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Investigating the bioclimatic circumstances of beaches to develop coastal tourism based on becker method (case study Guilan province, Iran)

Abstract

Coastal tourism is one of the most attractive and a popular activity all over the world which is growing fast and has been transmuted into a multi-purpose activity. In this regard, weather conditions and climatic circumstances are considered factors effective on tourism industry and generally life, health and welfare of human beings. Considering climatic circumstances, we can choose type of tourism attraction and plan specifically. One of the methods through which the extent of welfare can be investigated bioclimaticaly is Becker method.In order to statistically evaluate the bioclimatic circumstances of human being in coastal line of Guilan province, climatic elements such as temperature (minimum and maximum) and wind speed were collected for a period of 20 years from synoptic stations in Astra, Anzali, Rasht and Ramsar. Ramsar station was selected as a neighboring and climatically similar station and due to absence of a synoptic station with 20-year data in East of Guilan province.Evaluating the 4 stations according to Becker index showed that costal line in Guilan possesses optimal and relatively optimal climatic circumstances at least during 7 months of a year.

Keywords: costal tourism, bioclimatic comfort, climatic elements, becker method

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Introduction

Climate and tourism are the integral components of an ecosystem have mutual effect and their interaction leads to a new subject called tourism climatology. Tourists, tourism organizations, travel agencies and tourism planners should all take role and importance of climate and effective climatic parameters in tourism into high consideration. The climate tourism potential of a region can be described by methods used in human biometeorology and applied climatology.[1] This is due to the fact that nowadays role of tourism has risen in development of economic activities, job creation and finally meeting physical and mental needs of human beings especially in industrial societies. Major global tourism market segments include: sun and beach tourism, sports tourism, adventure tourism, nature-based tourism, cultural tourism, urban tourism, health and wellness tourism, cruises, theme parks, visiting friends and relatives and meetings and conferences.[2] A piece of information that tourists require to know about is the climatic circumstances of the destination which most of them take into consideration to choose a destination. From view point of tourism planning, climate is very important and tourists usually look for optimal and convenient climate in which they do not feel any climatic dissatisfaction and inconvenience. Hence, this factor plays an important role for a tourist to choose the destination.[3] Due to the above mentioned reasons, climate and basically measuring parameters and atmospheric elements whether in short term or long term has been considered by tourism planners. The relations between weather and tourism are manifold and complex Unpleasant climatic circumstances may lead to cancellation of many weekend trips.[4] Hence, Travel agencies and tour managers are well familiar with bad consequences of climate. For instance, rainy summers or winters with no snow can considerably influence tourism, tourism organizations and economy in an area. In addition, travelling to the destinations with inappropriate climatic circumstances may result in problems and difficulties that risk the tourists' health.Tourism and tourism industry usually need climatic information before, during and after holiday periods. It's labeled tourism climatology deal with the concept of "climate" and "tourism" in the broadest sense.[5] However, the climatic information about touristic areas provided in books and catalogues are general and what tourists need during holiday is meteorological information rather than climatic information. In these cases, considering climatic parameters cannot be helpful. Meteorological information is broadcasted daily through mass media. Although the residents may also enjoy the area during their daily life, it may not be sufficiently attractive to retain them, and so they may prefer to experience a different climate elsewhere.[6] Even though meteorological conditions of an area cannot spoil human being's activities in that area completely, they are considered important economic factors for tourism planners. When meteorological specifications of an area are analyzed from view points of tourism, it is determined that in fact some areas have low potentials to attract tourists due to their climatic circumstances. Hence, tourism managers cannot consider such areas in their planning. The tourists who travel to such areas will inevitably incur high costs (transportation costs) and tolerate environmental circumstances (physical stresses). Meteorological changes can also influence tourism industry economically, in addition; regional leaders and the tourism industry have voiced their concern that international climate policy will negatively affect their tourism economy.[7–9] Hence, this paper investigates bioclimatic circumstances of beaches in Guilan province in Iran through Becker method to develop coastal tourism. Guilan province is 14711 square kilometers big out of which 725 square kilometers comprise the coastal line. Precise planning and identifying climatically convenient and appealing points for tourists in different seasons have led to providing good circumstances to attract tourists with different motivations and in different seasons. All these measures will result in sustainable development of coastal tourism in Guilan.

