the density of greenhouse gases in the atmosphere.

According to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report, the average temperature increase in the last century has approached 1 degree due to the increase in greenhouse gases. The 2008 IPCC report states that 20% of greenhouse gas emissions are due to deforestation and changes in land use. In order to combat climate change, the agendas of climate scientists, nature and social scientists and policymakers have begun to be determined, and different arguments have started to be formed on the reasons, results and how to deal with this problem (Odabaş, 2018).

The need for a global effort to combat climate change has been put forward and international climate meetings have accelerated. The United Nations Framework Convention on Climate Change was enacted in 1994 with the aim of preventing the greenhouse gas accumulation in the atmosphere at a level that would prevent dangerous human-induced impact on the climate system. With the 192 countries that have entered into force in 2005, the European Union and European Union members have agreed to reduce their greenhouse gas emissions by 5.2% from the level of 1990 to 2008-2012. Parties to the United Nations Framework Convention on Climate Change convene every year at the Parties Conference, and work on climate change and the global fight against climate change. In the framework of this framework agreement signed Kyoto Protocol II. The commitment period will end in 2020. For this reason, it was decided in the 20 th Conference of the Parties to be held in 2014 that after the year 2020, the framework of the new climate agreement was

drawn up and it was decided that the parties would make their own commitments regarding the contribution to the struggle against climate change. In this process, strategies have been determined by countries to struggle against climate change and action plans have been prepared. International funds were put into operation in order to realize the activities. For example; Up to 20% of the funds allocated by EU funds should be used for climate related expenditures. On the other hand, studies on monitoring, reporting and evaluation of national policies are carried out. However, scientific studies show that even if the emission of greenhouse gases is stopped immediately, the effect will continue for a long time and the climate system may take hundreds of years to return to normal. (Baykal, 2018)

The problem is actually a problem of education because it is caused by human attitudes and behaviors to the global environmental problem. It is known that mental sensitivity towards the environment develops more at the age of 9-10 (Demirkaya, 2006). Researches show that people who are interested in living things in their childhood and have childhood experiences in nature, are more sensitive to environmental problems in their future lives (Erten, 2004). Therefore; efforts to struggle against climate change should be supported by enriched activities to increase the environmental awareness level. It is seen that the aims of environmental education are not fully achieved, and it is recommended that teachers and students take the methods and techniques that are of interest to them. (Seçgin and fr., 2010; Erdoğan and Cerrah, 2012)

The quality of environmental education to be given is proportional to the variety of solutions that can be created against environmental problems. National and international organizations emphasize the importance of environmental education. (Gamba 1994; Özbebek and fr., 2012) Therefore, environmental education investment for our children should be perceived as an investment in our world. (Atasoy and Ertürk, 2008; Bozkurt and Cansüngü, 2002; Yılmaz and fr., 2002) Education in the environment is student-centered and activity-centered. (Tilbury, 1995) It is aimed to develop environmental awareness through experiential outdoor studies. (Lucas, 1972)

In recent years, environmental education has been given importance in order to create environmental awareness. In our country, the curriculum in primary school was examined and as a result of the study, distribution of environmental gains to classes and courses was determined (Ateş and Tuna, 2017). Although the primary education program includes gains and activities related to environmental education, there is not much mention of global warming, there are no direct gains and activities, but there are some gains that may be considered indirect. While some of these gains were in accordance with the target characteristics, some of them were found to be unsuitable. (Ünlü and fr., 2011; Tanrıverdi, 2009) Tuncel and Ayva (2010) found that the process-based learning approach in global warming gave more successful results than classical teaching methods. It is concluded that new studies are needed to address the issues of global warming and greenhouse effect. In order to provide students with accurate and scientific information about global warming, these subjects should be included in the curriculum in the beginning of primary education. (Ünlü and fr., 2011)

The surveys revealed that there were no expectations for the prevention of climate change and its effects from the Kyoto Protocol (Gülbahar, 2008);

Intergovernmental Panel on Climate Change, "Rio Summit Protocol" and "Kyoto Protocol " indicate that climate change cannot be prevented. (Duygu, 2010). Scientific reserches shows that there will be climate refugees who are going to leave their country and % 20 decreasing on grain production of Turkey depending on World climate change by 2050. (Hürriyet, 2017) The 2007 Paris Climate Conference found that the global warming in recent years has been human-driven, and that all conditions of the Kyoto Protocol have to be implemented quickly, and that global warming after 1995 was 99% human-induced. (Uçak, 2007) At Climate Treaty of Paris countries had an agreement on putting an end to the opening of the fields in the rain forests and preventing deforestation. (National Geographic Turkey, 2015)

Researches indicate that international steps has been taken on global warming and climate change that have become the most important problems, but not enough and most solutions are current and in this steps the effects of the forests on global warming and education are not studied enough. It is obvious that solutions can be found to the problems of global warming and climate change with the educational approaches taking the humanity to the center rather than the determination of the situation.

Our project number 118B502, "İzimiz Ağaç Olsun İklim Değişmesin" carried out within the scope of TÜBİTAK 4004 Nature Education and Science Schools Project, which is included in this study, is to provide rational, participatory and sustainable solutions to the problem in line with the literature, to provide positive behavior changes with a holistic approach and to give the best contribution to the solution. In the area of education, the forest is demonstrated by global warming-related trainings and activities.

The aim of this project is to provide the target group with a variety of activities enriched in nature education camps.

At the end of this study, it is aimed to increase the awareness of climate change and tree and forest relationship on target group through the nature education camp, out of the traditional environmental education, through a project and process-oriented holistic approach, through comprehensive activities, to rational environmental awareness and ecology vision, to think through scientific methods, research and inquiry capabilities are improved.

Method

In this research, the project processes and outputs of the project "İzimiz Ağaç Olsun İklim Değişmesin" supported by the project number 118B502 have been used within the scope of TÜBİTAK 4004 Nature Education and Science Schools Project. In this context, a nature education camp was held in Kızılay Hasırca Camp on June 26-30, 2018 with the participation of 72 students, 30 school staff and the first, second and the third degree students in the target group. 36 activities were carried out in accordance with the activity implementation plan in nature education camp. In this research, nature training camp processes and results in the mentioned project were taken as the basis.

Qualitative research method was used in the research data. Descriptive and content analyzes were performed in the data analysis. The universe consists of 72 students and 30 staff, in order to determine the change in the attitude and behavior of the students before and after the camp, the participants were interviewed with

102 people, using the focus group interview technique in groups of 5, and the content analysis was made.

SUBTITLES	FREQUENCY (n) (Teacher)	FREQUENCY (n) (Student)
A-Climate change (76-Teacher) (79-Student)		
A.1 Global warming	28	22
A.2 Seasonal irregularities	12	1
A.3 Increase in temperature	6	35
A.4 Drought	15	5
A.5 Greenhouse effect	12	-
A.6 Over-cooling of air	2	14
A.7 Seasonal balance of the world	6	2
B- Cause of climate change (65-Teacher) (98-Student)		
B.1 Human activities	30	19
B.2 Rapid population growth	9	12
B.3 Destruction of forests	15	7
B.4Industrialization	8	6
B.5 Technology	3	1
B.6 Respontaneously	-	53
C-Measures to be taken (99-Teacher) (93-Student)		
C.1 Saving energy	21	5
C.2 Reproduction of forest areas	18	7
C.3 Protecting water resources	12	-
C.4 Reduce carbon emissions	16	-
C.5 Protecting nature	5	35
C.6 Protecting the environment	8	42
C.7 Informing for awarenes	19	4

Table 1. Analysis Of Views On Climate Change Before Nature Training Camp

As a result of the focus group interviews (30 Teachers), descriptive analysis of the data was made. According to the results of the interviews conducted before (Table 1) and after (Table 2) the Nature Training Camp; teachers described climate change as global warming, seasonal irregularities, increase in temperatures, drought, greenhouse effect, overcooling, and deterioration of seasonal equilibrium. Teachers stated that they perceive human activities, rapid population growth, forest destruction, industrialization and technology as factors that cause climate change. They also stated that energy saving, afforestation, protection of water resources, reduction of carbon emissions, protection of nature and the environment, and awareness are needed for the measures to be taken. They stated that they support

environmental studies and projects in our school and that the studies are important in explaining the ways of reducing the effects of climate change, and that activities outside the classroom have an important place.

Before and after the camp activities, 72 students were asked questions before (Table 1) and after (Table 2) the study and their information was taken and their content analysis was done. In the content analysis, it has been seen an increase of awareness both on teachers and the students on some subjects such as; desription of climate change, causes and precautions to be taken and after the camp a development on awarenes was seen. (Table1) (Table 2)

SUBTITLES	FREQUENCY (n) (Teacher)	FREQUENCY(n) (Student)
A-Climate change (86-Teacher) (236-Student)		
A.1 Global warming	32	65
A.2 Seasonal irregularities	10	5
A.3 Increase in temperature	6	21
A.4 Drought	25	35
A.5 Greenhouse effect	28	45
A.6 Over-cooling of air	-	27
A.7 Seasonal balance of the world	31	35
B- Cause of climate change (102-Teacher) (146-Student)		
B.1 Human activities	32	61
B.2 Rapid population growth	7	6
B.3 Destruction of forests	32	69
B.4Industrialization	29	9
B.5 Technology	3	1
B.6 Respontaneously	-	-
C-Measures to be taken (99-Teacher) (192 Student)		
C.1 Saving energy	32	58
C.2 Reproduction of forest areas	32	72
C.3 Protecting water resources	25	-
C.4 Reduce carbon emissions	27	-
C.5 Protecting nature	15	35
C.6 Protecting the environment	3	12
C.7 Informing for awarenes	29	15

Table 2. Analysis On Climate Change After Nature Training Camp

Before and after the nature training camp with teachers and students, opinions about scientific methods were taken by question and answer analysis and descriptive analyzes were made. In the opinions about scientific methods, teachers stated the contribution of experiment, questioning, researching, making, analyzing and interpreting to reduce the effects of climate change. The students have expressed their opinions about the experiment and research as the scientific method before the camp. In descriptive analysis; It has been observed that teachers and students develop their skills of thinking by using scientific methods before and after the camp.

Application Results

Group workshops were carried out in which 102 participants were actively involved for logo preparation on our project and TUBITAK 4004. In order to create awareness and to increase the impact, an opening meeting was held, seminars were held, and visits were made to the support institutions and organizations. In order to create widespread impact, social media accounts specific to the project were opened, and nature training camp processes were shared with these accounts and the school website and in the Education Information Network (EBA) of the Ministry of Education. A special hat, t-shirt, bag was used to create widespread effects and to create a sense of belonging. A group of 72 students participated in the group. From the activities planned in the project by taking the samples from the target group and by evaluating them, experiments, nature games, drama, presentations, workshops, the trip were carried out as a pilot study before the main activities started. Possible shortcomings were identified in all activities in the project and measures were taken for the risks for the project.

In the forest, sports, online interactive competitions, experiments, nature walks, nature and art activities, environmental nature trips, groups and workshops were held, seminars were given, nature games were played, nature books were read and evaluation studies were done. (Figure 1)

Figure 1. Nature Training Camp Application Studies

It has been determined that nature education camp activities are important for teachers to realize in nature with interdisciplinary approach with their students, and to realize that environmental education of teachers should be at the forefront of education activities. Many of the previous studies were aimed at raising awareness of environmental problems of students and transferring the determination of the situation and with this project, students see human factor as part of the problem and have an active role in solving the problem. It has been recognized by students that the tendency to environmental problems and climate change is not a preference but a duty of citizenship. With nature education camp; In addition to environmental education, the importance of forests, project and process-oriented holistic approaches to reduce climate change impacts, comprehensive activities have been made and students have gained by making and contributed to education and science culture in terms of individual and macro measures.

Conclusion Discussion and Suggestions

In the literature, there is no study including environmental studies with a holistic approach, project-process-oriented, enriched application examples, targeting a direct forest-climate change relationship in climate change. Therefore, the importance of the study is revealed. As a result of the study, it has been seen that awarenes of the relationship of tree and forest with the climate change was gained and with process-oriented holistic approach, comprehensive activities, rational environmental awareness and ecology vision has been gained, scientific methods of thinking, research and inquiry skills have been developed in target groups.

In additionity has been concluded that the cognitive, affective and psycho-motor skills of students and teachers can be increased with the project activities enriched in nature. (Ateş and Tuna, 2017) In this respect, it is similar to the results of the literature. It is emphasized that environmental education should be carried out in natural environments (Randal, 1997) and should be based on activities (Sağır and fr., 2008). The results of this study coincide with the literature. In early age, positive attitudes towards the development of empathy and the development of love towards nature are very important in the relations with nature (Erten, 2004). Rational, participatory and sustainable solutions to environmental problems, positive behavior changes to be made in a holistic approach should be given at an early age (Ateş and Tuna, 2017). For this reason, the methods of combating climate change have been presented in the early years through the nature training camp and the gains have been increased in proportion to the literature.

The majority of the work on climate change focuses on current solutions, and there is not enough emphasis on climate change-forest relationship. Climate change-education, climate change-consumption habits and climate change-deforestation relations can be the subject of discussion while indicating the methods. It is suggested that the studies to be carried out on this issue evolve into more project-oriented education approach.

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NEOLIBERAL ENVIRONMENTAL POLICIES AND ENVIRONMENTAL DEGRADATION IN KARABURUN PENINSULA, TURKEY

YAĞMUR ÖZCAN CIVE & ADiLE ARSLAN AVAR
Yağmur Özcan Cive, Msc Student in City Planning, Izmir Institute of Technology
Adile Arslan Avar, Assoc. Dr. Prof., Izmir Institute of Technology

Abstract

Following the crisis of the 1970s, capitalism expanded and deepened its limits under the auspices of neoliberalism. The expansion of capital at the global scale by neoliberal policies has changed the form of, and expanded the limits of, the commodification of nature. On the other hand, appeared an awareness of the limited resources. Hence, "the ecological resilience of capitalism" gained an "extractive-destructive nature" (O'Connor, 1997 see Neves and Igoes, 2012 pp. 166). The shift from government to environmental governance, which has associated with either conserving nature or sustaining capital accumulation, brought about a new environmental policy framework. As the state is restructured by deregulation and reregulation according to the logic of capital, new "eco-scalar fixes" are created. Hereby the role of civil society and firms etc. increased in environmental management. The later provided for firms or individuals the private property ownership, or the right to use of previously uncommodified resources such as water, forests, etc., and the conservation areas, wildlife areas, pastures etc. (Apostolopoulou and Adams, 2015 pp. 18; Castree, 2010 pp. 15). The management of boundaries has been naturalized as witnessed in "management of basins". However, as Bakker and Cohen (2014, pp. 139) elaborately show, the changes in actors and institutions involving with the environmental management also means the change in power relations. Besides expanded commodification, the governance process, new power relations between actors, deregulation, and reregulation at the advantage of capital accumulation have culminated in degradation of nature. In other words, new environmental policies associating with neoliberal environmental governance serve for economic concerns rather than for environment.

In Turkey, by the 1980s and continuing well throughout 2000s, pastures, common village areas, forests etc. have been encompassed in capital accumulation process by industrial agriculture, energy or tourism investments (Çoban et al, 2015

pp. 6). Neoliberal environmental governance driven by mostly reregulation or deregulation policies paved the way leading not only to environmental degrading but also to damage in the relationship between the local people and biophysical natures. Indeed, the local people and their practices had always been integral parts of environmental conservation.

Karaburun Peninsula except some parts of settlements is thoroughly covered by natural, historical, urban conservation areas, most parts of which also overlap with each other; hence it is unique with its natural, historical and settlement characteristics. It had once been exposed to the conflicting strategies and plans for environmental conservation, since these overlappings inevitably had resulted in conflicting authorization areas and complicated power relations between state institutions being responsible for different conservation issues. What makes matters worse in Karaburun is that capital accumulation related actions such as tourism, "sustainable energy" investments, fish farms, quarries, and industrial agriculture in enclosured pastures, agricultural areas, and natural conservation areas prevented the local peoples' agricultural practices, which had been integrated to natural conservation.

Introduction

Karaburun Peninsula is an exemplary and critical case of how neoliberalizing nature and environmental degradation intertwined, and how environment is harnessed to "allowable natural destruction" (Apostolopoulou, 2014 pp. 18). As Apostolopoulou and Adams (2014 pp. 16) argue, neoliberal conservation is among a means to create new opportunities for both capitalist activities and environmental concerns such as ecotourism, species banking, ecosystem services such as decreasing water pollution. The legal frameworks for using biophysical world increased the environmental bargaining and degradation. Neoliberal environmental governance serves to conserve nature as a source of capital accumulation. In other words, neoliberal environmental governance gravitates towards more commodification and less conservation.

Indeed Karaburun's natural areas had begun to be impaired previously by the development of secondary housing. By the 2000s, it has been exposed to a dense environmental pressure through neoliberal environment policies consisting in privatization, enclosure, deregulation and reregulation. Neoliberal environmental policies have been structured under the auspices of a sheer scaled reregulation through a sheer number of laws, enactments and regulations concerning the lands under the disposal and decree of the State (*Cebel arazi* in Turkish; hereafter State lands), Treasury lands and public lands. This firstly reveals "the 'state's increasing approach to its land as property, as a commodity", as Adaman, Arsel and Akbulut (2017, pp. 4) emphasise. By the ends of the first decade of the 2000s, Treasury and State Lands have begun to be commodified at a sheer scale. Needless to say, these commodified lands were mostly mountains, riversides, coasts, uncultivable and uninhabitable areas. Just as the commodification of State and Treasury lands remarkably contributes to the regulation capacity of the State, as Türem (2017, pp. 21,35) finely reveals, so does it creates the very biophysical and material bases of the "environmental fixes" that Castree (2008, pp. 146-149) defines.

In Karaburun Peninsula, by the 2000s, the pastures were leased to private

entrepreneurs and enclosed for industrial olive production. It was the first sheer sized operation within the context of nature's neoliberalization, leading not only to the dispossession of the local people but also to violation of natural integrity. Then, by the arrival of the de-regulation of energy market and reregulation for creating the conditions of the privatized energy infrastructure, the Peninsula is interspersed with wind tribunes, and cut across with their concomitant transportation infrastructures, transmission lines, heavy machineries, construction site facilities, as well. Also remarkable part of its coastal waters is densely enclosed by fish farms at the expense of local fishery. On the other hand, it has been discussed to announce the Peninsula as Special Environmental Protection Area since 2014. Nevertheless, let alone protecting the natural areas, the amendments and regulations in existing laws buttress the increase in intensive activities such as fish farms, sustainable energy and tourism investments and quarries, in natural protection areas.

Neoliberalizing Nature

The conception of "neoliberalizing nature" is developed by the "new materialism" and the critique of "neoliberalization." The former reveals an understanding of non-deterministic and non-dualistic human and non-human nature, by taking a departure from the Spinozist idea of ''creative and open-ended nature of physical process'' (Braun, 2015 pp. 1). The latter focuses on the necessity of transformation of neoliberalism levelling at commodification, commercialization and marketization of nature (Neves and Igoe, 2012 pp. 166). As McCarthy and Prudham (2004 pp. 275-76) argue, neoliberalism is a "complex assemblage" of various political, ideological, discursive and institutional practices being buttressed by different class alliances, and organized at different geographical scales. However, classical liberalism with its loyalty to "self-regulating market" still resonates in neoliberalism. What goes beyond classical liberalism is that neoliberalism is defined by an expanded market through deep and invasive commodification of everything including social reproduction and nature, and by a corresponding governing and regulatory mechanisms through rescaling and restructuring state, in a way of facilitating capital accumulation.

