A systemic and prospective sustainability analysis within the Šibenik-Knin County (Croatia)

Report on the 4th "*Climagine*" workshop, 21st April, 2015

Facilitated by Vladimir Lay, consultant for Plan Bleu

Main author: Vladimir Lay, local team co-ordinator

Additional contributions: PAP/RAC experts – Daria Povh Skugor
Plan Bleu/RAC - Antoine Lafitte

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I. Introduction

By mid-2015 the drafting of the integrated coastal zone management plan for Šibenik-Knin County and the parallel "*Climagine*" process have reached its final phase. End of 2015 is the planned finalization date.

The final "*Climagine* 4" workshop was held in April 2015. The previous "*Climagine* 3" workshop was held ten months before on June 9th, 2014.1 According to the opinion of the local team, timing of the "*Climagine*" workshops was determined by the method itself and the drafting pace of the integrated coastal zone management plan for Šibenik-Knin County, as well as by the DIVA method realization - an additional contribution to this plan.

Two key questions were raised at the final "*Climagine* 4" workshop held in spring of 2015 in Šibenik. The experts mobilized to develop the Plan needed the participants' responses to these questions for the final articulation of the criteria, parameters and operative costs of the Plan. These questions were:

- "Which direction should the County take, especially in the coastal zone, to achieve a reasonably balanced development by 2030, based on economic, ecological and social sustainability?"; "Based on the selected relevant dimensions and indicators, which criteria should be selected to serve as the realistic and convincing guidelines for acting and behaving in the coastal zone in the following years?"

- "What activities should we undertake in the following years in order to ensure the coastal zone sustainability in the decades to come, and prepare for the climate change impacts?"

These questions were in fact aiming to get the participant's comprehensive and long-term positions on the long-term sustainability of living they, as residents, find satisfying.

Having in mind the objectives of the "*Climagine*" process, we emphasized the ecological component (climate, sea water quality, scarce forest vegetation, fresh water renewable stocks, in karst areas usually very unstable throughout the year, existing biodiversity, etc.) and noted that these ecological media and resources should be made more resilient with the help of various measures[2].

The greenhouse gases will, due to human actions, gradually accumulate in the earth's atmosphere. The temperatures shall, according to the data and ICCP 2015 reports (International Climate Changes Panel of the UN), continue to rise globally. This will affect local communities as well. The ones who will be the first to recognize this fact and start drafting adaptation plans and adaptation steps will mitigate the damage and problems for humans and the biosphere, for habitation and production.

The final workshop included three sections.

In the first section the expert, Anil Markandya from the Basque Center for Climate Change (company BC3),, Bilbao, Spain, presented an assessment of possible damages from the sea level rising and

[1] Our methodological and conceptual position is that the time gap between the two workshops was too long, because local participants somewhat "cooled off" and distantiated from the participatory process we wanted to promote with the workshops.
[2] The "Resilient communities" is a term and topic of contemporary theoretical and analytical reflections (see in Richard Heinberg) which is conceptually close to terms and analysis of sustainability, survival and especially relevant for issues linked to climate change adaptation.

climate change for the Republic of Croatia. The DIVA method was used here.3 An assessment of potential climate change costs for Šibenik-Knin County was given.

Ivica Trumbić the PAP/RAC associate from Split presented the first draft of the integrated coastal zone management plan for Šibenik-Knin County.

Vladimir Lay, the sociologist from Zagreb, consultant for Plan Bleu's, presented the initial proposed set of indicators. After the discussion, in spring 2015, the final proposal of indicators with quantified parameters and criteria for the Šibenik-Knin coastal zone was adopted.

[3] DIVA (Dynamic Interactive Vulnerability Assessment) Model allows the spatial interpolation of data (*analysis*) in an optimal way, comparable to optimal interpolation (OI). In comparison to OI, it takes into account coastlines, sub-basins and advection. Calculations are highly optimized and rely on a finite element resolution.

II. 'Climagine' Workshop 4: goals and expectations

The basic goals of the "Climagine3" were:

The main objective of the "Climagine 4" was to finalize the proposal of basic indicators for the coastal zone sustainable development. The proposal of the dimensions and indicators was initiated during the "Climagine 3" workshop.