Background of the study

So far, a lot of efforts have been made to construct and calculate empirical indexes to evaluate human being's thermal comfort. Moreover, some efforts have been taken to determine collective effects of environmental temperature and moisture as well as to show amount and level of heat stress. These indexes have been used in wide range of scales from global to local. Recently, more complicated biographic models are used for bioclimatic evaluations and they are more advanced as compared to the empirical ones. These models are powerful enough for bioclimatic analyses. However, this model cannot thoroughly consider all needs of tourists in evaluation of thermal comfort. In this regard, some changes in thermal comfort indexes can prepare them to be used to evaluate climatic circumstances of tourism destinations in different areas so that tourism potentials of different areas can be determined and the tourists can be informed regarding the circumstances. Following the efforts made for climatic zoning in different areas and regions all over the world, the climatologists are inclined to evaluate and classify climate from view point of human being. Tourism is obviously related to climate.[10] It is an interdisciplinary science resulted from interaction between climatology and biometeorology and is considered an achievement of modern bioclimatic. Evaluating regions of tourism climate by tourism climate index, rest climatology of Arizona in the US, studying effects climatic changes on tourism, studying thermal comfort at Sun Moon Lake in Taiwan and determining bioclimatic comfort in Istanbul in Turkey through GIS are among the studies conducted in this regard.[11]

Studies conducted in bioclimatic evaluations in Iran are of specific variety of subjects. Part of these studies is seemly bioclimatic evaluations explaining comfort conditions of human being through different days of the year in the studied areas. These studies possess a general application for bioclimatic circumstances of the regions. There is also a bioclimatic classification of Iran based on Terjung's index. Another range of studies are in relation with architecture and building and these types of studies usually evaluated bioclimatic of building through Mahoney, Gioni and Terjung indexes. Results of the studies were used to design a building considering climatic circumstances for size of windows and applied materials as well as size of balcony and other items. Another category of studies investigated bioclimatic of the country in relation with tourism. They investigated circumstances of tourism climate for a limited number of areas in the country based on different indexes. The investigations resulted in a tourism calendar which can be used by tourists and tourism planners. According to the background mentioned, explaining tourism climate's circumstances of the whole country has not been considered based on a comprehensive index.The thermal bio-climate is of high interest for decision makers in the public health and recreation tourism sectors, as well as for the general public.[12] Hence, this study aims to investigate bioclimatic circumstances of beaches in Guilan province through Becker method to develop coastal tourism. It tries to systematically specify effect of climatic elements on tourism activities. Besides, it tries to specify potentials and capabilities of tourism coastal climate of Guilan province for general tourism activities in the city such as sightseeing and shopping.

Methodology

In order to investigate and determine the extent of bioclimatic comfort of coastal line in Guilan province, the required data, temperature and wind speed, were collected from Astra, Anzali, Rahst and Ramsar stations for a period of 20 years. After collecting the required data and calculating the average mean, the study evaluated bioclimatic circumstances of coastal line in Guilan using Cooling Power index (CP) known as Becker index.[13] To calculate and measure CP of the environment by Becker method, the following equation was used:

$$CP = \left(0.26 + 0.034V\ 0.672\right)\left(36.5 - T\right) mcal / cm^2 / sec$$

In the above equation, CP indicates cooling power of the environment based on micro calorie/Cm/Sec, V illustrates average wind speed based on m/sec and T indicates daily temperature based on Celsius degree. According to Becker index, when CP is below 5 or above 20, bioclimatic pressure will appear. Results of evaluating circumstances of environmental comfort can be mentioned as follows:

a. CP below 10 is indicative of desirable (warm) bioclimatic circumstance in the environment
b. CP between 10 and 20 is indicative of desirable natural bioclimatic circumstance in the environment
c. CP between 20 and 30 is indicative of undesirable (cold) bioclimatic circumstance in the environment
d. CP above 30 is indicative of undesirable (very cold) bioclimatic circumstance in the environment.