New policies and means, in turn, brought together the changing form and intensity of commodification of nature. According to Castree (2010 pp. 5-6), neoliberal environmental policies introduced in late 19970s and mid-1980s. Since the crisis of capitalism entails to exceed the limits of capital, new areas and activities have begun to be searched out. At the same time, rise concerns with productivity and also an awareness of the finite nature at global scale. Firstly, "green neoliberalism" released in 1970s; and by the 1980s, "green development" became a current issue. Both culminate in the commodification and commercialization of previously un-owned and un-priced natural features or areas under the control of global institutions (see Castree, 2010 pp. 14).

The transition to neoliberal policies and regulation at global scale brought together neoliberal environmental governance. Indeed, as McCarthy and Prudham (2004 pp. 277) write, 'neoliberalism is also an environmental project and …it is necessary so.' Neoliberalism, environmental policies, and environmental changes are interwoven (McCarthy and Prudham, 2014 pp. 275; see Bakker, 2005 pp. 543). Nevertheless, for Castree (2008), it is a mismanagement of non-human world, since it introduced remarkable exploitation of biophysical world according to the logic of

capital.

Neoliberalizing nature is realized through some mechanisms: privatization by the way of enclosure; valuation in view of commercialization and marketization; and, governance including deregulation (roll-back state), reregulation and flanking mechanisms (Castree, 2010 pp. 8-9; Heynen and Robbins, 2005 pp. 2). Privatization makes possible to use previously non-owned, communally owned or state-owned natural sources and places for capitalist activities. Previously non-valued and inconvenient environmental outcomes are standardized and priced for commercialization. The roll-back of the state means its withdrawal from the public services, and hence the commodification of the social reproduction. The government undertakes the role to control, regulate and create opportunities for sustaining capital accumulation. Also, reregulation and deregulation mechanisms serve to create a free and competitive environment for the private sector, and to transfer some role of the state to quasi-state institutions or non-state actors like NGOS (Castree, 2010 pp. 10-11). In the conservation of nature at global scale, NGOs work with private sector actors, collect donations, and help to the marketization of biophysical world (Affolderbach, Clapp and Hayter, 2012 pp. 1393- 1395; see Holmes, 2012 pp. 188). They are also supported by some contracts, global policies and environmental friendly projects at global scale such as Organization of Economic Cooperation, New Environmental Policy Instruments, Kyoto Protocol as climate change contracts, implementation of eco-label etc. (see Bailey, 2007 pp. 530; Holmes, 2012 pp. 185-188).

Classical liberalism had previously privatized the non-commodified biophysical world through the way of the enclosure movement. Having been associated with dispossession of peasants and culminated in making them waged labourers, enclosure directly involves with what Marx once had elaborated on by the term "primitive accumulation." With neoliberalism, as Harvey (2003) shows, 'accumulation by dispossession' goes beyond 'primitive accumulation.' In the process of accumulation by dispossession, the society has been deprived off the public services and off their non-private, communally-owned or non-owned properties by the way of the enclosure, expropriation, privatization, marketization (Castree, 2010; Mercille and Murphy, 2017 pp. 1042-1043; see McCarthy and Prudham, 2004 pp. 277). In this way, the public services and also biophysical world like rivers, pastures or conservation areas, which had not been not a part of making a profit for the private sector, were encompassed in capital accumulation process. Under the reign of neoliberalizing nature, the local peoples can no longer use the lands and biophysical environment for activities such as agriculture, farming, and fishery in order to make their lives.

Commodities in Naturalized Boundaries

New concepts such as "ecological fix" (Bakker, 2004), "environmental fixes" (Castree, 2008), and "eco-scalar fix" (Baker and Cohen, 2014) are elaborated on to reveal the mechanisms and strategies for facilitating capital accumulation based on nature, and for delineating the shape and density of commodification of nature, rescaling environmental management and also governance. These concepts draw on Harvey's conception, "spatial fix" (1985). According to Harvey, the circulation of capital requires fixed places and infrastructures. During overaccumulation

crises, capital wants to extend its limits, by increasing circulation, changing shape and placing temporarily. Therefore, territories are restructured and geographical boundaries are rescaled (see Brenner, 1998 pp. 462). This rescaling process occurred at global scale after the 1970s crisis. "Ecological fixes" consist in environmental externalities and outcomes of the capital accumulation process. They serve to encompass biophysical world within capital accumulation process (see Baker and Cohen, 2014 pp. 131). Castree (2008) defines four "environmental fixes" as means for neoliberalizing nature: free market environmentalism; increasing protected areas which are not controlled previously for marketization; extended private right on these areas; and, decreasing state responsibility on capital and environment. Having criticized the concepts of "ecological fixes" and "environmental fixes", because they have not a spatial dimension like Harvey's "spatial fix," Bakker and Cohen (2014) propose the "eco-scalar fix." It differs from "spatial fix", and refers to naturalized boundaries, which are defined by the government as ecosystem or basins, rather than jurisdictional boundaries. To naturalize boundaries is a strategy of depoliticizing them in order to avoid environmental degradation and to create uneven labour supply. However, on the one hand, it actually sustains the crisis because the management and also power relations are reorganized as naturalized boundaries, and it makes the boundaries political and relates directly to capital, on the other (Bakker and Cohen, 2014 pp. 132-139). In a work on "eco-scalar fix" in Canada, Alberta, Bakker and Cohen (2014) define two boundaries, respectively: watersheds referring to hydrological features as natural boundary; and, land use units as jurisdictional boundary. After the shift in management of land use on watershed boundaries, also power relations were reorganized by the way of redefining the responsibilities and reassigning the works of relevant state bodies (Regional Advisory Council and the Watershed Planning and Advisory Council). Following these regulations, as Bakker and Cohen (2014) show, environmental degradation and population have increased, and an uneven labor supply has appeared. In sum, naturalized boundaries in Alberta have involved with capital accumulation and displacement of the crisis, rather than avoiding environmental degradation and providing environmental conservation (pp. 140-142).

Turkey's Practice of Neoliberal Environmental Governance

In Turkey, the transition to neoliberal program started with 24th January decisions in 1980. It was in accordance with the Washington consensus that the role of state was redefined and the financial support to public investments was reduced at the same time. The program has been promoted by supporting the foreign investments with some tariff, extending limits or quotas of foreign trade (see Özgül, 2017 pp. 36). Having left the inward-oriented industrialization model, Turkey's economy was integrated to global economy (Bal, 2011 pp. 44). The process initiated by the efforts and breakthroughs leading to liberate some sectors in the 1980s, and move along the construction of legal framework in 1990s, and, the implementation of these policies practically in 2000s, in turn (Erensü, 2017 pp. 124). In 1983, DPT (the State Planning Organization) prepared the Privatization Main Plan, and some regulations introduced according to the demands of international institutions like IMF and World Bank. The stabilization and structural adjustment programs were prepared with the suggestions of same institutions and OECD. Also, the Environmental law

introduced according to international contracts. The range of regulation authority of DPT was restricted by the way of delegating some powers to the Secretariat of Treasury and Foreign Trade in 1991 (Temizel, 2007 pp. 109-111; Şengül, 2008 pp. 74).

Following the 1994 crisis, came to the fore deregulation (the rollback of state intervention into economic and social life), reregulation (state policies for facilitating privatization and marketization) and privatizations. Some energy and transportation institutions like THY, TEDAŞ, ERDEMİR, POAŞ were privatized according to some additional contracts with IMF in 2000 (Bal, 2011 pp. 50-54). After the 2000- 2001 crisis, the range and scope of privatization expanded through the enactment of new laws and revisions in the previous ones. Neoliberalization has gradually widened through 2000s, and continued more destructively in 2010s.

As to the environmental policy, new laws, the 1983 Protection of Cultural and Natural Properties Law (No. 2863), the 1983 National Parks Law (No. 2873) and the 1989 Legistlative Decree for the Establishment of Special Environment Protection Institutions Presidency (No. 383), and regulations were enacted in line with the international contracts. The laws that ensued were the 1990 Coastal Law (No. 3621), the 1998 Pasture Law (No. 4342), and the 2005 Soil Protection and Land Use Law (No. 5403). As new laws and revisions and regulations in previous laws constitute a framework for the natural protection, so did they pave the way leading the use of the forests, olive groves, pastures and agricultural lands to contribute capital accumulation. Indeed, it was long before neoliberalisation that the legal frameworks for the protection of olive groves and forests had been laid with the 1939 Law on Improvement of Olive Cultivation and Budding the Wild Olive Trees (No. 3573) and The 1956 Forest Law (no. 6831), respectively. However, by the 2000s, various laws on environmental and natural protection have been revised in a way of expanding the use, allocation and leasing of natural areas and sources, pastures, forests, agricultural lands and State lands to private investments (Adaman et al., 2017; Çoban et al., 2015 pp. 6; Dağıstan Özdemir, 2005 pp. 23-24; Erensü, 2017; Türem, 2017). The range of permissions for the use of pastures, which are common properties of peasants or villages, were extended by ensuing revisions and regulations in the 1998 Law of Pastures (No. 4342). Provided that the Ministry approves the public good and necessity, on the one hand, the use of pastures was made possible for oil prospection and the operation of quarries, and aquaculture production was permitted in the water sources in pastures, on the other. After 2004, as the regulations were released from the condition of necessity, so it became possible to run various activities including exploration and drill for oil, the production and operation of energy production infrastructures and natural gas and the construction of geothermal greenhouses in the pastures. The revisions of 2017 in Pasture Law widened their use to such extent that industries, technology development areas, organized industrial zones and free zones allowed in pastures (Legislation Information System, 2018). With a revision of Forestation Regulation in 2004, private forestation became possible even in the high fertility rated agricultural lands. This regulation also introduced the allocation of Treasury lands to private forestation by planting the defined tree species including olive tree. The range of activities that could be done in agricultural lands was extended with the 2005 Soil protection Law (No. 5403). Furthermore, the 1956 Forest Law (no.

6831) was revised in 2002, 2004 and in 2010 in a way of enabling private or public-private partnerships to carry out construction works for natural gas operation, oil and energy infrastructure, as well as landfills, waste water treatment, health and education services. A further revision in the 1956 Forest Law, however, enabled the transfer of forest areas to the Treasury. Provided that the president of the republic defines it as infertile, particular parts of forests can be taken out the forest boundaries and transferred to the property of Treasury in return of allocation other forest areas to the Ministry of Forest. In addition, the revisions in the 1982 Tourism Incentive Law (No. 2643) in 2008, introduced the allocation of Treasury lands, as well as forest and biodiversity areas, for new and alternative tourism activities. As the 1990 Coastal Law (No. 3621) had not permitted constructions for tourism services, the regulations of 2003 and 2005 allowed the construction of yacht and cruse ports. The 2005 Use of Renewable Energy Resources to Generate Electricity Law (No. 5346) introduced the allocation of Treasury or forestlands for renewable energy investments. The revisions of 2008 extended the range of allocations to road construction and infrastructure constructions of energy investments. With an added article, it became possible to use pastures for renewable energy infrastructures, as well. Furthermore, in 2010 the Regulation of Sustainable Energy was revised. It was a revision so widely extending the range of permits for energy infrastructures that they were allowed even in national parks, natural parks, protection areas, the protected forests, special environmental protection regions and wildlife improvement regions (Legislation Information System, 2018).

Planning and the use of preservation areas, natural reserves, and special natural protection areas in the State lands were begun to be regulated by the Regulation on Plans in Preservation Areas, and the Regulations for the State Lands in Natural Protection Areas and the Natural Resources Area and Environmental Protection Areas, in 2012 and 2013, respectively (T.C. Official Gazette, 23.03.2012; 02.05.2013). According to these regulations, if a place is defined as natural protection area, the planning process must be stopped immediately. Not until the planning proposal is justified, based on the report on biodiversity in this area, can the planning procedures commence. However, the revision of 2016 in the Planning in Protection Areas Law repeals the requirement of justification based on biodiversity report. Another regulation in the same law changed the classification of protection areas as follows: 'absolute protection areas', 'qualified protection areas', and 'sustainable protection and use areas' (T.C. Official Gazette, 06.12.2016). Indeed, this classification redefines the old categories of 'first- degree natural protection areas', 'second- degree natural protection areas' and 'third- degree natural protection areas', respectively. This revision allowed turning a first-degree protection area into second-degree, and a second-degree protection area into third-degree, provided that the ministry approves, and based on a scientific environmental assessment.

The Principle Decision About Preservation and Use of Natural Protection Areas in 2017 created the possibility to extend the use of the first-degree protection areas, by changing their degree of protection status, for such activities as industries and quarries, which had been permitted previously in a second-degree ones (T.C. Official Gazette, 05.01.2017; Ministry of Environment and Urbanization Official Website, 2017). Furthermore, an amendment about the natural protection areas and special natural protection areas at the disposal and decree of the state in 2018 removes

the constraints coming from upper scale plans, and allows to take preliminary permissions with an implementation plan (T.C. Official Gazette, 23.06.2018).

The legal framework of rescaling process was laid with passing of the 2004 Metropolitan Municipalities Law (No. 5216), and the 2012 Delegated Law on Fourteen Municipality and Twenty Seven Province (No. 6360). The rural areas were encompassed into the boundaries of the Metropolitan Municipalities in some provinces. Besides, the 2006 Development Agencies Law (No. 5449) introduces economic regions, according to which upper scale plans to be done. Needless to note, all these legislations and regulations directly affected Karaburun Peninsula, as well. Especially, the use of, and property rights on, common village areas being included in the Metropolitan Municipality boundaries became a controversial issue. The authorization for the approval of most investments in these areas was given to the Ministry of Environment and Urbanization in 2011. So, the Ministry of Urbanization and Environment started to do Environmental Plans or Strategic Coastal Plans according to natural boundaries (Legislation Information System, 2018).

Peninsula as an Economic Reserve Rather than a Significant Ecological Area

Karaburun Peninsula hosts significant flora and fauna. Natural protection areas, agricultural lands, pastures and forests cover it. Having been in parallel with the neoliberal conservation practice in Turkey, the assignment and approvals of the natural protection areas started with 1992 and continued through 1995 and 1998 to the 2000s (the 2014-2023 Izmir Manisa Environmental Plan digital data, 2013). The legally approved natural protection areas are generally located at coasts, and they are qualified as the first-degree. Also exist second and third-degree natural protection areas in the Peninsula. Agricultural lands, including olive groves, locate mostly in the north of the Peninsula, and are protected by the Soil Protection Law (No. 5043). The pastures, which are also the main sources of revenue related to livestock, are partly registered. Except the settled areas in Karaburun City Centre, Mordoğan and villages, the Forest Law had also protected the whole Peninsula.

The Peninsula has 384 plant species, of which 15 are endemic, four rare and 76 medicinal herbs. Endemic and rare species are protected by UICN (International Union for Conservation of Nature), and 5 species by the CITES (Convention of Endangered Species of Wild). Besides, the local people cultivate special products such as "*Hurma*" olive, "*Sultaniye*" grapes, "*Erkenci*" mandarins, and also breed special goat species, named "*Kıl Keçisi*" (Karaburun City Council Report, 2014; Nurlu et al, 2003 pp. 227).

The Peninsula has a rich marine and terrestrial biodiversity with mammals, and 204 terrestrial and marine bird species. The caves on the Peninsula coasts are habitat of Mediterranean monk seals being protected by Bern Convention. The decision to protect Peninsula coast is also approved by the 2014-2023 Izmir Manisa Environmental Plan (the 2014-2023 Izmir Manisa Environmental Plan). Some bird species like Audoins' gull and Bonelli's eagle, are classified as endangered species, and protected by Bern Convention. Some major species in the Karaburun Peninsula can be seen in the following table 1. The shores of Peninsula were also announced as a reference area for Posidonia seagrass in 2000-2003. Posidonia seagrass species in the marine flora is of importance, because it enriches the oxygen reserve (Doğa

Derneği, 2018; Karaburun City Council Report, 2018; Nurlu et al, 2003 pp. 227).

Marine Mammals	Mediterranean Monk Seal *(Monachus Monachus)*	R/B
	Eurasian Otter *(Lutra Lutra)*	R/B
Marine Birds	Audouin's Gull *(Larus audouinii)*	*R/B*
	Shag *(Phalacrocorax aristotelisdesmarestii)*	*R/B* (in Ildiri Bay)
	Yellow-legged Gull (*Larus cachinnans*)	R/B
Birds of Prey	Lesser Kestrel (*Falco naumanni*)	SM/B
	Golden Eagle *(Aquila chrysaetos)*	R/B
	Short-toed Eagle *(Circaetus gallicus)*	SM/B
	Peregrine Falcon *(Falco peregrinus)*	SM/B
	Lanner *(Falco biarmicus)*	R/B
	Eleonora's Falcon *(Falco eleonorae)*	SM
	Bonelli's Eagle *Hierraeetus fasciatus)*	*R (breeding not confirmed)*
Passerines	Rüppell's Warbler *(Sylvia rueppelli)*	SM/B
	Olive-tree Warbler *(Hippolais olivetorum)*	SM/B
	Cretzschmar's Bunting *(Emberiza caesia)*	*SM (breeding not confirmed)*

R: Resident; B: Breeding; SM: Summer migrant.

Table 1. Some Major Terrestrial and Marine Species of Karaburun Peninsula
Source: (Eken, 1997 see Nurlu et al, 2003 pp. 227).

In Karaburun Peninsula, nature's neoliberalization begins by the way of allocation or leasing the Treasury lands, State lands and public lands and coasts to private corporations for commercial fisheries in fish farms, industrial olive production, quarries and wind energy production at the expense of local people and nature. Pastures and meadows were State land or the properties of the State Treasury, or common properties of villages, where animal husbandry had been an important source of peasant livelihood; and, forests and natural protection areas were also Treasury land or State land (*cebel arazi* in Turkish), to which peasants had an access. Coming to the 2000s, the lands registered as forest or used as pasture but at the disposal of state were allocated or leased to private companies or individual investors, and enclosed for planting olive trees in Küçükbahçe, Salman and Parlak Villages (figure 2). It is clearly seen that the parcels enclosed for olive planting overlap with pastures. The pasture vegetation had been removed and then the olive trees were planted for industrial olive production (District Directorate of Agriculture data, 2017; Karaburun Directorate of National Estate, 2018; 2014-2023 Izmir – Manisa Environmental Plan digital data, 2013; Google Earth Pro, 2018). On the other hand, in Sarpıncık and Yayla villages, the pastures were allocated or leased to private firms for wind farms (figure 2). As the members of Karaburun City Council, an old village chief, and goat breeders stated, the goat breeding almost ended because the pastures have been narrowed down dramatically. These were the first steps in a process of extended neoliberalization of nature where enclosure and private investments began to be spread aggressively across the once pastoral geographies of the Peninsula. The enclosed olive groves have been created by land reclamation, removing the whole wild vegetation with other living beings. However, it should be noted that olive production increased owing to the sheer number of olive trees, which were planted on the enclosed pastures or State lands, or forests as in Yaylaköy.