The aim was to define the final list of indicators which could then be quantified according to the capacities of the Croatian statistical data bases available for the local level. These measurable indicators with assigned "sustainability ratios" could serve as easy to read criteria for directing the Šibenik-Knin county coastal zone sustainable development.

In order to ensure attendance of the local participants at the "Climagine4", in parallel with the invitation we asked the following specific questions in order to encourage the conversation.

a. What is the relationship between the permanent residence and the "secondary residence" (holiday homes, apartments, etc. for tourism) which can be considered as a ceiling for comfortable living? There are several municipalities in your county with less than 25% of permanent residents. Some of the following questions should help you provide the answer to this question. Is the 25% permanent residents' ratio acceptable? Is it 50% or 75%? Such development patterns require infrastructure (water supply, drainage, waste management and the cultural offer as well) 3 to 4 times the size needed for the actual number of permanent residents. Can the adequate quality of living be achieved if the total annual costs are covered by such a small share of residents? Could the full booking of tourist capacities be achieved if the price of the tourist offer would include all these costs as well?
b. How to stop the urbanisation process, and coastal settlements if it is certain that nowadays the apartment rental business for tourism is relatively the easiest way for a household to reach its economic goals? Excessive and aesthetically inappropriate building systematically diminishes the value of the entire coast line. How to make a decent living in the hinterland possible, and create conditions that will encourage people to stay and the young to populate the area? Is this, in fact, the main question that should be answered in order to find the key for coastal development? Can the coastal economy support the hinterland in a way that will guide both zones to sustainable development?
c. The upcoming climate change will impact numerous economic sectors, especially the agriculture. While reflecting on the future local development, the question of food sovereignty arises. To guarantee access to locally produced quality food, both for tourists and locals is a strategically important matter. The droughts apart from impacting the agriculture can impact the landscape as well. Therefore, strategic thinking about issues related to water and finding appropriate solutions will become key for the sustainability in the conditions caused by climate change.
d. Could the future, with higher summer temperatures, and droughts, which is a highly probable scenario, serve as a sound basis for developing the sun/sea/beach - oriented tourism.
e. In the heat of August the access to energy supply will surely present a source of conflicts. The climate change will have a negative impact on the hydro-power sector during the summer season. On the other hand, the summer droughts will additionally lower the quantities of water needed for the biological minimum. This conflict will surely develop, and if we do not find a solution on time, both sides will suffer from very damaging effects.
f. Heat and drought impacts will increase the risk of fires with each consecutive season. What else could be done? Are raising awareness about the dimensions of this problem

and working on prevention the tasks of all who live and work in the Šibenik-Knin County area? Who will and how exactly tackle this matter?

The three introductory presentations created a basis for the workshop dialogue and the discussion. A relevant topic for the Šibenik-Knin county was introduced about the potential damages and costs from the rising sea level as one of the climate change effects.

At the *Climagine*3 workshop, the initial list of dimensions and the first proposal of indicators for each of them were presented. At this workshop a step forward was made.

III. Initial proposal of indicators and quantitative parameters

At the *Climagine*4 workshop, the dimension and indicator matrix was proposed, as well as, the initial proposal of quantitative parameters for the climate and general sustainable coastal zone development for Šibenik-Knin County.

This was merely a rough sketch of indicators and assigned parameters to foster the workshop discussion. Only after the workshop discussion and the analysis of available data the entire picture was finalized.

The initial proposed dimension and indicator matrix with the first proposal of empirical values for 2001, and 2011/2014 was the following:

Table 1. The dimension and indicator matrix with proposed assigned empirical values for the years 2001 and 2011/2014[4]

Dimension	Indicator	2001	2011/2014	Min. sustainability	Max. sustainability
Physical space	Apartments for perm. residence ratio in the total No. of app. in CZ (%)	66.92	54.09		
	Population density in the CZ compared to the density outside of the CZ	4.11 (74,77 res/km2 in CZ/18,20 res/km2 outside the CZ)	4.12 (72,48 res/km2 in CZ/17,61 res/km2 outside the CZ)		
People	Ratio of employed in the entire working population in CZ and outside CZ	1.43 (32,99 % in CZ/25,45 % outside CZ)	1.40 (33,91 % in CZ/26,65 % outside CZ)		
	High school, grammar school and higher education graduates in 15+ popul. in CZ/outside CZ	1.37 (61,90 % in CZ/45,14 % outside CZ)	1.24 (71,12 % in CZ/57,36 % outside CZ)		
Water	Average annual consumption of water resources (%)	9.0	8.9	1.0	10.0
	Average consumption of water resources in August (%)	13.5	13	1.0	10.0
Sea	Average connection to waste water treatment facilities (%)	No information found	28.1		
Energy	Average renewable energy in total energy consumption in ŠKC[1]	No information found	No information found		
Waste	Kilogramme per resident in ŠKC[2]	313,28 (2005)	406.0	270,0[5]	330,0[5]