It is worth noting that, CP index of all of the sampling stations were evaluated both in day and night. Table 1 shows specifications of the sampling stations in the province and Table 2 shows cooling power of the environment as well as bioclimatic thresholds based on Baker method. As you can see the Figure 1 map of four synoptic stations (study sites) in the province, however; two stations are neighbor of it.[14,15]

Table 1 Specifications of the sampling stations in the province

Station's name	Astara	Anzali	Rasht	Ramsar
Longitude	48° 52/	49° 28/	49° 34/	50° 40/
Latitude	38° 25/	37° 28/	37° 20/	36° 54/
Elevation(meter)	-18	-26	-7	-21

Table 2 Cooling power of the environment as well as bioclimatic thresholds based on Becker method

CP quantity	Environmental circumstance	Human bioclimatic circumstance
0-4	Hot, humid and undesirable	Bioclimatic pressure
5-9	Warm, desirable	Desirable range bioclimatic
10-19	Moderate and pleasant	Desirable range bioclimatic
20-29	Cool	Moderate
30-39	Cold and a little pressure	Moderate to severe
40-49	Very cold	Moderate on pressure
50-59	Extremely cold	High pressure

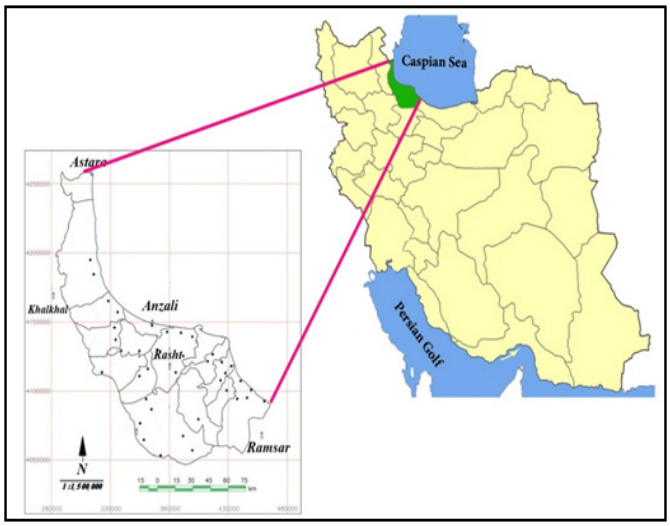

Figure 1 Location of study area: Guilan province, Iran.

Results

i. Analysis of bioclimatic circumstances of Astra station Table 3 shows evaluation of Astra station based on Becker index both in day and night for different months of a year.

ii. In November, December and April, Becker index shows to be C which signifies an undesirable bioclimatic range (cold) in 24 hours.

iii. In June, July and August, Becker index shows to be A in day which signifies an undesirable bioclimatic range (warm) and shows to be B in night which signifies a desirable bioclimatic circumstance.

iv. In January, February and March, Baker index shows to be C in day and B in night which both.

v. In October and May, there is a desirable bioclimatic circumstance in day and cold bioclimatic circumstance in night.

vi. It is only in September that Baker index shows to be B in day and night which signifies a desirable bioclimatic circumstance for those who would like to enjoy their leisure time.

Anzali station

i. In October, April, May and September, the bioclimatic range shows to be B both in day and night signifying a desirable bioclimatic circumstance.

ii. In December, January, February and March, the bioclimatic range shows to be C both in day and night signifying an undesirable bioclimatic circumstance (cold) of the environment.

iii. In November, the bioclimatic range shows to be B in day signifying a desirable circumstance whereas it shows an undesirable bioclimatic circumstance (cold) of the environment in night.

iv. In June, July and august, Becker index shows to be A in day signifying an undesirable bioclimatic circumstance (warm) and shows to be B in night signifying a desirable bioclimatic circumstance.

v. Table 4 shows results evaluation of Anzali station based on Becker index considering two parameters, temperature a wind speed.