In Karaburun Peninsula, nature's neoliberalization runs rampant owing to wind

power generation infrastructures. Not only were pastures, Treasury or State lands allocated, but also private properties of peasants were expropriated customarily or urgently and they were leased to five private energy companies (Ayen, Çalık, Öres, Salman, Lodos Energy) for wind power production. Lodos Energy has the biggest investment with the 87 turbines in Yaylaköy, Tepeboz, Bozköy, Saip, Ambarseki, and Centre Provinces. Currently, 130 wind tribunes, of which 90 are licensed and 40 not licensed, are in operation. Besides the projects that are already in operation, Lodos Energy and Ayen Energy companies have further projects to construct new tribunes. It is counted that wind farms, including either those in operation or planned, cover about 40% of the total surface area of the Peninsula (Counted by ArcGIS analysis and processing of EPDK, Digital Data, 2018; EPDK YEK List, 2018).

The wind power is defended because it is efficient and low-cost; and its generation does not cause carbon emission and air pollution (NWCC, 2010 pp. 1; Manville, 2005 pp. 1058). The wind farms, as well as with their equipments, transmission lines and transportation infrastructures, however, need wide areas. They are constructed in rural areas or State lands that are far away from dense settlements (Kantarcı, 2015 pp. 563). The environmental degradation and negative socio-economic outcomes are inevitable if the location of a wind turbine or farm is decided without taking into account the phenomena varying from forests, agricultural lands, pastures, village areas to bird routes or ecologically sensitive areas.

Geographical location and topographic characteristics of Karaburun Peninsula create convenient conditions for the birds that benefit from thermal differences and air streams for flying. The sensitivity map shows that the number of birds living under sensitivity conditions in each 5 km2 of the Peninsula change between the range of minimum 571 and maximum 2272. Also, across the coasts of the Karaburun Peninsula, Foça and Çeşme the upper limit is 6117. The map correlates the range between minimum and maximum numbers with some factors such as key bird areas and wind farm locations (figure 1). The density and frequency of wind turbines create harmful impacts on the sensitive areas (Doğa derneği, 2018).

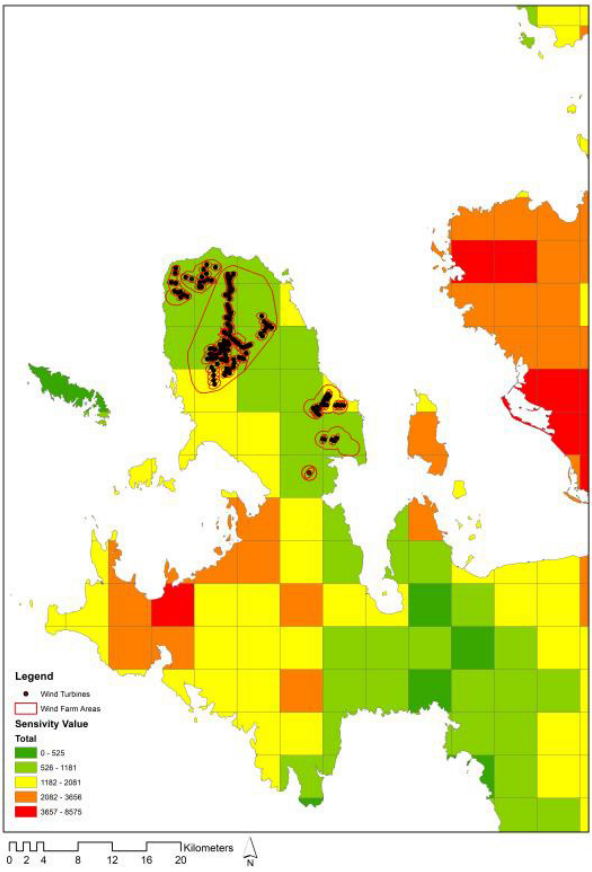

Figure 1. Bird Sensitivity Map with Existing Wind Turbines
Source: Produced by analysing and processing the data of Bird Life International and Doğa Derneği (2018) and EPDK (2018) by using ArcGIS by the authors

Researches show that the population of birds and bats decreased because of cumulative environmental effects of wind farms. In an environmental impact assessment reports, which were done in the course of the wind energy project proposal process, have supported the contradiction about the vulnerable ecology and location and density of wind turbines. The reports point out the significance of biodiversity in the project area, indicating that there are 101 bird species, most of which under conservation national and international scale, and certainly 6, but possibly 15 bat species live there. The reports state that the wind turbine's barriers could negatively impact especially the migratory birds in and around the project areas. In addition, the wind farm projects fall in forests that are classified as high valued for habitats, and the project will create threat to the landscape and vegetation (Karaburun City Council, 2018). Also, the increase in insects that are harmful for agricultural production was correlated with the decrease in bat and bird population (Kantarcı, 2015. pp. 568 ; Hayer, 2013 pp. 975; NWCC, 2010; Manville, 2005 pp. 1059). Recently, Karaburun Municipality and District Directorate

of Agriculture in Karaburun started the works for fighting with increased insect and fly harming olive trees and production. In Yaylaköy they are densely localised and 35 of them stay in pine forests. Wind tribunes that are generally localised in pastures and forests create the risk of fire. Besides the tribunes themselves, their transportation infrastructures and transmission lines degrade and impair the integrity of vegetation and the whole ecosystem.

Also Sediqi (2015) analyses the suitable areas for wind farms in Karaburun peninsula, considering the factors such as wind speed, natural protection areas, and settlements. His findings indicate that the existing and projected wind farms were located without taking into consideration the suitability criteria, which are defined in the city planning discipline for such energy infrastructures. The parcels, where the wind farms are placed, and the areas, which are to be suitable according to Sediqi's (2015) research, are shown as partly in figure 2.

The wind farm project processes and also objections against them have been continuing since 2005. The construction of wind tribunes had been carried out from 2008 onwards (Özçam, 2017 pp. 97). However, their operation dates varied as 2013, 2014 and 2016 (Energy Market Regulatory Authority (hereafter, EPDK), 2017). The construction and operation of the projects continued simultaneously with the environmental assessment and license processes. This meant that companies started some projects without having completed the required legal procedures. On the other hand, the local people and the City Council have been protesting and ensuing law suits against the projects. One of the longest formal objection processes has been against to projects of Lodos Energy, as well as against its demand to increase capacity and size of project area. The positive decisions on the environmental assessment reports were annulled four times because of The City Council's objection. The last objection to the positive decision based on the environmental assessment report about newly proposed turbines on Pirelli mount, Kurkaya hill, Değirmentepe, Çataltepe and Mınıslı still continues. Although the lawsuit has not been completed, on the one hand, the company began to construction works, and the expropriation proceeded, on the other. Similarly, Ayen Energy company proposed to increase the capacity and size of wind farm in Mordoğan. The Karaburun City Council have been objected the positive decision of the Environmental Assessment report. The company's demand to increase capacity was canceled in 2017. However, proposal for new projects and demands for increasing the capacity of existing ones still continue (Karaburun City Council, 2014; 2018).

The arrival of fish farms to coastal waters of the Peninsula creates another aspect of nature's neoliberalisation. Coastal waters of Karaburun Peninsula are under protection, and that the Ministry of Environment and Urbanization prohibited diving exept few points. The coastal waters, rivers, and ponds began to be leased to private firms by the 2003 revisions in the Aquaculture Production Law. Same revision defined the criteria for control and conservation of the coasts and coastal waters. The conditions for tourism constructions and services on coastal bands, including privatization were defined by the 2003 and 2005 regulations. Also in 2005, the Ministry of Agriculture and Livestock introduced a regulation allowing the establishment of fish farms. And finally in 2018, with a new revision on the sea regulation plans, sustainable energy investments allowed in defined sustainable

energy zones in the sea.

The fish farm activities have been located at the southeastern of the Peninsula extending along Görence Gulf and coastal waters of Parlak Villages. Analysing the historical data of Google Earth, it was indicated that since 2006, the number and the size of fish farms have been increasing, and currently arriving at 34 cages that operated by 11 companies. The coastal waters of Mordoğan village, the Northern and Southern of Küçükbahçe Village and the Görence gulf were allocated to fish farms and prohibited for local fishing by the Protocol of Potential Areas for Aquaculture Work Facilities in 10.03.2008. While local fishing is prohibited here, fish and other aquaculture products that the private companies produce are exported (Google Earth, 2018; Provincial Agriculture Directorate, 2018; Soykan, 2007 pp. 12). Between the companies and local people a tension appeared, because the companies requested to increase the production capacity and size of fish cages. The tension ended by the victory of fish farms companies in 2014. Recently, the Agromey Company requested to move fish farms to the west of the Peninsula (along with the coastal waters of Saip, Kaynarpınar, Eşendere, and Centre villages) by enlarging them 11 times more than its existing project area, but the project has been canceled because of high level of bacteria (begotta sp.) in the project area (Karaburun City Council, 2014). Fish farms, as well as concomitant activities, cause pollution and disrupt in coastal waters, resulting in displacement of fish population and decrease in biodiversity. Pollution originates from intensive use of antibiotics and chemicals, uncontrolled organic wastes (faeces, fish foods, dead fishes, etc) and increase in bacteria biomass. The sedimentation of particles negatively effects the species living at the bottom of the sea. Sedimentation and excess in nutrients finally create the risk of eutrophication (see Yabanlı and Egemenli, 2009 pp. 208; Bobat, 2009 see Kuşçu, 2011 pp. 2). Four researches were carried out in Gülbahçe, Görence, Ildırı and Mordoğan on the environmental impacts of fish farms. In Gülbahçe samples, there were no significant differences in terms of water temperature, pH and phosphate N-nitrate, while the level of nutrients (phosphate and ammonia) originating from organic waste particles was higher in Gülbahçe samples than the reference station (Yabanlı and Egemen, 2009). Researches on water pollution generated from fish farms in the Ildırı bay and Görence bay, where fish farms densely located, show that the particles concentration increased in summer, but the increase in nutrient levels was insignificant (Bengil and Bizsel, 2014; Kuşçu, 2011). Also, Demirel (2011) found out that fish farm activities were responsible for the increase in nitrate (88%) and phosphate (82%) levels in the watershed surrounding Ildırı and Görence bays. It should be noted that the annual production 15.690 tones as Demirel carried out the research (2011). The levels of nutrients would increase, considering that the annual production of the western Peninsula, which includes a part of work areas with Görence bay and North peninsula (except Ildırı bay), reached 40.840 tones in 2018. Önen (2008), on the other hand, shows that fish farm activity and the accumulation of organic material at the bottom, damage Posidonia seagrasses, and cause population decline in the fish farm areas. Another important issue is the possible threats of fish farms for the Mediterranean Monk Seal Population. For young seals may be accidentally entangled in fishnets (Karamanlidis et al, 2008 pp. 205). In Izmir Province Strategic Coastal Plan by Ministry of Urbanization and Environement (2013), it is emphasised that the Mediterranean Monk Seal living

area has been narrowed down by fish farms in Görence bay, and this fish farms and logistics services create negative impact on the marine ecology.

The members of Karaburun City Council declare that there are four open quarries located in Mordoğan, between Salman and Parlak, and also in Ildırı. Two of them are operated by big companies that are associated with national and international networks. In addition, some quarries were closed thanks to Karaburun City Council. Despite the efforts of Karaburun City Council, either the incentives for and approvals of quarries or companies' demands to reopen and integrate the closed quarries, to open new ones, or to increase the capacity still continue, by creating further threat to fauna and flora of Karaburun Peninsula. In Kösedere and Eğlenhoca villages, new quarry areas were approved. They are closer to olive groves less than 3 km, in contrary to the distance decreed by the 1939 Law on Olive Cultivation Improvement and Budding the Wild Olive Tress (no. 3573). Being contrary to the same law, the quarry area in Eğlenhoca village was approved without fulfilling the requirement of an environmental impact assessment. It is a requirement that was set up especially for protecting olive groves. The quarries cause local people's dissent, since quarries have been creating negative impacts on olive groves (Karaburun City Council, 2014).

Having begun long before but recently articulated to nature's neoliberalization, tourism is promoted, especially in its "alternative forms". Mass tourism is quite limited in Karaburun. There are two registered hotels in Mordoğan and around the Ayıbalığı (Monk Seal) gulf. However, daily tourism facilities and secondary houses, which once had been located only on the coasts, have been extending recently to villages that are far from the coasts, depending on the increased attraction of these areas. The development of transportation network with new ports and road infrastructures as proposed in development strategies and plans will cut across intensively the natural protection areas. Also, İzmir Development Agency proposes ecotourism strategies for the Peninsula in the 2014- 2023 İzmir Regional Plan (2015). Considering the fact that the farmers have been getting poorer, the City Council also supports rural tourism activities. This meant forests, natural protection areas and the remaining properties of peasants will be exposed to alternative tourism activities, and thus subjected to marketization and commodification.

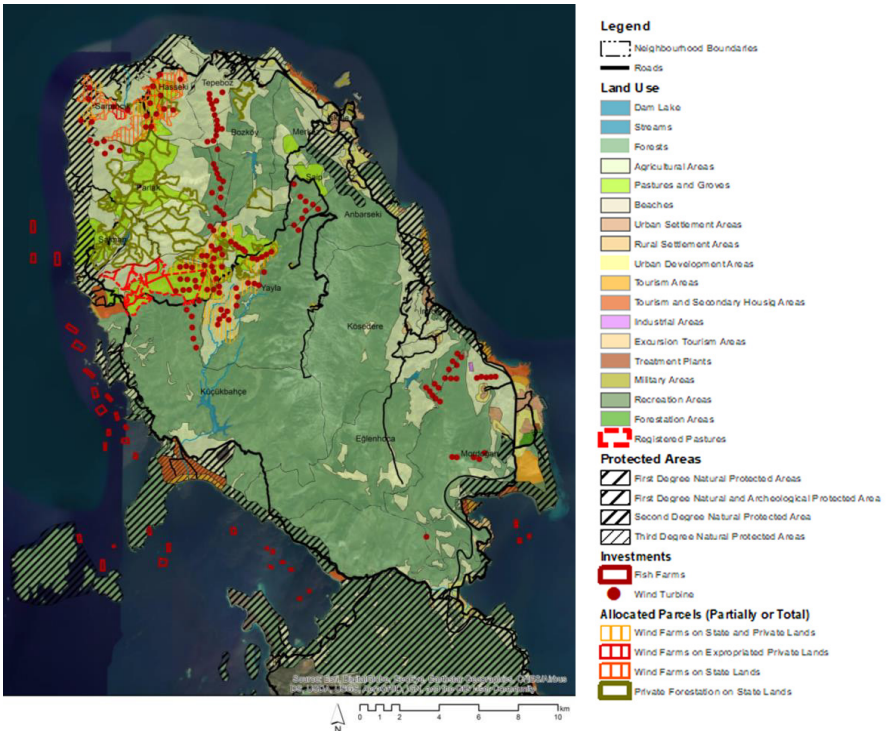

Figure 2. The existing threats on Nature of the Karaburun Peninsula
Source: Produced by analysing and processing the digital data of 2014-2023 Izmir Manisa Environmental Plan (2013), EPDK Wind Turbines KML Data (2018), listed parcel data by Karaburun Directorate of National Estate and Karaburun Cadastre Unit (2018), Google Earth Pro 2018 by using ArcGIS by the authors

Conclusion

Karaburun Peninsula is a crucial example how nature's neoliberalisation and environmental degradation have been intertwined through neoliberal environmental policies and regulations as framed by the legislation. Deregulation and reregulation, on the one hand, allowed to meet the land demand for private investments in agroindustry, energy production infrastructures, quarries, fish farms, tourism activities, and eased to encompass natural areas and conservation areas into capital accumulation process, on the other. From the 2000s onwards, the Peninsula has begun to be exposed to implementation of neoliberal policies and regulations according to the legal framework laid by a sheer number of laws and the ensued revisions in the previously enacted laws. Firstly, the pastures and meadows were encompassed into the capital accumulation by the way of allocation to, and enclosure by, private entrepreneurs for "forestation" by planting olive trees. As the construction of wind farms as well as concomitant infrastructures, roads and transmission lines have been spreading not only through forests and natural protection areas, but also through agricultural lands so does nature's neoliberalisation go further. However, regulations on allocation or leasing forests, State lands, pastures, coastal waters to private entrepreneurs for tourism facilities,

quarries, fish farms have contributed to nature's degradation. Moreover, the expropriation and urgent expropriation have moved the local people away from their own lands. Nature's neoliberalisation meant not only degradation in nature but also dispossession of goat breeders and farmers in villages for the sake of capital accumulation.

Environmental policies, regulations and strategies framed by the legislation on privatization of pastures, forests, olive groves, natural protection areas etc. in a way of encompassing them into capital accumulation are examples for "environmental fixes". The classification of biophysical features of Karaburun Peninsula as pastures, coasts, forests, which are encompassed into accumulation by dispossession process, are examples for "ecological fixes". Furthermore, based on naturalized boundaries, the definition of Peninsula coasts together with whole coasts of Izmir as the strategic planning management unit by the Ministry of Environment and Urbanization is the example of eco-scalar fixes. The strategic plan expresses the threats on the Peninsula and proposes the definition of the special conservation areas, wildlife conservation areas etc. On the other hand, it defines wind turbine areas together with potential fish farm areas, and proposes the development either of ports for creating a network of Aegean tourism activities or of controlled aquaculture production. It introduces "sustainable economic strategy" for coasts rather than presenting a comprehensive conservation plan for coasts as naturalized boundaries.

To sum up, the arrival of enclosure movement by the private entrepreneurs for creating olive groves, and massive wind power energy infrastructures to the Peninsula, distorted not only the ecological integrity of these areas, but also the local livelihoods that had always gravitated around agriculture. Thus appear another "socio-nature", but this time, being based on nature's neoliberalisation for the sake of capital accumulation. Whereas, plans and regulations should be done in a way of protecting unique values of the Peninsula and implementations should be carried out with environmental rather than economic priority. The proposal of Special Conservation Area and the proposal of Biosphere Reserve Area should be taken into consideration with this aim.

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ADSORPTION EFFICIENCY OF CLAY MINERAL FOR FLUOROQUINOLONE TYPE ANTIBIOTICS

BUKET GULENA, PELİN DEMİRCİVİ
Department of Chemical and Process Engineering, Faculty of Engineering, Yalova University

Abstract

Ciprofloxacin is a broad-spectrum antibiotic, which is a fluoroquinolone carboxylic acid derivative. Fluoroquinolone is one of the important micropollutant used in hospitals, veterinary and households and 70% unmetobolized fluoroquinolone released to the environment. Clays are the effective adsorbents due to high adsorption capacities. Montmorillonite is a semectite type clay mineral, which has 2:1 clay layers including of one octahedral sheet between two tetrahedral sheets. The net charge of montmorillonite is negative; therefore consisting interlayer cations (Na+, Ca2+, Mg2+, K+ and Sr2+) in its structure. Montmorillonite is one the clay minerals that can be used for removal of fluoroquinolones. Adsorption of ciprofloxacin on montmorillonite was inveatigated by batch process. Several effects were investigated, such as solution pH, adsorbent amount and temperature. The results showed that 0.1 g montmoriilonite was enough to adsorb 250 mg/L ciprofloxacin at natural pH level. Adsorption efficiency was reached almost 100% after 0.1 g montmorillonite. Increasing adsorbent amount did not show a significant effect on adsorption.