[4] Data for 2001 The initial point of measurement is unison. For the second point it was the year 2011. (the year of the census, same as 2001), but for some indicators we used 2014. This is not a perfect solution, methodologically speaking, but for the purpose of this pioneer conceptual and planning effort it is satisfactory.

Soil	Irrigated agric. land (ha)	60,11 (2003)	120		
Fires	Annual fire site area size (ha)	6523, 53 (1994-2002)	3656,31 (2003-2012)		
Biodiversity	Protected area ratio in relation to total in CZ/outside CZ[3]	No information found	No information found		
Air	CO2 in ŠKC(tons/annually) [4]	1281,939 t/god	No information found		

At this level of discussion, the local team faced the problem of non-existing empirical data at the regional and national levels in Republic of Croatia. This called into question some dimensions, not theoretically, but comparatively, since adequate comparable data lacked for two time periods.

The task was to find empirical parameters in two time periods and reveal the trends of several dimensions of climate change and sustainable coastal zone development. The final point of this effort was to calculate "minimum sustainability", "maximum sustainability" and "sustainability ratio" parameters.

"The sustainability ratio" is a flexible indicator with an incorporated implied evaluation of the sustainable and unsustainable factors for the coastal zone development, both in the climate change and a broader development sense.

This indicator is the basis for determining acceptable empiric values for individual dimensions and indicators for the year 2030 with the purpose to support the development planning process. It is a planning horizon to be used as orientation, close enough to be convincing and far enough to make the local team thinks very precisely.

The list of participants (see Annex B) shows that 35 participants attended. The discussion which followed after the presentations was fruitful and useful and opened the path for the development of the final indicator list with quantified parameters.[5]

[5] This occurred after the Climagine 4 workshop through cooperation between the Climagine Croatia process leader and PAP/RAC experts from Split who researched the quantitative values for individual indicators and who had an in-depth insight into the circumstances in the coastal zone.

IV. Final proposal of indicators for integrated coastal zone management in Šibenik-Knin County

The *Climagine* workshops focused on climate variability and change. However, their role was to enrich the content and foster the creation of the integrated coastal zone management plan for Šibenik-Knin County.

From spring 2013 to spring 2015 this was achieved by setting up a participatory process which allowed local stakeholders to provide inputs and contributions which were taken into account, an attempt was, also, made to create analytically and research based criteria for the local coastal zone sustainable development.

The result of this analytical and research effort is the following dimension and indicator matrix with quantitative parameters, sustainability criteria (ratio) and assessment of acceptable empirical values for the year 2030.

Table 2. The final dimension and indicator matrix for the Šibenik-Knin County coastal zone sustainable development, with determined "sustainability ratios" and acceptable values for the year 2030

Dimension	Indicator	2001	2014 (for physical space and people 2011)	Sustainability ratio	2030	Note
Water	Average annual consumption of water resources (%)	9.0	8.9	1 - 10	9.5	Expert proposal - external associate Jure Margeta PhD
	Average consumption of water resources in August (%)	13.5	13	1 - 10	18	Expert proposal - Jure Margeta PhD
Sea	Average connection to public drainage system (%)	23,5 (2009)	28.1	55 - 65	55	
Fires	Annual fire site area size (ha)	6966 (1994-2002)	3656 (2003-2012)	1000-3000	1000	External associate of the "Climagine" process Mr. Kević from the 112 Šibenik emergency rescue service said that "they could tolerate 3000 burned hectares annually and 30 million Croatian Kuna annually."
Energy	Average renewable energy in total energy consumption in ŠKC	5.616 PJ (2006)	6.046 PJ (2010)	4300 - 5300	5300	This is household consumption. The Croatian Energy Strategy states that *The Republic of Croatia is setting a goal to lower direct energy consumption by 10% by 2020 compared to the average consumption in 2001. - 2005 Year.* 15% that was selected was taken from the 2006 value (because we use 2030 as the referral year) And out of that value (4776 PJ) +/- 10% was taken to get the 4300-5300 range.
Physical space	Apartments for perm. residence ratio in the total No. of app. in CZ (%)	66.92	54.09	60-80	54	The primary housing ratio can grow, but the progressive development of tourism threatens it. For this reason the value 54% for 2030 remains.
	Population density in the CZ compared to the density outside of the CZ	4.11 (74,77 res/km2 in CZ/18,20 res/km2 outside the CZ)	4.12 (72,48 res/km2 in CZ/17,61 res/km2 outside the CZ)	1.8 - 2.2	3.5	