Table 3 Average temperature and wind speed in Astra station (1986-2006)

Astara	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.M.T1	8.9	9.3	11.4	16.4	21.4	27	29.6	29.5	25.1	20.3	14.9	11
A.M.T2	2.6	2.8	5.5	9.7	14.2	18.5	20.9	21.3	18.1	18.3	8.8	4.6
A.W.S3	3	3.2	3	3.5	2.9	2.9	2.9	2.9	3	2.8	3.3	2.8
Day	26	27	24	21	14	9	6	6	11	15	21	23
CP=Becker index												
Night	32	33	30	28	21	17	14	14	17	21	28	29

Table 4 Average temperature and wind speed in Anzali station (1986-2006)

Anzali	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.M.T1	1	9.6	11.2	15.9	12.7	25.7	28.3	28.5	25	21	16.2	12.3
A.M.T2	5.4	4.9	7.1	11.4	16.3	20.9	23.4	23.5	20	15.9	11.2	7.4
A.W.S.3	2.6	2.6	2.4	2.2	2.2	2.3	2.3	2.2	2.4	2.8	3.4	2.6
Day	24	24	22	17	13	9	7	6	10	14	20	21
CPBecker index												
Night	28	28	25	17	16	13	11	10	14	19	26	25

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Rasht station

The following Table 5 illustrates investigation of climatic elements in Rasht station

i. In February to December, bioclimatic range shows to be C in day. In April to November, it shows to be C and D in night. All the mentioned ranges signify cold and very cold bioclimatic circumstance in the environment.

ii. Bioclimatic range In November, October, May, April and March in day as well as in the whole October, September, August, July, June and May.

iii. In June, July, August and September, the bioclimatic range Is B signifying undesirable bioclimatic circumstance (warm) in the area

iv. In the station in question, it is only in November and October that bioclimatic range is B in the whole 24 hours signifying desirable bioclimatic circumstance.

Ramsar station

Bioclimatic circumstances in Ramsar station was calculated based on Becker method as shown in the following Table 6.

i. In October. November, December, April and May, bioclimatic range shows to be B both in day and night signifying a desirable bioclimatic circumstance.

ii. In January, February and March, The bioclimatic range shows to be B and C in day and night respectively signifying desirable bioclimatic circumstance in day and undesirable bioclimatic circumstance (cold) in night

iii. In June, July, August and September, bioclimatic range shows to be A in day and B in night signifying undesirable bioclimatic circumstance(warm) in day and desirable bioclimatic circumstance in night.[16,17]

Table 5 Average temperature and wind speed in Rasht station (1986-2006)

Rasht	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.M.T1	11	11.6	14	19.3	23.7	28.1	30.2	30.5	26.6	22.3	17.4	13.3
A.M.T2	3.1	3.1	5.7	10.1	14.8	19	21.2	21.4	18.2	14	9	5.2
A.W.S.3	2.9	2.9	2.7	2.8	2.5	2.4	2.2	2.2	2.3	2.5	2.9	2.8
Day	24	24	20	16	11	7	5	5	8	12	18	21
CP=Becker index Night	31	31	28	24	19	15	12	12	15	20	26	29

Table 6 Average temperature and wind speed in Ramsar station (1986-2006)

Ramsar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.M.T1	10.9	10.6	11.9	16.5	21.1	25.9	28.5	29	25.8	21.8	17.1	13.2
A.M.T2	4.5	4.2	6.4	10.3	15	19.6	22.2	22.9	20.2	15.5	10.6	6.1
A.W.S.3	1.5	1.7	2	1.9	1.8	1.7	1.7	1.7	1.6	1.5	1.4	1.4
Day	18	19	19	15	11	7	5	5	7	10	13	15
CP=Becker index Night	22	24	24	20	16	12	10	10	11	14	17	20

Discussion

Variety of bioclimatic circumstances in day in different seasons

i. In the mentioned stations, all 3 months in the fall show to possess desirable bioclimatic circumstances in day. In addition, Ramsar station possesses desirable bioclimatic circumstance in the whole fall. Anzali and Rasht stations showed desirable bioclimatic circumstances in October and November but undesirable circumstance (cold) in December. Astra station showed desirable bioclimatic circumstance only in October shifting to undesirable circumstance (cold) in November and December.

ii. In winter days, all the sampling stations possessed desirable bioclimatic circumstance except Ramsar. Astra and Anzali stations showed to have cod bioclimatic circumstances in the whole winter. Rasht station had undesirable bioclimatic circumstance (cold) in January and February which shifted to desirable circumstance in March. As mentioned, Ramsar station showed to possess desirable bioclimatic circumstance in the whole winter.