PHOTOCATALYTIC PERFORMANCE OF MULTIFUNCTIONAL CHITOSAN BASED CATALYSTS

PELİN DEMİRCİVİ[A], ESRA BİLGİN SİMSEK[A]
Department of Chemical and Process Engineering, Faculty of Engineering, Yalova

Abstract

Photocatalysis is one of the most effective methods for removal of pollutants from wastewater. Adsorption is adjunct method, which increases photocatalytic degradation. Chitosan could be used as the based material due to its high adsorption capacity including amino and hydroxyl groups in its structure. Titanium dioxide (TiO2) is generally used as the photocatalyst, due to its inexpensive, non-toxic and photostable properties. Due to its large band gap (3.2 eV for anatase TiO2), TiO2 cannot be used properly under visible light. Therefore, metal doping is one of the ways to decrease the band gap of the photocatalyst. Chitosan based photocatalyst was synthesized by sol-gel method to use for the photodegradation of dye molecules. Photocatalytic experiments showed that adding chitosan into the catalyst structure increased the photocatalytic degradation under visible light irradiation. Removal efficiencies were found as 28 (5%wt. chitosan), 38 (10%wt. chitosan), 46 (15%wt. chitosan) and 50% (20%wt. chitosan). First-order reaction rate constant, kapp, was calculated using Langmuir-Hinshelwood (L-H) equation. The kapp value was calculated as 0.014 min-1 for 20% chitosan loaded catalyst under visible light irradiation. Besides, the highest adsorption capacity was found in acidic medium, which promotes the electrostatic interaction between protonated amino molecules on chitosan and anionic sulfonic groups of dye molecules.

UNCERTAINTIES OF ARIDITY INDICATORS ORIGINATED FROM EMPIRICAL POTENTIAL EVAPOTRANSPIRATION METHODS AND AN ASSESSMENT VIA BOOTSTRAP CONFIDENCE INTERVALS

UMUT KIRDEMIR, UMUT OKKAN

Umut Kirdemir, PhD Std., Dokuz Eylul University, Umut Okkan, Assoc. Prof., Balikesir University,

Abstract

Aridity is a phenomenon in which the long-term climatological regime is defined in terms of water scarcity. It is defined with respect to the response of atmospheric supply to atmospheric demand and captures that how 'arid' or 'humid' a region is for a long time period. It is generally digitized by equations including atmospheric variables such as precipitation and potential evapotranspiration. Even if the precipitation can be measured in a region, the determination of potential evapotranspiration is built upon the various equations such that each of them is the function of variables varying across each equation. Hence, in the study prepared, it was addressed the uncertainty in the determination of aridity index originating from different potential evapotranspiration methods. In the study, 21 different empirical potential evapotranspiration methods were utilized in order to calculate the potential evapotranspiration time series in Gediz Basin/ Turkey. Subsequently, the correlations between each potential evapotranspiration methods and the aridity indexes corresponding to each method were evaluated. Then, the confidence intervals were obtained for both potential evapotranspiration and aridity index by means of bootstrapping method. According to the results, it was deduced that significant variations were obtained between the methods and standard method Penman-Monteith and the uncertainty was tried to be examined by constituting confidence intervals in order to carry out precise assessments of potential evapotranspiration and aridity indexes for Gediz Basin. According to the results, the estimates derived by Penman-Monteith, Blaney Criddle, Irmak-1, Irmak-2, Hargreaves, Hamon-2, Turc methods lie between the confidence interval generated for aridity indexes.

Keywords: Aridity index, Potential evapotranspiration, Bootstrapping, Confidence interval.

Introduction

Aridity stands for climatologically permanent state or climate regime of a region such that it directly depends on the amount of water supplied within a specific and relatively long time period. The term "aridity" conceptually designate how arid or humid a region is and gives us opportunity to make inferences about the vegetation, water potential, meteorological pattern and etc. of the related region. Due to the fact that it is defined in terms of presence of water, an evaluation is made whether the atmospheric supply compensates the atmospheric demand or not. In other words, it turns out to be a function of precipitation and evapotranspiration. By the reason that the actual evapotranspiration depends on the soil moisture, the latter is defined as potential evapotranspiration which is the removed water from the surface under sufficient soil moisture conditions. In the literature, the aridity is indexed by means of different ways such that most of them is constituted by mean annual precipitation (P) and mean annual potential evapotranspiration (PET) or mean annual temperature (T) (UNEP, 1992; UNESCO, 1979; Thornthwaite, 1948, De Martonne, 1925). In this study the aridity index was determined by UNEP (1992) and UNESCO (1979) in which the aridity was calculated in similar framework as the proportion of P to PET (P/PET).

In practice, the precipitation can be measured by several devices for the desired time intervals and it can be obtained an actual and observed precipitation time series. Hence, some prediction models for precipitation can be constituted such as intensity-duration-frequency relationships or similar regression-based models which are built upon numerical comparison between observed and modeled precipitation. Thus, when the precipitation is desired to be modeled, it is possible to interpret about model accuracy by using the observed time series. However, it is not as feasible as in the modeling of measurable variables at the stage of PET calculation. PET consists of evaporation and transpiration such that the first can be measured by evaporation pans while the latter is not easy to measure. However, lysimeter measurements are used for collecting evaporation data in the soil in order to evaluate the PET methods. Accordingly, the report FAO-56 was released by Allen et al. (1998) which introduces the Penman-Monteith method as standard PET calculation method by attributing that the estimates made by Penman-Monteith were compatible to lysimeter measurements. Even so, the uncertainty is still available in the estimates because PET can not be directly measured. As such, this situation gives rise to an uncertainty while determining aridity.

Given the above-mentioned issues, in the study, an evaluation was made about the uncertainties in aridity index by means of different PET methods. The study was conducted for Gediz Basin in Turkey. In the study, it is first calculated the PET time series by different PET methods and aridity indexes were calculated by each PET estimate. Subsequently, the comparative results were obtained in terms of descriptive PET statistics and aridity indexes. Finally, an uncertainty analysis was carried out and the possible variability of PET methods and climate regime were evaluated for the study area.

Methodology

There are considerably diversified PET methods existing in the literature such that they are loosely grouped into five categories as water-budget, mass transfer,

combination, radiation and temperature-based (Xu and Singh, 2002). In the study, 21 PET methods including the standard method Penman-Monteith were employed in order to derive PET estimates. The methods utilized in the study was given in Table 1 and the detailed information about the methods can be accessed from Xu and Singh (2000) and Xu and Singh (2001). Given the methods utilized in the study, Thornthwaite (Thw), Romanenko (Rom), Blaney-Criddle (Bl-Cr), Kharrufa (Khr), Hamon-1 (Ham1) and Hamon-2 (Ham2) were categorized as temperature-based methods. The radiation-based methods were available in the utilized methods such that they were Turc (Turc), Hargreaves (Harg), Makkink (Mak), Priestley-Taylor (Prs-Tyl), Caprio (Cpr), Jensen-Haise (J-H), Irmak1 (Irm1), Irmak2 (Irm2), Irmak3 (Irm3), McGuinness-Bordne (McG-Bor) and Baier-Robertson (Bai-Rob) methods. In addition, Meyer (Myr), Rohwer (Roh) and Penman (Pen) methods were categorized as mass-transfer methods. The standard method Penman-Monteith was categorized as combination method in which energy-budget and mass-transfer functions were incorporated in the PET model mentioned in the FAO-56 report arranged by Allen et al. (1998).

Category	PET Method
Temperature-based	Thornthwaite (Thw)
	Romanenko (Rom)
	Blaney-Criddle (Bl-Cr)
	Kharrufa (Khr)
	Hamon-1 (Ham1)
	Hamon-2 (Ham2)
Radiation-based	Turc (Turc)
	Hargreaves (Harg)
	Makkink (Mak)
	Priestley-Taylor (Prs-Tyl)
	Caprio (Cpr)
	Jensen-Haise (J-H)
	Irmak-1 (Irm1)
	Irmak-2 (Irm2)
	Irmak-3 (Irm3)
	McGuinnes-Bordne (McG-Bor)
	Baier-Roberstson (Bai-Rob)
Mass-transfer	Meyer (Myr)
	Rohwer (Roh)
	Penman (Pen)
Combination	Penman-Monteith (Pen-Mon)

Table 1. The PET methods utilized in the study

The complicated structure of PET, their empirical constants originated from regional calibrations and inaccuracies in observations inherently lead to such uncertainties in PET estimates. Thus, it entails similar uncertainties in determination of aridity index. As such, confidence intervals in estimates of related statistics can

be evaluated as metrics giving information about uncertainty (Khan et al., 2006). Therefore, a nonparametric statistical method, bootstrapping, was utilized in order to obtain confidence intervals by means of estimated PET time series. The algorithm of the method as follows. Initially, the bootstrap samples having B dimension are generated with replacement and the related statistics are calculated for each sample. Subsequently, for confidence level, the th and th percentile points are determined as lower and upper bounds of the confidence interval in between the statistics of bootstrap samples. In the study bias corrected and accelerated bootstrap sampling procedure was carried out such that it was also recommended by Efron (1987). The detailed information of bootstrapping can be accessed from the studies of Efron (1987) and Efron (2000). The bootstrap samples were generated with respect to the monthly mean PET estimates, thus, confidence intervals were constituted for mean parameter of each month.

The aridity index was determined by the proportion of P to PET and the classifications were made according to the given intervals in Table 2. The uncertainty evaluations for aridity index were made by confidence intervals which were derived for PET estimates. The results about the uncertainty assessments about PET and aridity index were given in Results section in detail.

Climate Regime	AI
Hyper-Arid	<0.05
Arid	0.05-0.20
Semi-Arid	0.20-0.50
Dry Sub-Humid	0.50-0.65
Sub-Humid	0.65-1.00
Humid	1.00-2.00
Hyper-Humid	>2.00

Table 2. Climate classification corresponding to the aridity indexes
(AI: Aridity Index)

Study Area and Data

In the study, the above-mentioned implementations were carried out in Gediz Basin/Turkey which has a drainage area of about 17125 km^2 and is dominated by Mediterranean climate characteristicsAgricultural activities are intensely implemented in the basin and the agriculture sector demands a great majority of the water accumulated in the reservoirs. The major water resources are Demirkopru Dam and Marmara Lake that are agriculturally operated ones in the basin. (Okkan and Kirdemir, 2016, Kirdemir and Okkan, 2018).

The precipitation and temperature data were obtained from 20 meteorological stations operated by Turkish Meteorological Service. The precipitation and temperature data utilized from meteorological stations cover the period between 1980 and 2010. According to the precipitation and temperature data, the total areal precipitation is 550 mm and mean annual temperature is 15 ℃ in the basin.

The PET methods which were employed in the study demand several input variables such as maximum, minimum and mean air and dew point temperature, surface pressure, solar, extraterrestrial and net radiation, wind speed and several physical variables referring to day time for the given geographic coordinates. Although maximum, minimum and mean air temperature can be obtained from meteorological stations, it is not possible to access the qualified and continuously measured data capturing the rest of the input variables. In order to overcome this issue, the ERA-Interim reanalysis data sets were utilized for the rest of data such that the data were serviced as gridded-type which represent Gediz Basin (Figure 1).

Results

31-year observed precipitation and PET estimates obtained from 21 different PET methods were utilized in order to generate aridity indexes. Upon evaluating the PET estimates, it is seen that the methods such as Penman, Rohwer and Romanenko point out the highest mean annual PET estimates respectively for given data over Gediz Basin. The lowest estimates were obtained by means of Irmak-3, Baier-Robertson and Hamon-1 methods, respectively. It is predicted mean annual PET of 1150 mm by the standard PET method Penman-Monteith such that it is surprisingly the median value in between 21 various mean annual PET estimates (Figure 2a). In addition, the root mean square (RMSE) statistics between each PET method and Penman-Monteith were examined in the study. Accordingly, the methods such as Turc, Hargreaves, Irmak-1, Blaney-Criddle, Priestley-Taylor, Hamon-2, Irmak-2 and Makking show the least RMSE statistics considering the standard method. The related RMSE statistics for these methods are between 114-360 mm while RMSE is over 1100 mm for both Penman and Rohwer (Figure 2b).

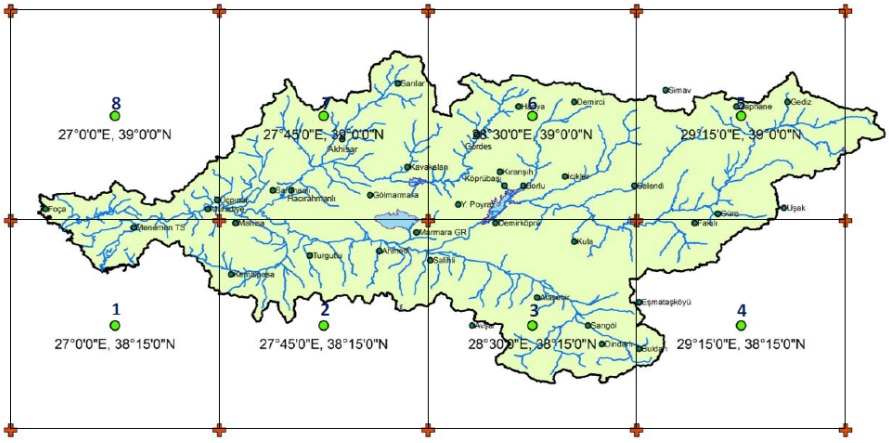

Figure 1. The map of Gediz Basin and ERA-Interim grids covering the study area (extracted from Okkan and Kirdemir, 2016, 2018)

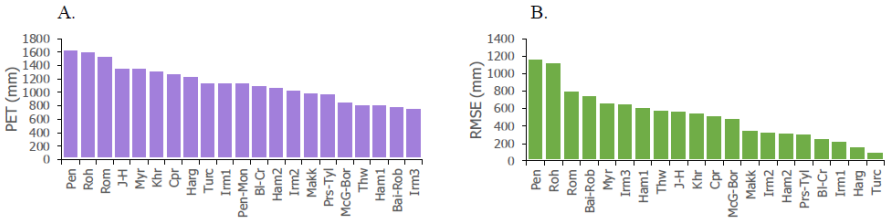

Figure 2. The mean annual PET estimates obtained by PET methods (A) and RMSE statistics related to comparison of each PET method to Penman-Monteith (B)

Although Penman-Monteith method is recommended as the reference method for PET calculations, the uncertainty still remains about the accuracy of the model and different estimates are generated by different methods as in this study. The bootstrap confidence intervals were used in order to digitize the uncertainty in the PET estimates and as such a confidence band was obtained for aridity index as well. 10000 bootstrap samples were generated for mean annual PET estimates in order to calculate lower and upper bounds of confidence interval of each month. The bias correction and acceleration processes were implemented and the bands were generated in 95% significance level. When the confidence band is evaluated, it is seen that none of the mean monthly predictions of Thornthwaite, Romanenko, Penman, Rohwer, Irmak-3 and McGuinnes-Bordne don't lie between the calculated confidence intervals. The 75% of the mean monthly PET estimates of both Penman-Monteith and Turc methods lie between the confidence bands such that this ratio is the highest value among the all methods employed in this study. It was obtained that Penman-Monteith estimates for the months February, March and April and Turc estimates for the months March, April and May are out of the intervals (Figure 3).

The uncertainty assessment for aridity index was also carried out by means of obtained confidence intervals for PET estimates. Accordingly, the lower bound and upper bound of aridity index were calculated as 0.41 and 0.51, respectively. The calculated lower and upper bounds assert that the confidence interval of climate regime is in between semi-arid and dry sub-humid climatic conditions. When the aridity indexes calculated by each PET method are evaluated individually, it is realized that most of the aridity indexes portray the semi-arid climate regime for the period of 1980-2010.

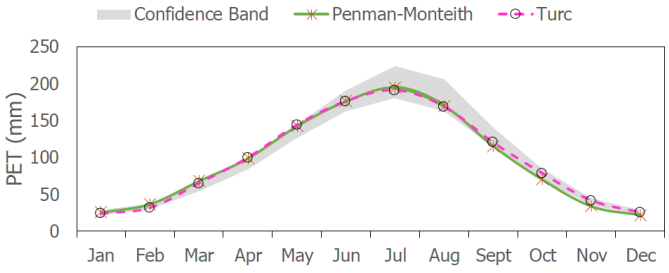

Figure 3. The confidence band derived from resampling method and the position of Penman-Monteith and Turc estimates

However, only the aridity indexes calculated by Penman-Monteith, Blaney-Criddle, Hargreaves, Hamon-2, Turc, Irmak-1 and Irmak-2 methods lie between the confidence band generated for aridity index (Figure 4).

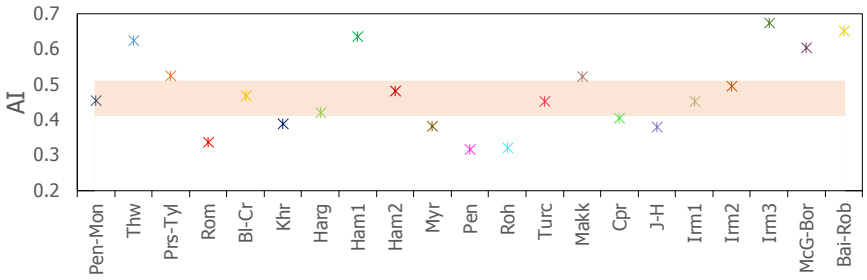

Figure 4. The confidence band for aridity index and the estimates obtained by using PET methods

Conclusions

The aridity indexes are used for labeling the climatic conditions depending upon the long-term meteorological events and the availability of water is the main determinant of this term. Therefore, it becomes critical to calculate the amount of water removing from the related region. Even so, since the physical behavior of evapotranspiration is very complicated, the uncertainty in PET estimates and determination of aridity index should be taken into consideration. Hence, in this study, the assessment of different PET estimates and aridity indexes were carried out by means of different PET calculation methods. The meteorological data serviced by Turkish Meteorological Service and ERA-Interim reanalysis data were compiled for PET calculations. According to the estimates by 21 PET methods, Penman, Rohwer and Romanenko methods derive the highest estimates whereas Irmak-3, Baier-Robertson and Hamon-1 methods derive the lowest PET estimates for Gediz Basin. When the comparisons are made between Penman-Monteith and the other 20 PET methods, Turc, Hargreaves and Irmak-1 methods perfoms the best estimates with the lowest RMSE statistics while Penman, Rohwer and Romanenko methods show the those of highest values. Subsequent to the generation of different PET estimates, 10000 bias corrected-accelerated bootstrap samples were derived and confidence intervals were generated for each month. Upon evaluating the positions of PET estimates obtained by 21 different methods, 75% of monthly estimates of Penman-Monteith and Turc methods lie between the monthly confidence intervals such that these methods are the most satisfying methods in terms of this criterion. In addition, the uncertainty of climate regime of Gediz Basin was evaluated by the confidence intervals obtained by those of PET estimates. Accordingly it is estimated that true climatological regime lie between semi-arid and dry sub-humid climate regimes with 95% confidence level. When the confidence band of aridity index is assessed, it is seen that the methods such as Penman-Monteith, Blaney Criddle, Irmak-1, Irmak-2, Hargreaves, Hamon-2 and Turc methods predict the climate regime of Gediz Basin in between lower and upper bounds of aridity index. The more detailed study including climate change scenarios will be drafted as our future direction.