Dimension	Indicator	2001	2014 (for physical space and people 2011)	Sustainability ratio	2030	Note
People	Ratio of employed in the entire working population in CZ and outside CZ	1.43 (32,99 % in CZ/25,45 % outside CZ)	1.40 (33,91 % in CZ/26,65 % outside CZ)	0.9 - 1.1	1.25	This drop of ratios is very slow. Even if it were faster, it could hardly reach the 1,1 ratio in 2030
	The ratio of highly educated in population aged 15+ in CZ/outside CZ	1.37 (61,90 % in CZ/45,14 % outside CZ)	1.24 (71,12 % in CZ/57,36 % outside CZ)	0.9 - 1.1	1.1	In this case the drop of ratios is much faster
Nature protection	Protected sea areas in relation to total sea areas (%)	9.37	9.37	8-12	9.37	This remained unchanged for decades, and the assumption was made it will not change in the next 20 years. The Ecological Network area will change, but it is not part of the calculation.
	Protected land areas in relation to total sea areas (%)	15.86	15.86	15-19	15.86	Same as in the previous column.
Waste	Kilogramme per resident in ŠKC	228.3	388.6	270 - 330	495	Estimates were provided for 2001 For the 2030, PAP/RAC experts took the population drop projections for the Croatian Adriatic area by 2030 (Croatian Statistical Institute) and the annual waste growth pace of 1% (Waste management strategy of the ŠKC). So, the population is dropping and the waste is growing.
	Kilogramme per resident in CZ and outside CZ	1.47	2.13	1.35 - 1.65	1.65	It is not realistic to expect that the consumption in CZ and in the hinterland will be 1:1, due to tourism. Therefore we used 1,5:1 and +/- 10% (1,35 – 1,65)
Soil	Irrigated agricultural land (ha)	60,11 (2003)	120	200 - 240	200	
	Soil used for organic plant production (ha)	140 (2008)	407 (2013)	800-1000	800	For the year 2016. the aim of the "National Action plan for the development of the organic agriculture (2011-2016)" was to have 8% of land used for organic production compared to total agricultural production (cca 900ha)

Table 3. The indicator numerical marks for the "amoebae" presentation

Dimension	Indicator
Water	1 Average annual consumption of water resources (%) 2 Average consumption of water resources in August (%)
Sea	3 Average connection to waste water treatment facilities (%)
Fires	4 Annual fire site area size (ha) 5 Average renewable energy in total energy consumption
Physical space	6 Apartments for permanent residence ratio in the total No. of app. in CZ (%) 7 Population density in the CZ compared to the density outside of the CZ
People	8 Ratio of employed in the entire working population in CZ and outside CZ 9 High school, grammar school and higher education graduates ratio in 15+ population in CZ/outside CZ
Environment protection	10 Protected sea areas in relation to total sea areas (%) 11 Protected land areas in relation to total land areas (%)
Waste	12 Kilogramme per resident in ŠKC 13 Kilogramme per resident in CZ and outside CZ
Soil	14 Irrigated agricultural land (ha) 15 Soil used for organic plant production (ha)