iii. In spring, all the sampling stations had desirable bioclimatic circumstances. Rasht, Anzali and Ramsar stations had desirable bioclimatic circumstance in April and May. Astar station possessed desirable bioclimatic circumstance only in May. All the 4 sampling stations had undesirable bioclimatic circumstance (warm) in June. Days in summer were under medium human bioclimatic pressure and showed to have undesirable bioclimatic circumstances (warm) in all the 4 stations. It was only in September that Anzali and Astara stations had desirable bioclimatic circumstance.

iv. The whole winter has undesirable bioclimatic circumstance (cold and very cold) in night and human bioclimatic pressure ranges from medium to high.

v. In spring, most of the stations have desirable bioclimatic circumstance in night. Anzali and Ramsar stations have desirable circumstance in the whole season. Rasht station has desirable circumstance only in May and June. Astra station has undesirable bioclimatic circumstance (cold) in April and May but desirable bioclimatic circumstance in June.

vi. In the whole summer, all stations have desirable bioclimatic circumstances in night.

vii. In the fall, Ramsar station has desirable bioclimatic circumstance in night as opposed to Astra station. Anzali and Rasht stations have undesirable bioclimatic circumstance in November and December, but the bioclimatic circumstance of the two stations is desirable in October shows in Table 7.

viii.

Table 7 Variety of bioclimatic circumstances in day in different seasons

Day												
Month Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Astara	C	C	C	C	B	A	A	A	B	B	C	C
Rasht	C	C	B	B	B	A	A	A	A	B	B	C
Anzali	C	C	C	B	B	A	A	A	B	B	B	C
Ramsar	B	B	B	B	B	A	A	A	A	B	B	B
						Niht						
Astara	D	D	D	C	C	B	B	B	B	C	C	C
Rasht	D	D	C	C	B	B	B	B	B	B	C	C
Anzali	C	C	C	B	B	B	B	B	B	B	C	C
Ramsar	C	C	C	B	B	B	B	B	B	B	B	B

Climatic suggestions for tourists heading for coastal line of Guilan province

a. January

Bioclimatic circumstance is undesirable (cold and very cold) in this month and human bioclimatic pressure ranges from medium to high. Thus, there is not appropriate situation to travel to this province due to cold bioclimatic circumstance, heavy rain and snow and absence of required facilities.

b. February

Bioclimatic circumstance is undesirable (cold and very cold) in this month. It is only the eastern part of the coastal line of the province which has desirable bioclimatic circumstance. Travelling to this province has some difficulties in this month.

c. March

In this month, bioclimatic circumstance is desirable in all the sampling stations but Astra that ahs cold circumstance. Tourists can travel to this area with the season appropriate clothing to enjoy the beach and landscapes.

d. April

Bioclimatic circumstance is desirable in this month. Even though the area has cold bioclimatic circumstance to come extent, there is no worry for travelling and enjoying the beach whether in day or in night.

e. May

This month has the most desirable bioclimatic circumstances for travelers. Bioclimatic circumstance is desirable in day and night and for nature-lovers. However, there is no possibility of doing sports like swimming and water skiing yet.

f. June

In this month, bioclimatic circumstance is undesirable (warm) in day but it is desirable in night. There is also possibility of providing beach sports in this month so that the tourists can enjoy it more.

g. July

Like June, this month has also undesirable bioclimatic circumstance (warm) in day but it has very desirable circumstance in night. Walking at the beach as well as swimming and other beach sports pave the way for more noticeable presence of tourists.[18]

h. August

In this month, bioclimatic circumstance bears very close resemblance to June showing desirable circumstance for the tourists.

i. September

In this month, the circumstance is ideal and desirable for costal tourists and they can enjoy their leisure time at the beach using equipments and facilities.

j. October

Like September, costal tourism circumstance is desirable at the costal line of Guilan province.

k. November

In this month, traces of cold weather may appear in night. However, it is possible to enjoy the time in the nature and at the beach in day with no swimming suggested to create a memorable coastal tourism.

l. December

Except the eastern section of Guilan, coastal climate of this province has undesirable bioclimatic circumstance (cold) in December.