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EFFECTS OF CLIMATE CHANGE ON THERMAL STRUCTURE OF MESO-EUTROPHIC MEDITERRANEAN LAKE

VARDIT MAKLER-PICK, DIRK SCHLABING, NOAM SHACHAR, GIDEON GAL
Vardit Makler-Pick, Ph.D., Oranim Academic College
Dirk Schlabing, Institute for Modelling Hydraulic and Environmental Systems, Department of Hydrology and Geohydrology, University of Stuttgart, Germany
Noam Shachar, Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research, Israel
Gideon Gal, Ph.D., Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research, Israel

Abstract

The thermal structure of lakes greatly affects key ecological processes, thus, any changes in thermal structure will likely impact the lake ecosystem. Thermal structure and water temperature drive the chemical and biological processes occurring in lake ecosystems. Key processes such as primary and secondary production, nutrient regeneration, oxygen depletion and water movement are highly dependent on them.

It is of consensus that the climate is changing globally and increases in air temperature and in the frequency, strength and duration of extreme weather events are occurring and are likely impacting the thermal structure of lakes. Air temperature in the region of Lake Kinneret (Israel), for example, has an increasing trend across all seasons. The rate of increase in maximum air temperature is 0.6 °C per decade and the time periods between heat events is decreasing (i.e. frequency is increasing) from every 8 to 9 days recorded between the years 1950-1980 to every 6 to 6.5 between the years 2005-2015.

To understand the long term outcome of such climate changes on the thermal structure of Lake Kinneret, four different climate scenarios were conducted. These included: unchanged current meteorological characteristics, a gradual linear air temperature increase of 2 ˚C over the entire simulated period, increased frequency of extreme heat waves and merging of the linear increase and increased frequency of heat waves.

The scenarios were constructed using an adopted vector-autoregressive (VAR) weather generator (VG), based on Schlabing et al. (2014). The scenarios were used as input into 1-dimenstional lake hydrodynamical model (DYRESM) of Lake Kinneret and the thermal characteristics were analyzed. The uniqueness of this work is that the VG scenarios are based on two variables, i.e. air temperature and relative humidity, and the change propagates to other variables that are linked to them. The generator was adjusted to the statistical distributions of the observed weather and to specific local diurnal patterns, therefore forming a tool to reliably examine the different scenarios.

The results indicate that simulation of 30 years of a gradual temperature

increase of 2 ˚C led to an average increase of 0.5 ˚C in the epilminion temperature, and an increase of almost 1 ˚C in the summer epilminion temperatures over the last 10 simulated years. A long-term impact on hypolimnion temperature was demonstrated with an average increase of 0.6 ˚C. In all scenarios the effect of gradual air temperature increase was dominant over extreme heat events and the merged scenario had the greatest effect on lake warming. Predicting these effects is critical to both resource management agents and to public awareness.

Keywords: Climate change, Lake model, Weather generator, DYRESM

Introduction

Climate change

Earth's average surface temperature has already increased by 1 ˚C and is expected to rise further. This observed trend is robust and has been confirmed with very high confidence by multiple independent research groups around the world (IPCC, 2018; Karmalkar & Bradley, 2017).

The increase in temperature recorded in the Middle-East is greater than the average observed around the world. A recent study that analyzed the trend of change in temperature in Israel during the years 1950-2016 indicated that there is a clear trend of warming in all regions of the country and in all elements of the temperature (maximum temperature, minimum and average). The trend of warming occurred during the period of 1950-2016, but it is especially pronounced in the shorter period of 1988-2016. It was also found that during the extended period, the rate of increase in the daily minimum temperature was greater than that of the maximum daily temperature, while during the shorter period, as a rule, the rate of increase in maximum temperature was greater. The trends differ in magnitude spatially, where the greatest rate of change occurred in the western parts of the country. This spatial heterogeneity occurred during both the extended period and the shorter period (Yosef, et al., 2018). Study of trends in extreme weather events in Israel shows that there is a significant increase in the frequency of summer heat waves, e.g., events in which the average daily temperature exceeds the average by 6 ˚C for 3 consecutive days (Ziv, et al., 2011).

Impacts of climate change on lakes

Climate change has an impact on numerous natural systems including all types of aquatic ecosystems. Freshwater ecosystems are very sensitive to climate changes that impact their physical, chemical and biological characteristics, directly or indirectly via modifications to the surrounding watershed (Kernan, et al., 2010; George, 2010; Adrian, et al., 2009). Changes in thermal structure of lakes across diverse climatic regions are systematically associated with long-term increases in air temperature and in the frequency, strength and duration of extreme weather events (Magee & Wu, 2017; Livingstone, et al., 2010; Perroud & Goyette, 2010), which in turn drive the chemical and biological processes occurring in lake ecosystems, i.e. the primary and secondary production, nutrient regeneration, oxygen depletion, and water movement (Kundzewicz, et al., 2007). For example, the consequence of the 2003 European heat wave, was that the surface temperature and thermal stability in two lakes in Switzerland, Lake Zurich and Lake Greifense, were the

highest ever recorded, which in turn resulted in extraordinarily strong hypolimnetic oxygen depletion (Jankowski, et al., 2006).

Modeling the impact of climate change on thermal structure of lakes

The processes responsible for the temperature and thermal structure are commonly described by numerical models in which mathematical equations represent the complex interactions amongst physical, chemical and biological processes. These models spatially range from 0-D to 3-D models (Trolle, et al., 2012). 1-D models are very efficient in computer memory utilization and CPU processing time in forecasting long term periods, thus allow examining the impact of long-term climate changes (Ziemińska-Stolarska & Skrzypski, 2012), hence, a 1-D model was adopted in the current research. A variety of 1-D models have been used in the past to explore lake–climate interactions. For example, the response of 2368 lakes in Wisconsin (Read, et al., 2014) to regional climate was modeled using the GLM model (Hipsey, et al., 2014; Hipsey, et al., 2017), revealing complexities in lake–climate interactions. Study of eight lakes in North America (Michigan) using the MINLAKE2012 model and 50 years of meteorological data (1962-2011), showed increased summer epilimnion temperatures and increased frequency and duration of thermoclines, in deep lakes (Edlund, et al., 2017). F-Lake model was applied to two temperate lakes that have similar morphometrical characteristics but differ in the mixing regime, by means of meteorological data of two future climate scenarios based on IPCC reports from 2001. In these scenarios, both lakes changed their mixing regime to warm monomictic over the course of the century (Kirillin, 2010). In the current study, like in many others ones, appropriate delivery of climate nature is important for future scenarios. Increasing or decreasing air temperature, for example, does not consider the linkage between warming and other meteorological factors such as humidity or short and long radiation, or the impact of heat stress. Relying on the output from Global Climate Models (GCM) as input to hydrological model, provides resolution that is too coarse and prone to substantial biases for local assessments. Alternatively, it is recommended to apply regional climate models (RCMs) (Weinberger & Vetter, 2012), statistical downscaling (e.g., deriving finer resolution data for a particular site from coarser resolution GCM data), or weather generators (WG) that produce synthetic time series of weather data of unlimited length for a location based on the statistical characteristics of observed weather (Khalili, et al., 2011). The Richardson model (Richardson, 1981), for example, is a popular technique for stochastic simulation of daily weather variables including precipitation amount, maximum and minimum temperature, and solar radiation. However, its shortcoming is the failure to adequately describe the length of dry and wet time series (Ailliot, et al., 2015; Fowler, et al., 2007).

The present research aimed to study the effects of different climate change scenarios on the thermal structure of Lake Kinneret. For this purpose a weather generator that produces consistent meteorological time series which preserve the correlations, distributions and annual cycles of measured data, and is capable of constructing hand tailored scenarios was developed based on Schlabing et al. (2014). Synthetic meteorological data, produced by the weather generator, were used as input to 1-D hydrodynamic lake model (DYRESM) that simulates changes in lake thermal structure and salinity, with depth.

Methods

Study site

Lake Kinneret is a warm-monomictic lake located at an elevation of 210 m below sea level in the northern part of Israel. The lake is 22 km at maximum length and 12 km at maximum width; maximum and mean depths are 44 m and 24 m, respectively, and surface area is 170 km^2. Lake Kinneret is the only natural surface fresh water reservoir in Israel and is therefore subjected to multi-purpose use, such as supplying drinking water, tourism, recreation and commercial fishery. It is meso-eutrophic with a mean annual primary production of 650 gC m^{-2}, secchi depth ranged from 0.7 to 5.5 m and turbidity ranged from 0.7 to 22 NTU, in the years 1972–1993 (Berman, et al., 1995).

Two key climatic features of Lake Kinneret significantly affect its physical characteristics. The first, is the relatively high air temperatures all year round (annual mean of 21 ˚C). The annual midday air temperature in the Kinneret valley is about 8 ˚C higher than that in the mountain regions to its northwest and northeast. The maximum temperature in the summer months exceeds 36 ˚C, and on average during 52 % of the days between March and November the temperature exceeds 33 °C, 33 % of the days it exceeds 36 °C and on 8 % (23 days) it exceeds 39 °C. An analysis of the rate of change of air temperature during each of the four seasons in the years 1975–2010 indicates that air temperature shows rising trends at all times of the year. The rate of increase for the maximum temperature is considerably higher compared to the minimum temperature. The most rapid warming is observed during the summer months, June to August. The rate of increase in daily maximum air temperature is 0.65 °C per decade. This warming is manifested by intensification of the heat stress and increase in the occurrence of extreme high temperatures (Ziv, et al., 2011; Ziv, et al., 2014). The second feature is the wind regime over the lake, attaining speeds of about 10 ms^{-1} particularly during the afternoon when the Mediterranean Sea Breeze (MSB) reaches the lake during the months of May–September.

Lake Kinneret water temperature has changed considerably since 1970s: the average temperature of the epilimnion increased by ∼1 ˚C (∼0.025 ˚C $year^{-1}$), the average hypolimnetic temperature remained constant (∼15 ˚C), and the temperature gradient across the metalimnion increased by ∼0.016 ˚C $m^{-1}year^{-1}$ during the summer and fall (Ostrovsky, et al., 2012). The average epilimnion and metalimnion thickness decreased by ∼1–2 m and hypolimnion thickness slightly increased (∼1 m) (Rimmer, et al., 2011). According to Rimmer et al. (2011) it is related mainly to the reduction in lake level and secondly to increase in air temperature. The increase in air temperature is expected to continue and to intensify in the future, with higher frequency of extreme heat waves (Ostrovsky, et al., 2012; Ziv, et al., 2014)

The data used in this study were collected as part of the on-going Lake Kinneret monitoring program conducted by the staff of the Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research (IOLR) and Israel Meteorological Service (IMS).

Hydrodynamic model

The Dynamic Reservoir Simulation Model (DYRESM) is a numerical 1-D model which simulates vertical water temperature, salinity, and density, with depth

(Imberger, et al., 1978; Imberger & Patterson, 1982). The lake is represented by a series of horizontal water layers for which the energy budget is maintained. The layers are lagrangian, i.e. they change in thickness as the computation proceeds. The computation starts from the bottom working upwards through the layers, computing density as function of temperature and salinity and then testing the layer stability relative to the layer beneath. Stability and mixing processes are computed using parameterization derived from detailed investigation in the field and laboratory. The model accounts for surface heat, mass, momentum exchange, surface mixing processes, inflows and outflows dynamic, hypolimnion mixing and artificial destratification. Three mechanisms are available for surface layer mixing: stirring (energy from wind stress), convective overturn (decrease in potential energy), and shear (transfer of kinetic energy from the upper to the lower layer). The data preparation and simulation process for DYRESM require meteorological data, morphometry, inflows, outflows, an initial profile, a parameters data file, and a configuration data file. For more details see DYRESM Science Manual (Antenucci & Imerito, 2003).

DYRESM has been calibrated, tested and applied to Lake Kinneret (Gal, et al., 2002; 2003; Rimmer, et al., 2011). We thus refer the reader to the study by Gal et al. (2003) for additional information regarding the model's calibration for Lake Kinneret.

Model setup

Thirty-year simulations were initiated on 1 Jan. 2010 with an hourly time-step and daily output, during which there was no interannual variability in the input data with the exception of the meteorological data (short-wave and long-wave radiation, air temperature and vapor pressure). Other input data - rainfall, wind velocity and volume, temperature and salinity of six inflows and volume of three outflows (the downstream portion of the Jordan River, water extracted to the national water carrier and water extracted to local communities around the lake) were based on year 2002 which is considered as a typical year. Model parameters and schematic presentation of DYRESM are described in Gal et al. (2003). Extinction coefficient, *K*d, was set to 0.6 m^{-1}.

Analyses of the results was based on the mean of the 1000 realizations over 30 years, however, we mainly present results of the last 10 years of the simulation as the trends and expected outcome are more pronounced.

Climate scenarios

Based on predicted and observed long-term climate changes, we examined four different climate scenarios:

1. Unchanged – current meteorological characteristics remained unchanged and include typical three episodes of 2-4 days of heat-waves per summer. This scenario served as a reference for the other scenarios.
2. Gradual – this scenario replicated the observed increase of air temperature by 0.65 ˚C per decade (Ziv, et al., 2011). For this, we applied a gradual linear increase of 2 ˚C in air temperature over the entire period of the scenario.
3. Heat-waves – increased duration (7-14 days) of heat events during the summer, comparable to the changes described by Ziv et al. (2014).

4. Merged - merging of the gradual increase scenario (scenario 2) and the increased frequency of extreme events scenario, i.e. the heat wave scenario (scenario 3). This scenario is considered the most realistic.

Weather Generator (VG)

The WG developed in the current research, reproduces the dependency structures based on measured meteorological data, and climate scenarios (Schlabing, et al., 2014). It employs a single Vector-Autoregressive (VAR) process that captures the auto- and cross correlations in multivariate time series by separating them into a deterministic, linearly dependent and a random part, assuming that the variables at each day are linearly dependent on the values of all variables from the previous several days. Estimating the parameters of the deterministic part and drawing random numbers that correspond to the subsequent residual part, one can generate arbitrarily long synthetic time series that exhibit a normal margin. Transformations based on quantile-mappings are used to make them resemble the observed reality. This time series is considered as the base (unchanged) scenario.

Site specifics VG

Schlabing et al. (2014) VG was specifically adapted to the meteorological conditions at Lake Kinneret. As air temperatures in the region exhibit a skew towards higher values, the Gumbel distribution was used instead of the Normal distribution. While this change merely implies a different configuration, producing the combination of heat-waves and gradual change in temperature was only possible by extending the methods underlying scenario generation. Heat-waves at Lake Kinneret are not only episodes of high temperatures, but specific meteorological events on their own, characterized by weakened Etesian winds and a blocking of the MSB by the marine inversion height falling below the height of the Galilee Mountain ridges (Shilo, et al., 2015). During these episodes, temperature is exceptionally high and wind-speed and humidity are low. Reproducing these multivariate patterns was achieved by the VG through generating random sequences of low relative humidity (25%) events during the months June through September. In order to generate the "merged" scenario, VG was updated to accept changes in more than one variable (here: temperature and relative humidity). For each changed variable, the influence on the other variables was calculated and added separately as described in Schlabing et al. (2014). Thus, gradual change and heat-waves can be seen as different drivers each having an influence on the full set of simulated variables.

Specifically, the VG scenarios for Lake Kinneret were constructed to illustrate the annual air temperature pattern with built-in variability and daily fluctuation (unchanged scenario) for 30 years with a total of 1000 realizations for each scenario. The gradual scenarios encompassed interannual increase that is evident mainly during the hot dry summers and the cool rainy winters (Fig. 1). The heat wave scenario illustrates more frequent summer extremes with higher temperatures, as clearly shown in Fig. 2 (the 75^{th} and 95^{th} percentiles of all 1000 realizations at the upper part).

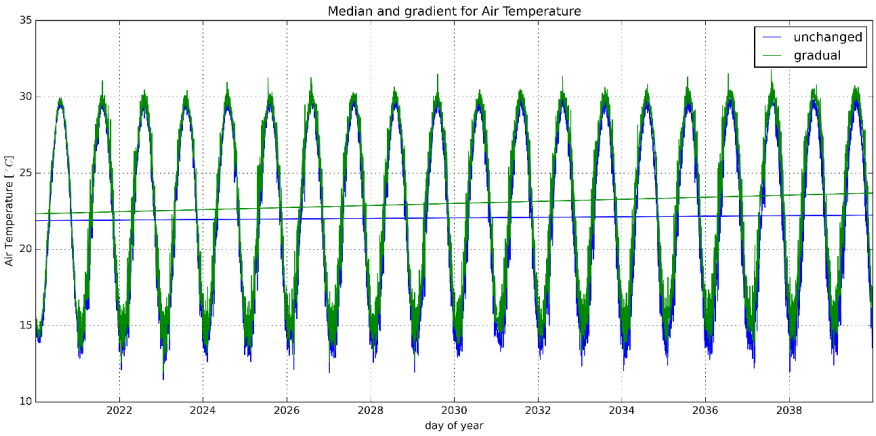

Figure 1 - Median and gradient of air temperature of all realizations in the unchanged (blue) and gradual scenario (green).

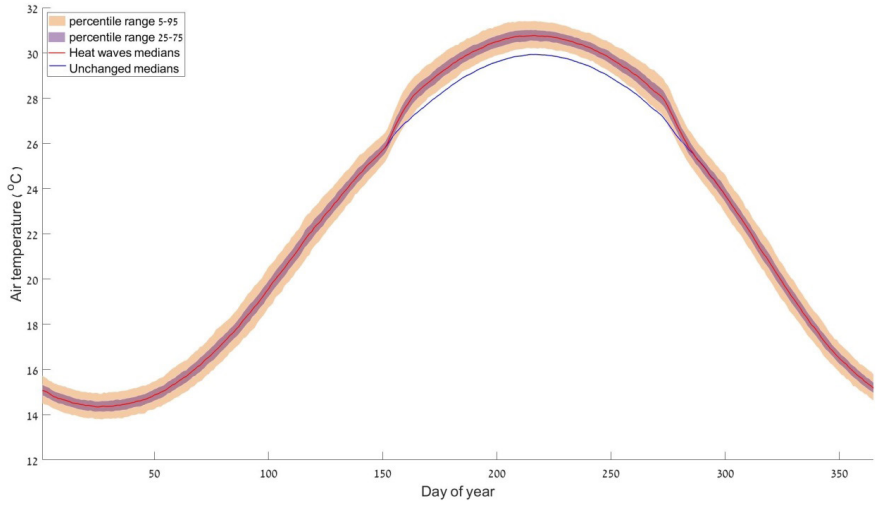

Figure 2 - The median air temperature of the unchanged scenario, and the median, 5th- 25th, 75th- 95th percentiles temperature ranges of the heat-wave scenario, for all 1000 realizations.

Results

Water temperature simulated in the unchanged scenario reproduce typical water thermal dynamics changing seasonally with a uniform water column in winter when the temperature ranged between 14 and 15 ˚C, and a peak summer stratification with an average surface temperature (0-10 m, hereafter "surface layer") between 27 and 29 ˚C and a bottom temperature (30-40 m, hereafter "bottom layer") typically about 0.4 ˚C higher than that observed temperature during the previous winter (Fig. 3). During the stratification period, the thermocline typically resides at a depth between 17 and 19 m.