Table 4. Numerical values for each indicator

Dimension	Indicator	2001	2011	2030	BoE_ MIN	BoE_ MIN	Norm _low	Norm _High	Norm _2001	Norm _2011	Norm _2030	Norm_B oE Min	Norm_B oeMax
Water	1 Average annual consumption of water resources (%)	9	8,9	9,5	1	10	-17	28	0,58	0,58	0,59	0,4	0,6
	2 Average consumption of water resources in August (%)	13,5	13	18	1	10	-17	28	0,68	0,67	0,78	0,4	0,6
Sea	3 Average connection to waste water treatment facilities (%)	23,5	28,1	55	55	70	25	100	0,00	0,04	0,40	0,4	0,6
Fires	4 Annual fire site area size (ha)	6966	3656	1000	1000	3000	-3000	7000	1,00	0,67	0,40	0,4	0,6
Energy	5 Average renewable energy in total energy consumption	5616	6046	5300	4300	5300	2300	7300	0,66	0,75	0,60	0,4	0,6
Physical space	6 Apartments for perm. residence ratio in the total No. of app. in CZ (%)	66,92	54,09	54,09	60	80	20	120	0,47	0,34	0,34	0,4	0,6
	7 Population density in the CZ compared to the density outside of the CZ	4,11	4,12	3,5	1,8	2,2	1	3	1,00	1,00	1,00	0,4	0,6
People	8 Ratio of employed in the entire working population in CZ and outside CZ	1,43	1,4	1,25	0,9	1,1	0,5	1,5	0,93	0,90	0,75	0,4	0,6
	9 High school, grammar school and higher education graduates ratio in 15+ popul. in CZ/outside CZ	1,37	1,24	1,1	0,9	1,1	0,5	1,5	0,87	0,74	0,60	0,4	0,6
Environment protection	10 Protected sea areas in relation to total sea areas (%)	9,37	9,37	9,37	8	12	0	20	0,47	0,47	0,47	0,4	0,6
	11 Protected land areas in relation to total land areas (%)	15,86	15,86	15,86	15	19	7	27	0,44	0,44	0,44	0,4	0,6
Waste	12 Kilogramme per resident in ŠKC	228,32	388,58	495	270	330	150	450	0,26	0,80	1,00	0,4	0,6
	13 Kilogramme per resident in CZ and outside CZ	1,47	2,13	1,65	1,35	1,65	0,75	2,25	0,48	1,00	0,60	0,4	0,6
Soil	14 Irrigated agricultural land (ha)	60,11	120	220	200	240	120	320	0,00	0,00	0,50	0,4	0,6
	15 Soil used for organic plant production (ha)	140	407	800	800	1000	400	1400	0,00	0,00	0,40	0,4	0,6

Based on these empirical values, and their trends in the 2001 - 2011/14 period, the so-called "amoebae" graphic presentations were created.