Way to achieving development shorter in a country by considering general specifications of that country. Coastal line of Guilan province's unparalleled tourism attractions and bioclimatic comfort in this area are among the important factors to attract tourists.[19]

The above mentioned results are based on this study's findings as follows:

a. Except in December, January and February, coastal line of Guilan possesses clod and very clod bioclimatic circumstances through the year. Bioclimatic circumstance is desirable in the other 9 months especially in Eastern section of the province.

b. By taking measures such as providing welfare and recreational facilities in the months which have bioclimatic pressure, tourism planners can provide good conditions to attract the tourists

c. Proximity and adjacency of beaches to cities and local communities are considered significant privileges that make it easier to provide conditions to attract tourists.

d. Coastal tourism development can result in economic growth as well as raising revenue for the coastal cities.[20]

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Conflict of interest

The authors decalre there is no conflict of interest.

References

1. Matzarkis A, Hammerle M, Koch E, et al. The climate tourism potential of Alpine destinations using the example of Sonnblick, Rauris and Salzburg. *Theoretical and applied climatology*. 2012;110(4):645–658.
2. Scott D, Lemieux C. Weather and Climate Information for Tourism. *Procedia Environmental Science*. 2010;1:146–183.
3. Matzarakis A. Heat stress in Greece. *International Journal of Biometeorology*. 2001;41(1):34–39.
4. Denstadli JM, Jacobsen JK, Lohmann M. Tourist perceptions of summer weather in Scandinavia. *Annals of Tourism Research*. 2001;38(3):920–940.
5. de Freitas CR. Tourism climatology: evaluating environmental information for decision making and business planning in the recreation and tourism sector. *International Journal of Biometeorology*. 2003;48(1):45–54.
6. Martin JL, Soria JA. Climate in the region of origin and destination choice in outbound tourism demand. *Tourism Management*. 2009;31(6):744–753.
7. Scott D. Matthews L. *Climate tourism & recreation: a bibliography—2010 edition*. University of Waterloo, Waterloo: Department of Geography and Environmental Management. 2011.
8. Scott D, Pentelow L. Aviation's inclusion in international climate policy regimes: Implications for the Caribbean tourism industry. *Journal of Air Transport Management*. 2011;17(3):199–205.
9. Scott D, Wall G, McBoyle G. The evolution of the climate change issue in the tourism sector. In: Hall CM, Higham J, editors. *Tourism, recreation and climate change*. Channel View Clevedon. 2005;44–60.
10. Jacqueline M, Hamilton D, Maddison J, et al. Climate change and international tourism: A simulation study. *Global Environmental Change*. 2005;15(3):253–266.
11. Matzarakis A, Lin TP. Tourism climate and thermal comfort in Sun Moon Lake, Taiwan. *International J Biometeorology*. 2008;52(4):281–290.
12. Farajzadeh H, Matzarkis A. Evaluation of thermal comfort conditions in Ourmieh Lake, Iran. *Theoretical and Applied Climatology*. 2012;107(3-4):451–459.
13. Becker F. Bioklimatische Reizstufen für eine Raumbeurteilungzur Erholung, Forschungs- und Sitzungsberichte derAkademie für Raumforschung und Landesplanung. Hannover. 1972;76:45–61.
14. Matzarakis A, Endler C. Analysis of high-resolution simulations for the Black Forest region from a point of view of tourism climatology – a comparison between two regional climate models (REMO and CLM). *Theoretical and Applied Climatology*. 2011;103(3-4):427–440.
15. Matzarakis A. Weather and climate related information for tourism. *Tour Hosp Plan Dev*. 2006;3:99–115.
16. Nielsen P, Sabine L. The vulnerability of beach tourism to climate change—an index approach. *Climatic Change*. 2010;100(3-4):579–606.
17. Safford TG, Hamilton LC. Demographic change and shifting views about marine resources and the coastal environment in Down east Maine. *Population & Environment*. 2011;33(4):284–303.
18. Kellens, Tijs Neutens, Pieter Deckers, et al. Coastal flood risks and seasonal tourism: analysing the effects of tourism dynamics on casualty calculations. *Natural hazards*. 2012;60(3):1211–1229.
19. Brown S, Barton M, Nicholls R. Coastal retreat and/or advance adjacent to defences in England and Wales. *Journal of Coast Conservation*. 2011;15(4):659–670.
20. Akpabio A, Eniang EA, Egwali EC. Socio-economic potentials and environmental implications of Coastal tourism at Adiabo, Cross River State, Nigeria. *Environment Development and sustainability*. 2008;10(3):249–265.