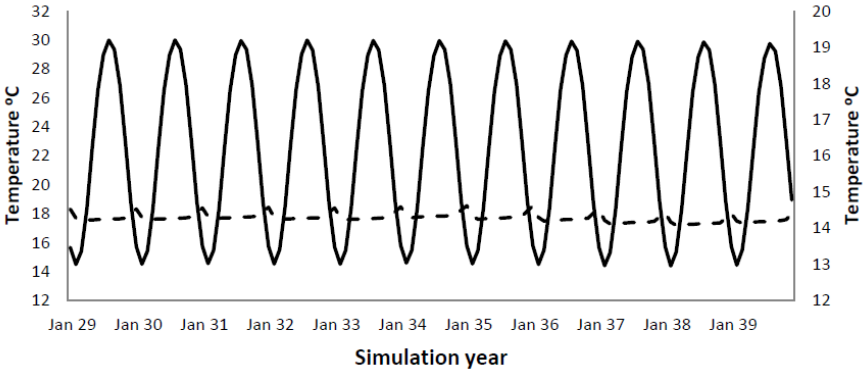

Figure 3 - Average water temperature of the surface layer (solid line), and bottom layer (dashed line, secondary axis) during final 10 years (years 30-39) of the unchanged scenario.

Comparing the different scenarios during the final year of the simulations indicates that the gradual and the merged scenarios had the greatest impact on surface layer temperature during the summer months. In both scenarios the temperature increased by an average of 1.1 ˚C compared to the unchanged and heat wave scenarios (Fig. 4, Table 1). The difference between the maximum simulated temperature of the heat wave, gradual and merged scenarios and the maximum temperature of the unchanged scenario ranged from -0.56–1.02 ˚C, 0.17-1.27 ˚C, and 0.18-1.66 ˚C, respectively (Fig. 5, 6). Additionally, we found a threefold increase in the number of days with a surface temperature > 30 ˚C, increasing from 15 in the unchanged scenario to 46 in the gradual scenario. The bottom layer response in both the gradual and the merged climate scenarios was a linear increase in water temperature over the whole simulation period (Fig. 7). Interestingly, the heatwave scenario bottom temperature is lower than the unchanged scenario with an average decrease of -0.13 ˚C in December and January when the lake is well mixed. The number of stratification days in January and March increased by an average of one day per month in the gradual and merged scenarios, thereby resulting in a slightly shorter mixed period.

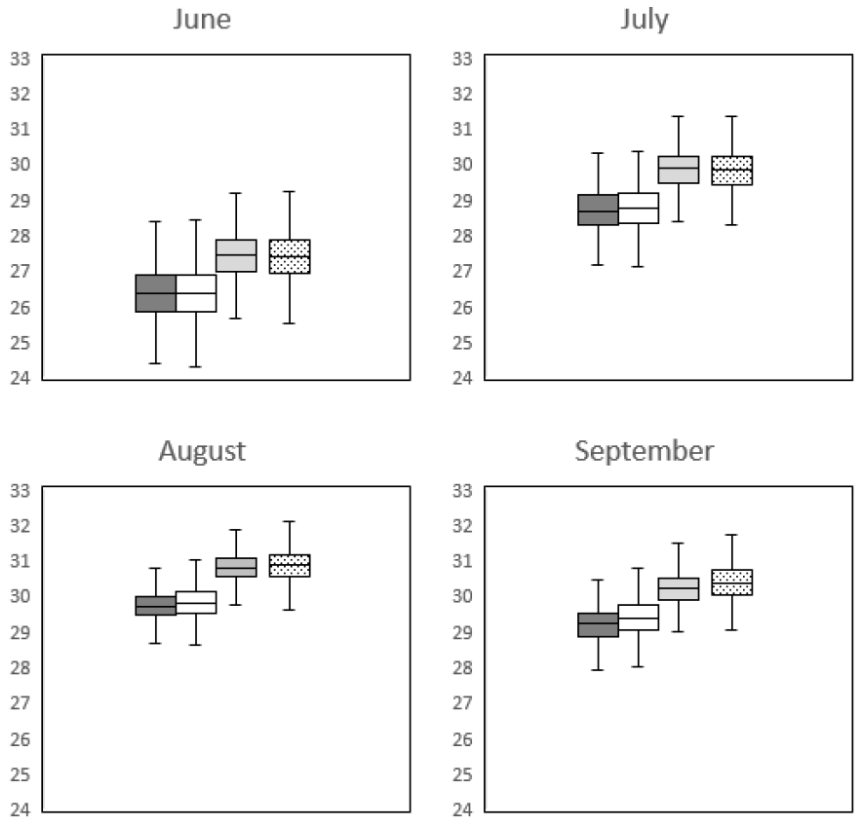

Figure 4 - Box and whiskers plots of summer temperature (June-September) in the surface layer during the last year of the scenarios (dark grey – unchanged, white – heat waves, light grey – gradual, dotted – merged).

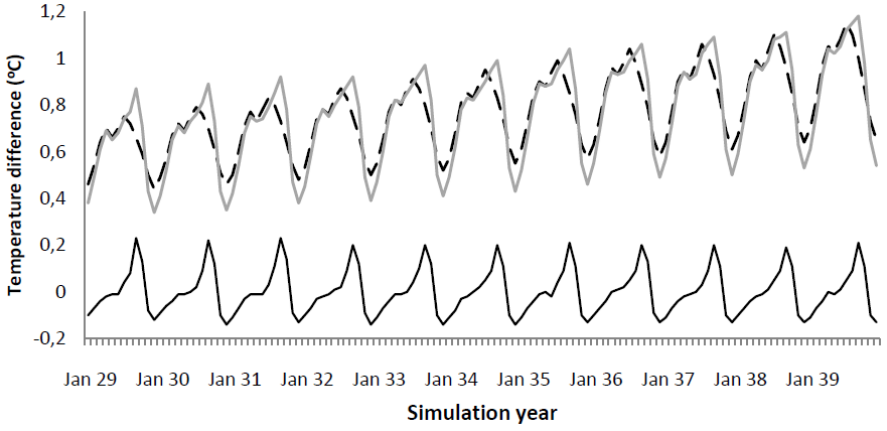

Figure 5 - Monthly average surface layer temperature differences between unchanged and heat waves (solid line), gradual (grey line) and merged (dashed line) scenarios during the last 10 years of scenarios.

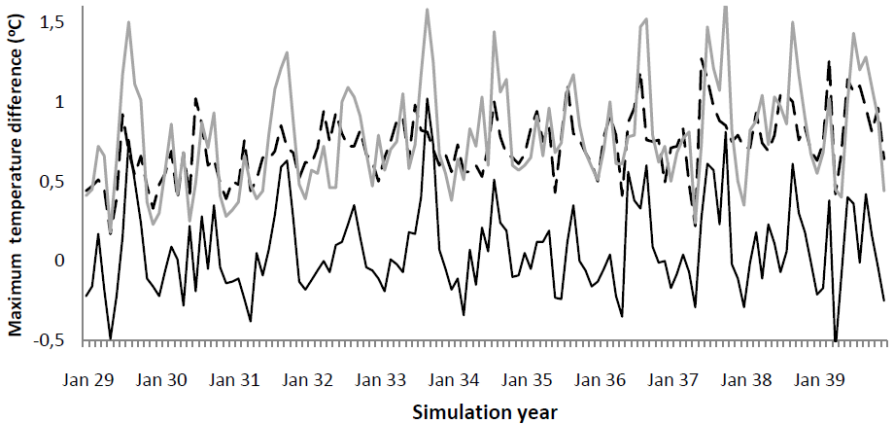

Figure 6 - Monthly average maximum temperature difference between unchanged and heat waves (solid line), gradual (grey line) and merged (dashed line) scenarios at surface layer.

Table 1 - Seasonal average temperature of the surface layer over the course of the final 10 years of the scenarios

	Mean temperature (˚C)			
	Unchanged	Heat waves	Gradual	Merged
Winter (Dec-Feb)	16.32	16.21	16.92	16.84
Spring (Mar-May)	18.76	18.74	19.59	19.58
Summer (Jun-Sep)	28.64	28.73	29.53	29.57
Fall (Oct-Nov)	24.93	24.94	25.60	25.62

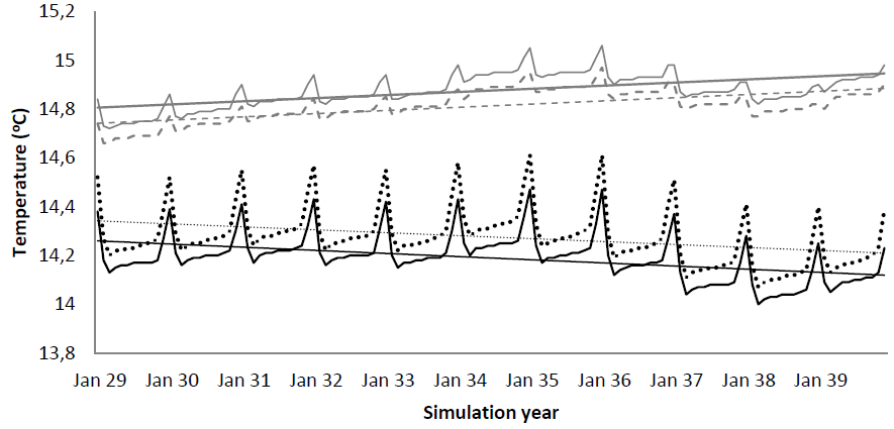

Figure 7 - Average water temperature of bottom layer in the unchanged (dotted line), heat waves (solid line), gradual change (grey line) and merged (dashed line) scenarios and corresponding trend lines.

Discussion

To examine the expected impacts of climate change scenarios we employed a vector-autoregressive (VAR) weather-generator (VG) to produce meteorological time series as input to a 1-D hydrodynamic model (DYRESM) able to predict the vertical distribution of temperature, salinity, and density in lakes. The results of the gradual temperature increase and the merged (gradual temperature increase and intensified heat waves) scenarios suggest that water temperature of Lake Kinneret will be higher than at present. These results are consistent with other studies indicating an increase in epilimnion temperature during all seasons, as epilimnetic water temperatures are highly correlated with air temperatures (Adrian, et al., 2009). The summer temperature increase is greater than the winter, both in the epilimnion and the hypolimnion and additionally, the eplimnion increase is greater than the hypolimnion. As indicted by different studies, while surface water temperatures show a rapid and direct response to climate change, the hypolimnetic temperatures exhibit a much more complex behavior and may undergo warming or cooling trends depending on lake morphometry and season (Sahoo, et al., 2015; Adrian, et al., 2009) . A rise in the number of stratification days resulted in a longer stratification period and stronger lake thermal stability. However, in comparison to other studies (Jankowski, et al., 2006; George, 2010), the impact on stratification of Lake Kinneret in both scenarios was minor.

The impact of the heat wave scenarios is less conspicuous than the gradual and merged scenarios. The monthly average surface temperature increased by maximum of 0.23 ˚C in the summer and decreased during the winter by minimum of –0.14 ˚C, in comparison to the unchanged scenarios. This can be explained by the distinct cooling of the hypolimnion. Additionally, there was no considerable impact on the number of stratification days. These results are inconsistent with the reported predictions of higher thermal stability in response to heat waves (Jankowski, et al., 2006).

Stratified lakes are particularly sensitive to changes in the weather since they integrate the effects of changes in the solar radiation, air temperature and the wind speed. However, in the Mediterranean and other arid and semi-arid regions, the warmer temperatures may also promote different effects than those expected in temperate regions since they have higher annual water temperatures and higher seasonal fluctuations in water level, but smaller seasonal changes in light and temperature in comparison to temperate lakes. Additionally, and based on long-term temperature data (1970–2010) from 26 lakes around the world, Kraemer et al. (2015) concluded that the magnitudes of lake stratification changes are primarily controlled by lake morphometry (mean depth, surface area, and volume) and mean lake temperature, possibly explaining our results.

Our results suggest that the influence of climate change on lake temperature and stratification in the subtropical, meso-eutrophic, deep (stratified) Lake Kinneret are particularly noticeable when air temperature increases gradually and when the gradual increase is intensified with higher frequency of extreme heat events during the summer.

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EFFECTS OF DIFFERENT LEVELS OF SALINE WATER ON INFECTION OF TOMATO BY BOTRYTIS CINEREA, THE CAUSAL AGENT OF GRAY MOLD

BOUMAAZA BOUALEM[1], BOUDALIA SOFIANE[2], GACEMI ABDELHAMID[1], BENZOHRA.I. E[3], BENADA M'HAMED[3], BENKHELIFA MOHAMED[1] AND KHALADI OMAR[2]

Biodiversity and Water and Soil Conservation Laboratory, Department of Agronomy, University of Abdelhamid Ibn Badis, BP 300, 27000, Mostaganem, Algeria.

Abstract

A greenhouse experiment was conducted to investigate the effect of different levels of NaCl salt on tomato *upon B. cinerea infection* the causal agent of gray mold disease. The disease assessment was recorded after inoculation by using the scale based on percentage leaf area affected, and the growth of the plants was recorded for each treatment. Three weeks after inoculation by conidial suspension, the estimated disease severity on plants of tomato was 35.18% compared to the control. The highest incidence disease increase of gray mold (39.21%) was obtained with using 300 mM of NaCl after inoculation with *B. cinerea* compared with the other concentrations and as well as distilled water. Under severe salt stress (150 and 300mM) increased susceptibility of gray mold disease severity were observed in plants inoculated with *B. cinerea*, while under mild salt stress (50mM of NaCl) this effect was reversed. The treatment of plant by *B.cinerea* has reduced the growth of the aerial part of tomato plants (39.06%) after three weeks inoculation compared to the control. Three levels of NaCl (50, 100 and 150mM) increased respectively the plant height from 12.73 to 29.84%, 0.28 to 27.16% for the fresh eight and

5.75 to 33.35% for dry weight compared to the plants inoculated and irrigated by distilled water. NaCl addition at 300mM on plants inoculated with *B. cinerea* decreased the height, fresh weight and dry weight at 0.99, 4.45 and 11.01% respectively.

Key words: *Botrytis cinerea,* Gray mold, Incidence disease, *Lycopersicon esculentum*, NaCl.

Introduction

Tomato (*Lycopersicon esculentum* Mill) is the most widely grown crop in the world. It is the second most important food crop in the developing world after potato, with an annual production of 164 million tonnes from 4.73 million hectares of area under cultivation in 2013 (FAOSTAT 2015). In Algeria, the tomato provides a key component in the so-called Algerian diet.

Several organisms such as fungi, bacteria and insect can cause diseases in tomato plant, resulting in significant yield losses (Mala *et al.,* 2016).

The tomato pathogen *Botrytis cinerea* causes gray mold, is ubiquitous fungi, widely distributed in soil, and other organic substrates, being pathogenic for a variety of plant species. Currently, *Botrytis cinerea* is one of the most severe diseases of tomatoes in Mediterranean basin (Elad *et al*., 2004). In greenhouse, *B. cinerea* is capable of causing disease on virtually all parts of the tomato plant during any stage

of plant growth (Carisse *et al*.,2014).

Many studies concluded that exposure of plants to salinity stress can significantly increase the susceptibility of tomato to root knot nematode (Endongali and Ferris, 1982; Maggenti an d Har dan, 1973), and to increase th e susceptibility of citrus and chrysanthemum to Phytophthora root rots (Blaker and MacDonald, 1986; MacDonald, 1984; Swiecki and MacDonald, 1988). Soliman and Kostandi (1998) showed that maize had varying susceptibility to smut disease caused by *Ustilago maydis* under different concentrations of NaCl. The low levels of salinity (25- 50mM) could increase the severity of *phytophthora* root rot of tomato with high Na:Ca ratios (10:1) (Bouchibi et *al*., 1990); *Phytophthora* **(**Roubtsova and Bostock 2009; Sanogo, 2004), *F. oxysporum f. sp. vasinfectum* (Turco et *al*., 2002), *F. oxysporum* f. sp. *radicis- lycopersici* (Triky- Dotan et *al*., 2005), *Verticillium dahliae* and *Alternaria solani* (Regragui 2003., Nachmias *et al*.,1993).

Materials and Methods

Isolation of the pathogen: *B. cinerea* isolate was obtained from decayed tomato, collected from greenhouse in the Mostaganem, North-west, Algeria. Healthy and weakly infected leaf fragments were washed with tap water and cut in the middle. The leaf fragments were sterilized with sodium hypochlorite (2% available chlorine) for 5 min, rinsed three times in sterile distilled water, and dried filter paper. The leaf fragments showing lesions with a gray mold were placed on Potato Dextrose Agar (PDA).*B. cinerea* was incubated at 25°C and stored at 4°C. In order to harvest the conidia, the fungal culture plates were flooded with autoclaved, distilled water and gently rubbed with a Drigalski spatula under aseptic conditions. The liquid fraction was filtered. The concentration of conidia suspension was adjusted at 10^7 conidia /ml.

Cultivation of plants and inoculation: The experiment was conducted in a greenhouse at the Guelma University Station. Tomato cv. 532 variety was selected with good adaptation to all climatic areas in East Algeria, based on their economic importance to the state with important traits to consider include: potentially different disease resistance (The diseases we selected are *Fusarium oxusporum* (FO), *Alternaria solani* and *Phytophtora infestants*), yield potential and market opportunities.

The seeds were sown in alveolar trays filled with peat on a one seed per mini-mound at a depth of 1 cm. After emergence, the transplantation was made in plastic pots of 16 cm diameter and 30 cm in height, the seedlings were transplanted on a one seedling per pot and filed in greenhouses with a 14-h light (24°C) and 10-h dark period (20°C) at 85% relative humidity. Every three days, the plants were irrigated regularly with Hoagland nutrient solution to 30% of the substrate holding capacity. The study was established with 20 plants per salt treatments (0, 50, 100, 150 and 300mM). After 60 days, the plants were exposed for one week to irrigation with different water salinity levels. The control plants were irrigated with distilled water. Then, tomato transplants were inoculated by applying 25 ml at 10^7 conidia /ml suspension of *B. cinerea* .For spray treatments, the spore suspension was applied to the entire plant, using an aerosol spray bottle, until plants were wetted. Non inoculated control plants received 25 ml of sterile water.

Disease assessment: Disease severity was recorded three week after inoculation

by using the scale based on percentage leaf area affected as described by Cohen *et al.* (1991) in a sample of 30 seedlings per replicate. Disease severity scale from 0 to 4 was used, whereas, 0 = No leaf lesions, 1 = 1-25%, 2 = 26-50%, 3 = 51-75% and 4 = 76-100% infected area of tomato leaf. The coefficient of infection was calculated by multiplying of disease severity (DS) and constant values of infection for host response ratings of resistant (R), moderately resistant (MR), moderately resistant-moderately susceptible (M), moderately susceptible (MS) and susceptible (S), following Pathan and Park (2006). The length of the aerial part of the plants and the fresh weight and dry weight of plants were recorded for each treatment.

Statistical analysis: The results were expressed in the form of the mean ± SD. The analysis of variance was carried out with respect to each parameter measured [incidence (I), severity (S), coefficient of infection (Ci), height (cm), fresh weight, dry weight (g) and water content (%)]. Mean discrimination was performed applying the t test; statistically significant differences were determined at the probability level $p<0.05$.