Figure 1. Amoebae graphical presentation for 2001

Figure 2. Amoebae graphical presentation for 2011

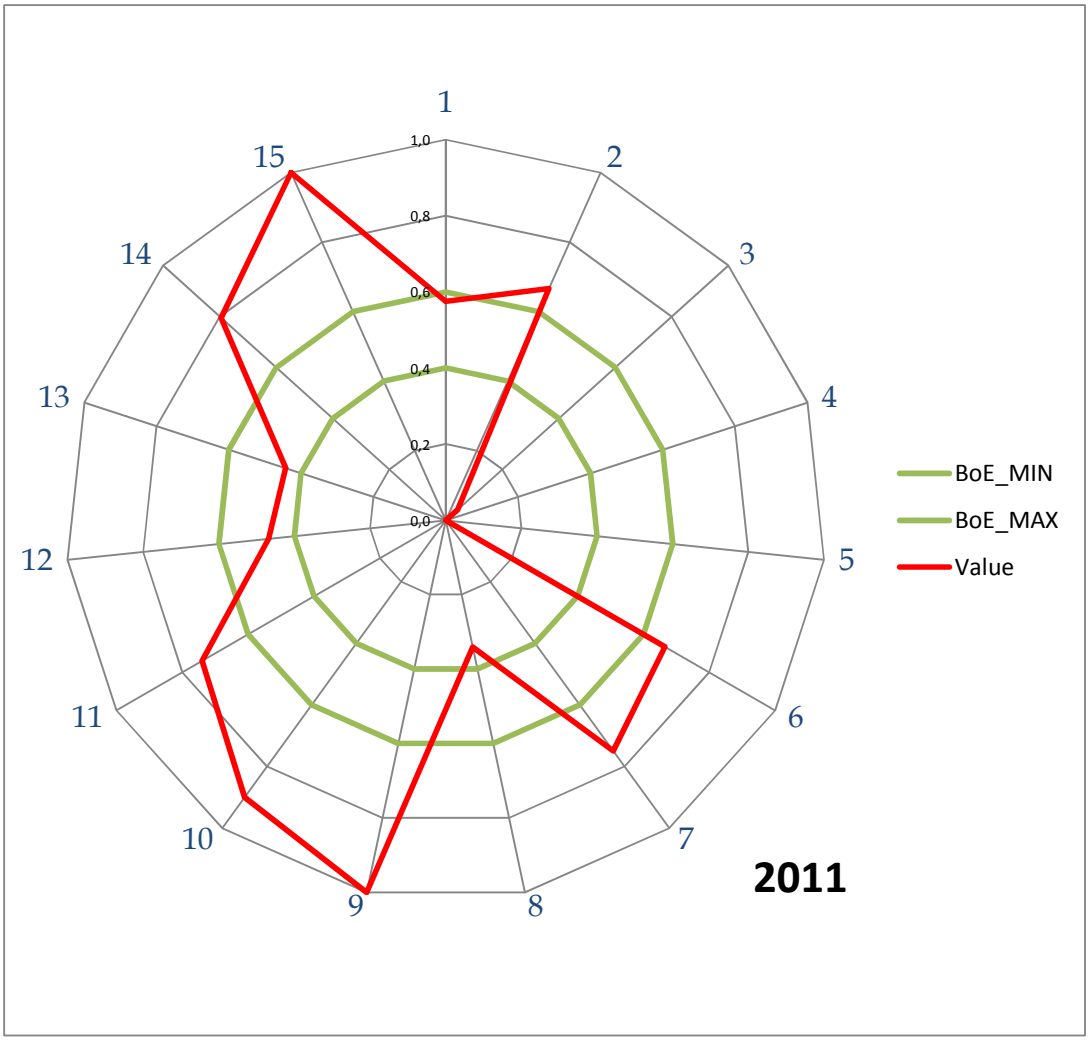
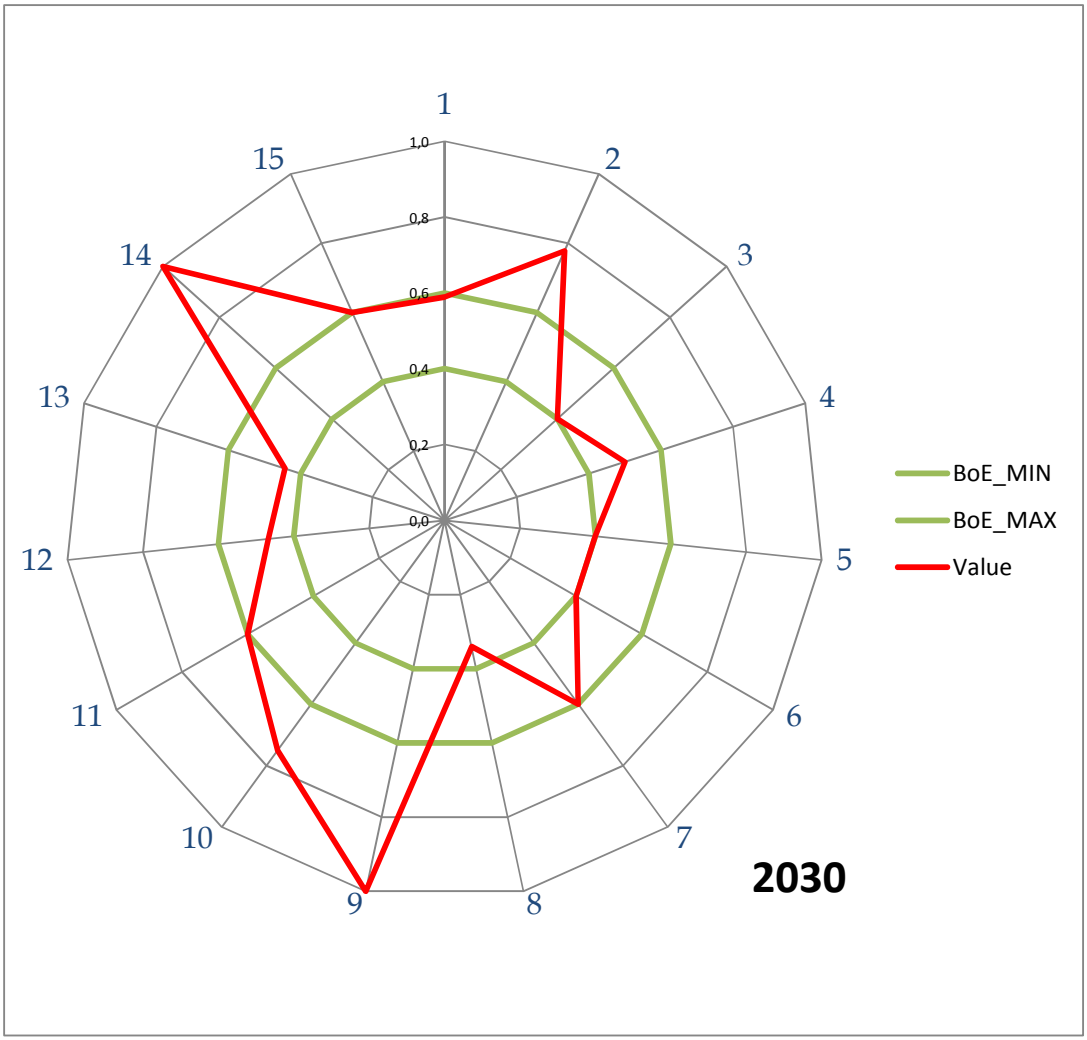