Results and Discussion

Results in Table 1 indicate that the isolate tested of *Botrytis cinerea* was able to infect tomato plants causing typical gray mold symptoms of disease at the temperature of 24°C and relative humidity of 85% at three weeks after inoculation (Fig 1). Significant difference was noted from pathogen-inoculated plants ($p<0.01$). In absence of salt stress (0mM), gray mold incidence was 35.18%, and severity was 4.21% (Table 1). However, the leaf that were inoculated and tested in lower levels of NaCl (50mM), decay incidence decreased from 35.18% to 16.66%, respectively. On the contrary, infection incidence and severity in leaf are higher at salt stress between 150 and 300mM than at other level ($P < 0.01$). Disease severity was increased by 4.87 and 5.02 at 150 and 300mM respectively, compared to plan ts in oculated with th e pathogen an d irr igated by sterile distilled water. With the same concentrations of salt (150 and 300mM), it is evidenced that the highest mean incidence was 54.16% to 57.88%.

The mean coefficient of infection in absence of salt stress was 8.42% and the highest mean coefficient of infection was 15.06% in 300 mM and lowest mean coefficient of infection was 1.49% in 50 mM. Also the inoculation of plants in the presence of NaCl has stimulated over time the incidence disease, severity and coefficient of infection at high levels of NaCl compared to plants inoculated with the pathogen and irrigated by sterile distilled water (35.18%).

Of the five groups of plants tested (0, 50, 100, 150 and 300mM), only two were confirmed to be resistant R" to combined effect of *B.cinerea* and salt stress (50 and 100mM), two groups (150, 300mM) were moderate susceptible "M" and once had moderate resistance "MR" in the plants inoculated with the pathogen and irrigated by sterile distilled water.

The plants were grown in the greenhouse and evaluations fresh weight, dry weight (g) and water content (%) were evaluated 30 days after inoculation.

The inoculation of tomato plants with *B. cinerea* reduced the height of plants (27.27), the mean inhibition in height of the plant was 39.06% compared with the control (44.75cm) Table 2.

It was observed from this study that the hybrid tomato cv. "532" is susceptible to

response of low levels of salt stress after inoculation by increasing of morphological characteristics, but it still remains low compared tothe control.

Fig 1: Effect of different levels (NaCl) on the disease severity on tomato, cv. 532 variety. (A) Control; (B) plant inoculated after 2 weeks. (C); plant inoculated and irrigated with saline water (50mM), (D); plant inoculated, irrigated with saline water (100mM), (E); plant inoculated, irrigated with saline water (150mM), (F); plant inoculated irrigated with saline water (300mM).

Treatments NaCl (mM)	Incidence (I)	S everity (S)	Coefficient of infection (Ci)	Observed epidemic group
0	35.18±4.24 a	4.21±0.51a	8.42±1.35a	M R
50	16.66±1.39b	1.49±0.12b	1.49±0.11b	R
100	31.01±2.12	2.79±0.19b	2.79±0.14b	R
150	54.16±1.39a	4.87±0.12	14.61±2.53a	M
300	57.88±2.14a	5.02±0.18b	15.06±3.81a	M

Table 1: Effect of different levels of NaCl on the: incidence (I), severity (S) and coefficient of infection (CI) of *Botrytis cinerea* on tomato. The results are expressed as the mean ± SD.

Treatments NaCl (mM)	Height (cm)	Fresh weight (g)	Dry weight (g)	Water content (%)
Control	44.75±0.95	164.75±1.25a	24.2±0.62 a	85.38±0.48a
0	27.27±1.47a	88.75±1.20a	11.8±0.24 b	86.85±0.27b
50	31.25±4.99b	89±1.82b	12.52±2.09b	85.94±2.13
100	34.25±0.59	101.87±4.68b	16±0.96b	84.26±1.31
150	38.87±0.90a	121.85±3.22b	17.75±0.69 b	85.52±0.68
300	27±1.41a	84.8±3.22b	10.5±0.53 b	87.61±0.55a

Table 2: Effect of different levels of NaCl and *Botrytis cinerea* on the height, fresh weight, dry weight and water content on tomato: The results are expressed as the mean ± SD.

Increase the levels of water *salinity (50 to 150mM)* with inoculated of tomato plants enhanced the plant height, fresh weight and dry weight compared to plants inoculated with the pathogen and irrigated by sterile distilled water. There was a significant increase in plant height from 12.73 to 29.84%, 0.28 to 27.16% for the fresh weight and 5.75 to 33.35% for dry weight measured respectively by 50 to 150mM. When plants of tomato were inoculated with *B. cinerea* and i*rrigated* by *water* of higher *salinity* (300mM), the mean inhibition were 0.99, 4.45 and 11.01% on the height, fresh weight and dry weight respectively. Plants inoculated at 300mM increased the water content compared to the control.

Among the great number of abiotic stress affecting plants, salinity in soil or water, especially in arid and semi- arid regions, is the most severe and stronger one that limits crop productivity (Freitas *et al*., 2011). Furthermore, salinity negatively affects plant physiology as a consequence of the toxic effects of sodium and chloride, which induce nutrient imbalances in the plant and alter osmotic potentials hindering water uptake by the roots (Munns and Gilliham 2015). From literature, plants exposure to salt stress can causes a range of adverse effects in plants, it imposes osmotic stress by imbalances and ultimately interfering with various metabolic processes (Munns and Tester, 2008). Also, it leads to an increase of diseases caused by various species pathogen (Bouchibi *et al*., 1990).

The primary goal of this study was to determine the effects of *saline irrigation water* on incidence and severity of gray mold caused by *B. cinerea* on tomato plants.

Here, we report that NaCl application at 150 to 300mM can increase disease incidence and severity. These results were consistent with those of Ouazzani *et al* (2014), who found the stimulator effect of salinity was observed on the mycelia growth, conidia production and conidia germination of the tested stain of *V. dahliae* respectively in concentrations 170, 120 and 256mM. In the same way, salinity effects were reported for: *Phytophthora sojae Kaufm*,

P. capsici, Fusarium solani, Phytophthora citrophthora, Fusarium oxysporum f. sp. *radicis-lycopersici* (Canaday *et al*., 2010; Sanogo, 2004; Firdous and Shahzad, 2001; Sulistyowati, 1993; Triky-Dotan *et al*., 2005) respectively. The same result was also showed by Elmer (2002), which found no reductions in the severity of *Fusarium wilt* caused by *F. oxysporumf.sp. cyclaminis* when NaCl were applied.

This study demonstrated that low salinity (50 to 100mM) associated with

B.cinerea decreased incidence disease. Furthermore, disease severity of infection in plants subjected to decrease compared to the plants inoculated and irrigated by distilled water. These results are in accordance with those of Kumar et *al*, (2010); with increase in salinity str ess th e sever ity of ear ly leaf spot (*Cercospora arachidicola*), late leaf spot (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*) decreased. The same author showed that higher salinity affected the crop growth and there was no corresponding increase in pod yield. The author concluded that although groundnut is a sodium sensitive crop, it can be grown profitably up to a threshold salinity stress of 2.0 to 2.5 dS m-1 at this salinity the severity of foliar diseases were less and the pod yield was maximum. According to Jeffrey *et al*., (1985), the concentration of 10.25mM elimin ates th e pr oduction zoospor es of *Lagenidium giganteum* able to germinate. In fungi, a low osmotic potential decreases spore germination and the growth of hyphae and changes the morphology (Juniper and Abbott, 2006) and gene expression (Liang *et al*., 2007). Sodium decreased the severity of cotton root rot (*Phymatotrichum omnivorum* Duggar) (Lyda and Kissel, 1974), yellow rust of greenhouse-grown wheat (*Puccinia striiformis* Westend) (Russell, 1978), and powdery mildew of wheat (*Erysiphe graminis* DC.) (Leusch and Buchenauer, 1989).

The reduction in disease severity in lower levels may be due to the metabolic changes in the host under salt stress causes stimulation the activity of enzymes involved in disease developmen t, of wh ich cellulase an d polygalacturonase are favored by alkaline reactions.

Application of NaCl at concentrations on 50 at 150mM with inoculated by *B.cinerea* enhanced the plant height, fresh weight and dry weight compared to the plants inoculated and irrigated by distilled water, which may be increase tolerance or plant response to salt. Other results that support what has been shown here, are those by Amira and Abdul Qados (2011) with his study on *Vicia faba*; Hamada (1995) on maize *Zea mays* L; Memon *et al*. (2010) in their study on *Brassica campestris* L; and ûnally by Misra *et al*. (1997) with their study on rice seedlings *Oryza sativa*

L. vr. Damodar, where they showed that the use of low levels of salt stress led to increases in plants lengths. The increase in fresh weight and dry weight may be due to the ability of the plant to increase the size of its sap vacuoles, which allows for the collection of a lot of water and saltions (Munns, 2002). Also, increased in fresh weight and dry weight that corresponded with the increased in chemical content. This reading was registered as well, including the study done by Chao *et al*. (1999). They noticed an increase of protein content of the tomato plant *Lycopersicon esculentum* (L.) in response to salt stress. Some plants can develop a lot of mechanisms to support low salinity, as example the development of internal water deficit, which can be important for some crops such as coffee and mango in order to trigger phenological events such as flower bud release, height, fresh weight and dry weight. Greenhouse experiments by Elmer (1997) conducted on two sugar beet cultivars showed that application of NaCl (10 g/l) increased plant dry weight by 12% in rhizoctonia-infested soils and by 40% in non-infested soils as compared with plants that did not receive NaCl treatment. The agronomical parameters used for salt tolerance are yield, survival, plant height, leaf area, leaf injury (Parvaiz and Satyawati 2008), however, salt tolerance in plants may be explained by functional and structural adaptations, such as growth regulations,

osmotic adjustment, regulation of stomatal conductance, changes in cell wall elasticity, mineral nutritional and hormone balance, all of which may help alleviate the harmful effects of stress (Suárez, 2011).

On the contrary, application of high salinity (300mM) with inoculated by *B.cinerea* has been shown to decrease the agronomical parameters (plant height, fresh weight and dry weight). Many studies have shown that salinity affects physiological processes of plants, causing a nutrient imbalance, altering the levels of growth regulators, inhibiting photosynthesis and protein synthesis, all of which lead to reduced plant growth (Hashem *et al*. , 2015; Hamed *et al*., 2014; Zaid *et al.,* 2014). An increase in the fresh and dry weights of the shoot system are affected, negatively by changes in salinity concentration, type of plant species or type of salt (Rui *et al*., 2009; Taffouo *et al*., 2010; Memon *et al*., 2010). Thus, salinity inhibition of plant growth was the result of osmotic and ionic effects and the different plant species have developed different mechanisms to cope with these effects (Munns and Tester,2008).

Conclusion

All though the mechanisms by which stress increases disease severity are not yet known, recent work with salinity stress has provided some information. This study is relevant to management of *B. cinerea* under saline conditions in that it provides an understanding of the direct and indirect effects of salinity on gray mold, and their interaction. In light of the results from this study, the salinity in water may predispose susceptible tomato plants to infection by *B. cinerea*. However, further work is necessary with the selected salts to evaluate their efficacy against several strains of *B. cinerea* in several tomato cultivars in order to establish whether NaCl could eventually be increased gray mold oftomato.

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TOWARD THE SUSTAINABILITY OF CULTURE SERVICES IN DEVELOPING COUNTRIES; CHALLENGES AND THREATS

ASMAA ABUALHAGAG, LÁSZLÓ KOLLÁNYI, ISTVÁN VALÁNSZKI
Asmaa Abualhagag, Laszlo Kollanyi, Istvan Valanszki, Department of Landscape Planning and Regional Development, Szent István University, Budapest, Hungary,

Abstract

Culture Ecosystems Services sustain humans all over the world. The unsustainable use of these services around the world has led to degradation which now threatens human health and livelihoods. Despite the increase of literature on cultural ecosystem services, still many challenges and threats that facing sustain and protect Culture Ecosystem Services (CES) in urban planning in developing countries. In Africa, Human reliance on provisioning ecosystem services is mostly recognized, where many people are poor and depending on natural resources. The dependence of society on natural resources in Africa differ from place to place as aridity, vegetation and socio-economic conditions change. Consequently. This paper aims to provide an overview of the challenges and threats that facing sustainable use of Culture Ecosystem Service and discuss the possible solutions to come to a comprehensive and practical framework. In this paper, we discus; firstly, the issue of defining and classifying Culture Ecosystem Services; followed by approaches to evaluate and sustain Culture Ecosystem Services in developing countries; Finally, developments and challenges regarding the inclusion of cultural ecosystem services in urban planning and decision-making tools are discussed. The main part of the paper is focused on the question of how to sustain and protect CES in developing countries from future land cover and land use change.

Keywords: Culture Ecosystems Services (CES), Sustainable use, Developing Countries, Challenges and Threats

1. Introduction

Ecosystems services support human's well-being all over the world and directly support more than one billion people in developing countries living in extreme poverty (Benis et al., 2009). Nowadays, unsustainable use and degradation of ecosystems services over the world threatens the health and livelihoods of many citizen in developing countries, so The Millennium Ecosystem Assessment (MA) highlighted both the current state of degradation of many ecosystem services and the importance of ecosystems to human's well-being around the world. According to the MA, it is apparent that more than 60% of ecosystem services around worldwide are being transformed or degraded (MA, 2005), so it is being urgent to safeguard ecosystems and their services and take more attention to research related to sustainability of ecosystem services and the challenges and threats facing ES in developing countries especially. Following the publication of the MA, scientific research on ecosystem services has been increased globally, and in Africa especially (Turpiea et al., 2017), where natural resources directly support the livelihoods of many poor people, so many people depend on these resources to gain their food (Benis et al., 2009 and Drakou et al., 2015). Nowadays, most important challenge facing ES in Africa that human's dependence on provisioning services is mostly acknowledged in developing countries like those in Africa where many people are poor and reliant on natural resources, so Many people depend on ecosystem services for the provisioning of wood for cooking, poles for fencing, wild animals for protein or water for drinking. Although ES are important in supporting livelihoods both in developing and developed countries (Elbra et al., 2013).

In South Africa's countries, natural resources are also collected for sale to increase household income. Although African is being a natural resource-rich continent, many African countries are still listed as the world's poorest, and Africa's citizens are depending on ecosystem services for their survival (Sarel et al., 2013). Recently, Research highlighted the urgent need for these natural resources to be managed sustainably in developing countries to prevent ecosystem services from degradation and effect from future impacts (Drakou et al., 2015 and Oladayo et al., 2017). Ecosystems services in developing countries such as Africa countries face a number of challenges and threats. The economies of many African countries for example south Africa (e.g., Cameroon, Ethiopia, Malawi and Nigeria) are controlled by agricultural production for supply food and large areas of natural resource and open green spaces have been converted to this end (Drakou et al., 2015). These activities led to a decrease in large scale agriculture and green areas in Africa and a diversification of livelihoods into activities such as the small-scale planting of fast-growing crops (e.g., tomatoes) and crops planted year-round (e.g., coffee and cocoa). Find an optimal balance between conservation and development is important, especially in developing countries such as Africa's countries, where addressing spread poverty is urgent, and where ecosystems and their services face threats from the land transformation, pollution, overexploitation, and climate change etc (see e.g., Oladayo et al., 2017, Drakou et al., 2015, Cavan et al., 2014, Barrios et al., 2008 and Collins et al., 2014).

Until now, recent studies are focusing on urban ES for example provisioning and regulating services, such as food production, and water management. so cultural ecosystem services (CES) should not be overlooked and take deserve more

explicit attention (Byela et al., 2018). CES differ from the other categories of ES in that they are primarily the non-material outputs of ecosystems, for example, providing opportunities for recreation, physical activity etc., so this kind of ES does not take more attention in developing countries where is more poorest countries. Unfortunately, such services are more difficult to observe, measure, and value (Bayliss et al., 2014). Although the threats in quantifying CES, these services remain of considerable importance.

1.1 Research aims and questions

this paper aims to provide an overview of the challenges and threats that facing sustainable use of Ecosystem Service and extract the threats facing cultural ecosystem services and how to come to a comprehensive and practical framework. there are few literatures found in Africa focusing on CES. In this paper, we discuss; firstly, Natural conditions in Africa, following by the issue of defining and classifying Ecosystem Services in Africa countries; then indicating the current state of Ecosystem Services and more focusing on cultural ecosystem services; Finally, developments and challenges regarding the inclusion of cultural ecosystem services in urban planning and decision-making tools will be discussed. The main part of the paper is focused on the question of what the threats is facing CES in Africa's countries. Thus, the specific research questions to be examined in this study are as follows:

- Does the ecosystem services in Africa be sustainable?
- What is the natural condition of ES in Africa and its effect on the locals?
- What is the relation between natural resource and ecosystem services?
- What is the current state of culture ecosystem services in Africa?
- What is the challenges facing ecosystem services?
- What is the challenges facing culture ecosystem services?
- What is the impact of environmental change in the future on ecosystem in Africa?

1.2 Current state of Ecosystem Services

Sustainable use of various ecosystem services is required so as to meet sustain livelihoods, safeguard productivity, and human needs (Drakou et al., 2015). Oladayo (2017) predicts that climate change will cause more deserttification in Africa's countries, leading to an additional degradation in the ecosystem services. Besides global change effects, desertification in Africa is furthermore driven by local human-induced behavior such as deforestation and unsustainable production systems. Such developments can often be linked to increasing population numbers resulting in higher demands for ES and degradation So, in this section we discuss the current state of ES categories in Africa (Drakou et al., 2015 and Basedau et al., 2014).

1.2.1 Provisioning ES in Africa

The Africa continent's per capita annual water availability is 4008 m3, which is below the global annual per capita of 6498 m3, so water is A critical provision ES(Sarel et al., 2013). This means that water supply and the main SPUs like lakes wetlands, rivers, or groundwater tank and related ecosystem functions such as groundwater recharge (Oladayo et al., 2017) are necessary for Africa. Food provision is urgently needed to recover nourishment in most countries in Africa,

especially in cities (Oladayo et al., 2017). The African Food Security Urban Network (AFSUN) confirmed that 80% of poor urban households in Africa were chronically food-insecure (Drakou et al., 2015) Cases of poor food production. Climatic change effects are already causing loss of livelihoods and hunger for many people in Africa (Oladayo et al., 2017).

1.2.2 Regulating and supporting ES in Africa

Regulating services that are of high value to Africa are mainly linked to agricultural production, including water regulation, disease and pest control, and pollination. Cultivation practices are dependent on irrigation; therefore, rainfall capture and storage are necessary. For example, more than 20% of South Africa is under irrigation which is the leading sector of water consumption in the country (Fisher et al., 2009). Agricultural production contributes substantially to household incomes (e.g., at least 27% of household income for both poor and rich in South Africa) making water regulation important ecosystem services for poverty alleviation (Fisher et al., 2009). Africa's vulnerability to climate change and desertification is expected to escalate due to human-malpractices such as deforestation and general land degradation (Barrios et al., 2008). Barrios et al. (2008) reported that 60% of all African countries are vulnerable to drought, with 30% classified as 'extremely vulnerable'. Desertification (Cavan et al., 2014), soil erosion, loss of biodiversity (Benis et al., 2009). This can be related to an undersupply of air quality regulating ES and poor air quality control policies. As a consequence, over 14 million Kenyans suffered from respiratory diseases in 2013 (DN10). This requires concerted efforts through air quality and emission standards, law and regulations, and ecological practices, such as increasing green spaces (Sarel et al., 2013). Abiotic resource extraction through mining, large scale agriculture and unsustainable use of natural resources now threatens not only soil services and other ecosystem functioning, but also biodiversity, and livelihoods (Benis et al., 2009, Collins et al., 2014 and Basedau et al., 2014)

1.2.3 Culture ES in Africa

Cultural ecosystem service includes leisure sites, natural heritage sites, and tourism, the use of natural areas for rituals and spiritual religion besides the use of nature for education. Tourism is an important source of income in southern, eastern, and northern parts of Africa, so it is well developed (Byela et al., 2018). The tourism industry is various and is related to the natural features of specific regions. For example, the primary motivation for tourists who go to South Africa for the landscapes, high biodiversity, flowers, and scenery (Bayliss et al., 2014). In contrast, Many African communities reserve a piece of land or section of river banks as a sacred place for worship and for communicating with their ancestors or for other traditional activities such as initiation (Byela et al., 2018). In Tanzania, more than 600 sacred groves exist in North Pare Mountains alone and comprise about 8% of the land. These sacred places that exist across Africa are believed to contribute significantly to the physical, mental and spiritual well-being of local people, and are also integral to their sense of cultural identity (Byela et al., 2018). In addition to the landscapes and the forests, many plant and animal species are used for spiritual purposes (Collins et al., 2014). So it is urgent to pay more attentions to CES in Africas

countries because it is a most important source of national income.

2. Materials and Methods

2.1 Study area

Africa is the second largest continent and has an area of 30 million km2 (Elbra et al., 2013). Currently, Africa has 54 countries recognized by the United Nations. it is confirmed that 66% of the total land area is characterized by dray and desert conditions. The remaining 44% have conditions favorable for human life and food production (Barrios et al., 2008). in Africa, the mean annual rainfall ranges between 1500 mm at the coast of West Africa (Byela et al., 2018) to 100– 200 mm in the north and Sahel regions (Byela et al., 2018). The central region of Africa is characterized by evergreen tropical forests such as the Congo Basin in the Democratic Republic of Congo (DRC) and the Kakamega forest in Kenya (Sarel et al., 2013). The southern region is mainly characterized by bushlands, woodlands, and savanna. Africa is popular for its geographical features. The continent of Africa can be divided into six main regions: Southern Africa (Tanzania to South Africa), northern Africa (Morocco to Sudan), central Africa (countries on the east of Cameroon to Democratic Republic of Congo (DRC)), eastern Africa (east of Burundi and Rwanda to Somalia), western Africa (Mauritania to Nigeria), and the Islands in the Indian Ocean (Byela et al., 2018). Across these regions, the vegetation and climate are diverse. along the coast of western Africa countries and Central Africa are the wettest regions covered by forests and these areas have various types of ES (Sarel et al., 2013) Humidity decreases to the north and south and we Can see that in figure 1.

The diverse vegetation cover and climatic conditions result in different ecosystem services in several parts of the continent (Barrios et al., 2008). The dependence of local people on natural resources differs significantly from place to place because of vegetation, aridity, and socioeconomic conditions change (Byela et al., 2018). In the humid and forested areas, located in the central and west parts of the continent, local people depend mostly on raw materials and food like agriculture coupled with non-timber forest products (Barrios et al., 2008) Timber extraction for export is also an important problem facing ecosystem service in these regions. local people in Africa have dependent on a combination of Timber extraction as well as small to medium scale agriculture in supporting their livelihoods. In contrast, in the dryer arid and semi-arid countries in southern and northern Africa, animals, water, and grazing are important ecosystem services support tourism and industry so these services are a most important source of national income.

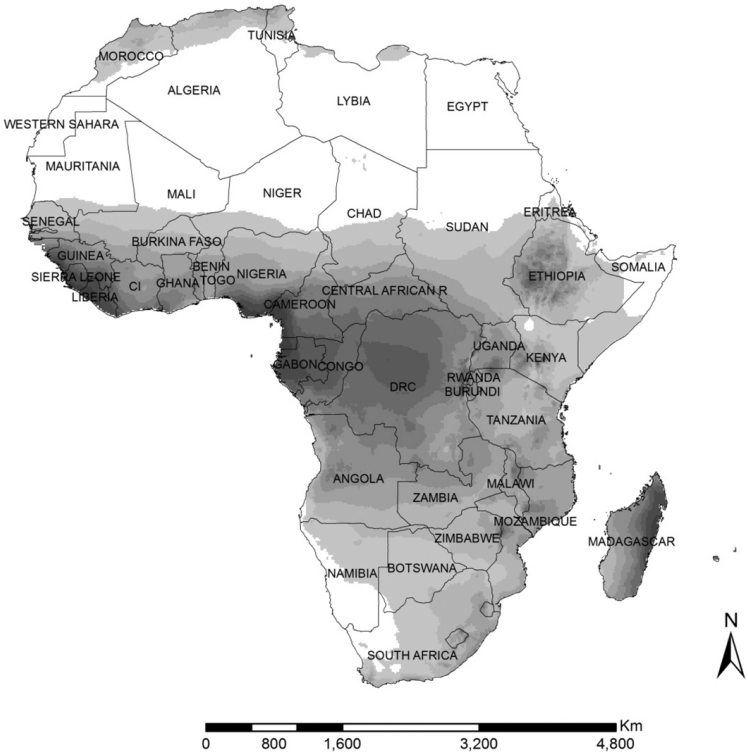

Figure 1. Africa map showing aridity. The lightest areas are the driest (Benis et al., 2012).

2.2 Data

The collection of relevant literature for this study was done electronically. The search was conducted on google search engine with "sustainable use ecosystem services in Africa" as the title for existing literature. Furthermore, electronic search for challenges and threats facing sustainability literature was conducted in African countries that are predominantly had been affected by climate change and environment issues. Google search engine helped in identifying major sources of data. These sources encompassed studies from journals from scientific publications, online websites and Conference Papers. The current study is a quantitative review discussing the threats facing CES in Africa's countries.

3. Results

This section of the paper review some of the threats facing ES in general and at the end of this section we can extract the most challenges related to sustainability of CES in Africa.

3.1 Challenges and threats facing ES in Africa

The challenges facing ecosystem services in Africa related to main categories, firstly; challenges related to the sustainable use of ES, secondary; challenges related to environmental and climate changes. We can discuss them as following:

Some of the Challenges to Sustainable use of ES in Africa

according to the United Nations Economic Commission for Africa, indicators of overall sustainability—encompassing economic, environmental and institutional dimensions—show that African economies are less sustainable today than they were 25 years ago. At the end of 2000 more than half the population of the 38 countries assessed lived in economies with low overall sustainability (Byela et al., 2018). Some of the reasons for this low level of sustainability for Africa are as follows:

Extreme poverty: poverty remains the foremost development challenge confronting Africa. Poverty in Africa is linked to the environment in complex ways, particularly in natural resource-based African economies. About two-thirds of the populations in African countries live in rural areas, deriving their main income from agriculture (Drakou et al., 2015).

Environmental impact of extractive industries for a continent that is dependent on its natural resources to achieve growth, the challenge of ecologically-friendly sustainable development is daunting (Oladayo et al., 2017). Current patterns of extraction of non-renewable resources such as gold, diamonds and crude oil have had an untold impact on the environment. In Nigeria, oil spills and gas flares have polluted the environment significantly for more than 50 years (). In Southern Africa, abandoned mine sites have constituted an environmental menace. The loss of productive land, surface and groundwater pollution, and soil contamination are part of the legacies of oil and mineral exploration (Basedau et al., 2014). Africa cannot afford the current approach to resource extraction. If the trend of unsustainable oil and mineral extraction is allowed to continue, environmentally sustainable development in Africa will continue to be a great challenge (Oladayo et al., 2017).

Rapid population growth According to the World Bank, the sub-Saharan population is growing at the rate of 2.5 percent per year as compared to 1.2 percent in Latin America and Asia. At that rate, Africa's population will double in 30 years. Rapid population growth has put a lot of stress on Africa's ecosystems. Problems such as food security, land tenure, environ-mental degradation and the lack of water supply are often related to high rates of population growth (Drakou et al., 2015).

Rapid urbanization the majority of Africa's population growth is expected to take place in urban areas, largely due to rural-urban migration. Rapid urbanization in Africa has been accompanied by new and challenging environmental problems. A sizeable proportion of urban dwellers in sub-Saharan Africa live in slum conditions, without durable housing or legal rights to their land. At least one-quarter of African city dwellers do not have access to electricity (Collins et al., 2014). A 2000 World Health Organization report estimated that only 43 percent of urban dwellers had access to piped water. Nearly a decade later, not much has changed. Waste disposal presents a tremendous health hazard in many urban areas: in Kibera, Nairobi's largest slum, plastic bags are used as "flying toilets." Clearly, current patterns of urbanization are not consistent with the desire to have ecologically friendly sustainable development in Africa (Drakou et al., 2015).

Deforestation, Now let us turn and look at the problem of Deforestation in Africa. According to the African Forest Forum (AFF), Africa has about 650 million hectares of forests and woodlands, covering 28 percent of its total land area

(Barrios et al., 2008). The Congo Basin, which covers 45 percent of Central Africa, is the world's largest area of contiguous forest and expected to double in the next 20 years (Drakou et al., 2015).

Climatic variability and natural environmental hazards The Inter-governmental Panel on Climate Change (IPCC) studies suggest Africa will suffer greater effects of climate change than any other region of the world (Oladayo et al., 2017). Projections include the decrease in rainfall in the already arid areas of Eastern and Southern Africa and increasing drought and desertification in the north of Central Africa (Cavan et al., 2014). In West Africa, the countries of Benin, Burkina Faso, Ghana, Mauritania, Niger and Nigeria all face water scarcity by 2025. Africa needs to step up its anti-climate change actions, as a legacy to future generations. However, not many African countries have this as a top priority in view of the pressing development challenges being confronted by the African continent such as HIV/AIDS, malaria and low agricultural production ((Cavan et al., 2014).

3.1.2 The Main Environmental Issues Facing ES in Africa

There is a huge list of environmental issues in Africa, which is turning out to be a threat to the global environmental condition and on ecosystem services (Cavan et al., 2014). Some of the aspects of these issues are discussed in the section below. Africa is the second largest and the second most populated continent in the world. It has 54 states and a wide variety of natural diversity and ecosystem services. In the past years, this continent has faced many political and war issues, which made the countries poor and underdeveloped (Basedau et al., 2014). But lately, the conditions have become better and people have started thinking of development and growth. Still, there are tribal areas where people rely on hunting and simple vegetation for food that effect on the ecosystem and degradation. The lack of education, poverty, and the ever-increasing population has raised many serious environmental issues in Africa. These issues have become a serious concern for not only the continent but also for the entire world. We can discuss environmental challenges as following:

Deforestation: Deforestation has become one of the major factors, which is affecting the ecological balance of not only Africa, but of the entire world (Drakou et al., 2015). The clearing of forest cover for wood and agricultural land has resulted in soil erosion, climate change, less rainfall, and many other adverse conditions. Degradation in the quality of soil and loss of fertility has also become a very serious concern (Barrios et al., 2008). Although the government has taken initiative for growing more plants, the imbalance in nature cannot be covered by just a little effort.

Air Pollution: Though the countries of this continent do not contribute much to the world air pollution, the increasing population has shown an increase in the air pollution as well (Drakou et al., 2015). This may be due to the industries, which are set up in the parts of countries where labor is easily available. Also, there are many houses where the food is still cooked by burning wood and coal. This too, contributes to air pollution and this action threat ES in Africa.

Water Pollution: Water pollution is among the top problems. Africa accepts solid waste from the developed countries like America, European countries and Japan for which they get paid. But these solid wastes are not processed properly and are dumped in the rivers and other water bodies (Bayliss et al., 2014). This

results in water pollution. Human waste has also contaminated the water bodies and access to fresh and clean water has become very difficult, Resulting in the degradation of Africa's ecosystems services.

Energy: The major source of energy here is wood. 70% of the energy is generated by burning coal and wood, which results in deforestation, soil erosion, air pollution, and ecosystems degradation (Cavan et al., 2014). The government has started awakening people and has made many efforts to get the conditions under control. An alternate energy source will require money and the continent is not so strong financially, so, this may take a while.

Loss of Biodiversity: Africa has many endangered species of flora and fauna. But due to the deforestation and the need of land for agriculture, there is a huge loss of biodiversity. The uneducated and tribal people are still dependent on hunting (Benis et al., 2009). Many of them burn up lands and forests in order to find animals easily. This has led to the death of many other animals too.

Oil Pollution: Oil is one of the major sources of income for these countries, but this has raised many environmental issues, which are very difficult to overcome. The advanced technology used to get oil is very dangerous and hazardous for the environment (Basedau et al., 2014). But due to the lack of education and lack of proper rules, the extraction of oil is done through the same methods. The transportation of oil through the sea route has also polluted the sea water due to improper packaging and transport. These environmental issues are not only harmful for ecosystem services in the African continent, but also for the world's ecosystem balance. They are contributing to global warming which is an alarming condition. Hence, strict measures should be taken by the African government and even the world's environmental organizations to check these issues before it leads to dangerous consequences. We need to find out ways on how to save our ecosystem services from degradation. It's our planet, and if we cannot save it, then no one else can. Depending on the last section we can extract the challenges related to sustainability of CES.

3.2 Challenges and threats facing CES in Africa

the protection of cultural ecosystem services faces serious challenges because of the threats of the effect of climate change, current trends in urbanization in the continent, and Social-economic and Political Challenges in Africa, so there is urgent to pay more attention to research focusing on sustainable use of ES to protect these services from degradation especially in developing countries such as Africa's countries where more poor cities. from the previous section we can extract the most important challenges facing CES in Africa's countries are as follows:

- Climate change
- Urbanisation
- Social-economic and Political Challenges

Climate change: In Africa, climate change is a reality (Barrios et al., 2008). The Intergovernmental Panel on Climate Change (IPCC) has predicted that temperatures across Africa are expected to increase by 2 – 60 C within the next 100 years and rainfall variability is expected to increase, resulting in regular flooding (Cavan et al., 2014). The IPCC report on Regional Climate Projections of 2007 states that by 2050 the average temperatures in Africa continent are expected to rise by 1.5 – 30

C and, the warming of Africa is very likely to be severe than other regions and it expected to decrease in the percentage of green spaces in Africa and it will effect on CES(Barrios et al., 2008). Countries in Africa are more affected by climate change due to the dependence on agriculture and naural source for food as well as their poor financial, technical and institutional capacity to adapt (Oladayo et al., 2017). Climate change, land degradation and desertification are expected to affect African countries (Drakou et al., 2015). Climate change can affect the ecosystems and the important services they provide such as oxygen production and protection from flooding. Furthermore, climate change will decrease green spaces, landscape and wetland region and lead to loss of soil and trees.

There is increasing evidence that climate change is affecting forests and forest ecosystems in Africa, For example, in a study of climate change impact on ecosystem services and livelihoods in Ghana (Boon & Ahenkan,2012) using secondary and primary data, they found the steady declining in the production of cocoa between 1990 and 2009 owing to the persistent reduction in rainfall patterns and high temperatures and lingering droughts. They also found the impact of climate change on the community water supplies in terms of quality and availability (Boon & Ahenkan, 2012) and also find that climate variability led to declining agricultural yields and a reduction of biodiversity in Africa (Oladayo et al., 2017). Similar studies that have found the correlation between climate change impact and ecosystems in Africa include ((Fayissa et al., 2008, Drakou et al., 2015, Cavan et al., 2014 and Barrios et al., 2008).

Urbanisation: In terms of population, Africa is urbanizing faster than any other continent and the population is expected to more than double to 750 million in 2030 (Collins et al., 2014). This shift in land use is associated with loss of natural ecosystems. This has massive implications for the delivery of ecosystem services, biodiversity, and human well-being and increase the poverty levels in Africa (Drakou et al., 2015). Future ecosystem service research needs to pay more attention to these kinds of research, understanding both the impacts and changes in services within urban areas and those beyond.

Social-economic and Political Challenges: Poverty emerged from the analysis of the paper to also contribute to the depletion green space in Africa. The 2010 State of African Cities Report indicated that the rate of Africa's urban poverty is critical (Drakou et al., 2015). The high rate of urban poverty in Africa has been linked to the depletion of Africa's green environment as many of the poor people depend on ecosystems resources for their survival (Fagerholm et al., 2012). The resultant effect has been excessive destruction of green spaces in many urban areas in Africa by the poor to satisfy their needs. Green spaces were found not be among the main priorities of many African countries. poverty remains the foremost development challenge confronting Africa (Drakou et al., 2015). Poverty in Africa is linked to the environment in complex ways, particularly in natural resource-based African economies. About two-thirds of the populations in African countries live in rural areas, deriving their main income from agriculture and natural resources (Barrios et al., 2008).

Over the last two decades, several civil wars have taken place in many African countries such as Sudan, Somalia, Liberia Chad, Mali, Cote D'lvoire, Sierra Leone, Democratic Republic of Congo, Rwanda, Angola and Libya. The devastating effects

of these civil wars on urban development as well as green spaces cannot be underestimated. For example, in Libaria, over 10 year's civil war in the country destroyed substantial amount of urban natural environment in areas such as Monrovia (capital city) and Bunchanan(Basedau et al., 2014). The Somalia civil war destroyed many urban trees. During the war some major urban areas such as Hargeisa, Borama, Berbera and Erigavo were the hot spots of the war and in view of that both indigenous and foreign trees in these areas were destroyed through cross bombardments (Basedau et al., 2014). In addition to this, urban green spaces in Rwanda also came under serious destructions caused by the civil war in Rwanda that occurred in the 1990s. It was estimated that the civil war in Rwanda destroyed some aspects of Gishwati forest, much of Mukura forest, and about 70 per cent loss of the Akagera National Park (Collins et al., 2014).

4. Conclusion

Most African people live in rural areas and are highly dependent on ecosystem services for their survival either through the collection of natural resources for direct use, or benefiting indirectly through range of regulating ecosystem services. Unsustainable use practices are threating ecosystem services, biodiversity, and local livelihoods. the main issues impacting on cultural ecosystem services relate to the vulnerability of the continent to rapid urbanization, climate change, and Social-economic and Political Challenges. Unsustainable use of ecosystem services coupled with other challenges discussed in this paper will be doubled in the future if predicted increases in population are realized. There are many national and international policies to protect the ecosystem services and ensure the delivery of ecosystem services. However, realization such policies are complex by the poverty and people practices. While international PES programs such as REDD could benefit some African nations, local awareness is needed in most Africa's countries. The high rate of urban poverty in Africa has been linked to the depletion of Africa's green environment as many of the poor people depend on ecosystems resources for their survival. Moreover, Countries in Africa are more affected by climate change due to the dependence on agriculture and natural source for food as well as their poor financial, technical and institutional capacity to adapt. so, Solutions to these issues will have to come from the African people. Future ecosystem service research needs to pay more attention to these kinds of research, understanding both the impacts and changes in services within urban areas and those beyond. Africa has the experience to build a strong research program on ecosystem services which could address these challenges and try to introduce practical solutions to these problems. moreover, more attention has to be paid to culture ecosystem services in Africa's countries to achieve sustainable development related to human wellbeing. So, it is urgent to apply more research in CES research and more focusing on tourism and recreation values because these values contribute in national income in Africa's counters

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