Figure 3. Amoebae graphical presentation for 2030



V. Short Concluding Remarks

The *Climagine* workshops focused on climate variability and change impacts on coastal zone. In the course of the creation of the integrated coastal zone development plan for ŠKC, problems, topics and criteria regarding the sustainability of the local coastal zone development were discussed.

The *Climagine* process had two main dimensions:

a. Initiating and fostering local stakeholders' participation in the discussions on the topics of climate change and the sustainable development of County's coastal zone.

b. The analytical and research effort conducted in cooperation with the creators of the "Integrated coastal zone management plan for Šibenik-Knin County", with an aim to determine empirical parameters and sustainability criteria to serve as an orientation and planning horizon for the year 2030.

The result of this analytical and research based effort is the above presented dimension and indicator matrix with quantitative parameters, sustainability criteria (ratio) and assessment of acceptable empirical values for the year 2030.

In that sense the "*Climagine* Croatia" process fulfilled its aim and purpose and with its specific findings, it was able to produce some crucial baseline data for the final draft of the integrated coastal zone management plan for Šibenik-Knin County.

VI. Annexes

a. Agenda of *Climagine*4 workshop

OBALNI PLAN

Plan integralnog upravljanja obalnim područjem Šibensko-kninske županije

Integracija klimatske varijabilnosti i promjena u obalne planove i nacionalne obalne strategije

Obalni plan Šibensko-kninske županije

s posebnim naglaskom na klimatsku varijabilnost i promjene [1]

17.4.2015.

PROGRAM

09:00 - 09:30	Registracija učesnika
09:30 - 09:40	Otvaranje radionice i pozdravni govor (Šibensko-kninska županija) Pozdravni govor (PAP/RAC, gđa. Željka Škaričić, g. Vladimir Lay)
	Procjena mogućih šteta od podizanja razine mora i klimatskih promjena
09: 40 - 10:40	Procjena šteta od podizanja razine mora za Republiku Hrvatsku (DIVA) Procjena mogućih troškova od klimatskih promjena za Šibensko-kninsku županiju (BC3 Bilbao, g. Anil Markandya) Diskusija
	Obalni Plan ŠKŽ: Prvi Nacrt Plana
10:40 – 11:40	Prvi Nacrt Plana (g. Ivica Trumbić) Diskusija
11:40 - 12:00	Pauza za kavu
	Climagine
12:00 – 14:00	Prijedlog indikatora i Climagine „ameba" (g. Vladimir Lay) Diskusija
14:00 - 15:00	Pauza za ručak
	Climagine - Obalni Plan ŠKŽ (g. V. Lay, g. I. Trumbić, gđa. D. Povh Škugor)
15:00 - 16:30	Prijedlozi, preporuke i rješenja za upravljanje obalnim područjem

[1] Za učesnike koji dolaze iz Splita bit će organiziran autobus s polaskom u 7.30 s autobusne stanice u Sukošanskoj.

b. List of participants

1.gđa Nikolina Aras
Lučka Uprava Šibensko-kninske županije
Draga 14
22000 Šibenik
Tel: 022 219852
E-mail: nikolina.aras@cpa-sibenik-knin.hr

2. gđa. Anita Babačić Ajduk
Ravnatelj, JU za upravljanje zaštićenim prirodnim područjima i drugim zaštićenim prirodnim vrijednostima na području Šibensko-kninske županije
Prilaz tvornici 39
22 000 Šibenik
Tel: 022 218462 / Faks: 022 218331
E-mail: ababacic@zpv-sibenik.hr

3.gđa Lidija Bralić,dipl. oec.
Viša savjetnica za pomorstvo i koncesije
Upravni odjel za pomorstvo, promet i otočni razvoj
22000 Šibenik
Tel: 022 / 460-739
E-mail : lidija.bralic@skz.hr

4. g. Neven Bujas
Hrvatske vode
22000 Šibenik
Tel: 022 354 613
E-mail: neven.bujas@voda.hr

5.g. Matija Bumbak
Pročelnik
Grad Šibenik
Upravni odjel za gospodarstvo,poduzetništvo i razvoj
Trg palih branitelja Domovinskog rata I
22000 Šibenik
Tel: 022 431 035
E-mail: matija.bumbak@sibenik.hr

6. g. Neven Cukrov,
Znanstveni suradnik
Zavod za istraživanje mora i okoliša
Laboratorij za fizičku kemiju tragova
Institut Ruđer Bošković Martinska bb
22000 Šibenik
E-mail: ncukrov@irb.hr

7.g. Marko Čule
Javna ustanova Zavod za prostorno uređenje Šibensko-kninske županije
Vladimira Nazora 14
22000 Šibenik
Tel: 022 217255 / Fax: 022 217256
E-mail: zavod-za-prostorno-uredjenje@si.t-com.hr

8.gđa. Tina Dragutin Barić
Javna Ustanova za upravljanje zaštićenim prirodnim područjima i drugim zaštićenim prirodnim vrijednostima na području Šibensko – kninske županije
Adresa: Prilaz tvornici 39
22 000 Šibenik
Tel: 022 218462 / Faks:022 218331
e-mail: zastitaprirode@zpv-sibenik.hr

9.g. Darko Dukić
županijski vatrogasni zapovjednik
Vatrogasna zajednica Šibensko-kninske županije
Ivana Meštrovića 11 D
22000 Šibenik,
tel/mob: 022/485-570, 098/266-000
e-mail: vzz-sibenik@si.t-com.hr

10. gđa Danijela Erceg
Voditeljica odjela za preventivne i planske poslove
Područni ured za zaštitu i spašavanje Šibenik
Velimira Škorpika 5
22000 Šibenik
Tel: 022 347425
E-mail: sibenik112@duzs.hr

11.gđa Zrinka Erceg,
Šibensko Kninska županija,
22000 Šibenik

12.gđa Jadranka Fržop
Pročelnica, Upravni odjel za pomorstvo, promet, otočni i područni razvoj
Šibensko-kninska županija
Trg Pavla Šubića I. br. 2
22000 Šibenik
Tel: 022 460741 / Faks: 022 460752
E-mail: pomorstvo@skz.hr

13.g. Goran Grguričin
Udruga Otočni sabor
Petra Zoranića 1/III
23000 Zadar
Tel: 023 / Faks: 023

Mob: 098-336909
E-mail: goran.grguricin@si.t-com.hr
http://www.otoci.hr/

14.g. Milovan Kević
Pročelnik, Državni Ured za Zaštitu i Spašavanje - Područni ured za zaštitu i spašavanje Šibenik
Velimira Škorpika 5
22000 Šibenik
Tel: 022 347240 / Faks: 022 347244
E-mail: sibenik112@duzs.hr

15.gđa. Sanja Kljajić
Javna ustanova za prostorno uređenje Šibensko-kninske županije
Vladimira Nazora 14
22000 Šibenik
Tel: 022 217255 / Faks: 022 217256
E-mail: zavod-za-prostorno-uređenje@si.htnet.hr

16.gđa Živana Lambaša Belak
Viša savjetnica za zaštitu okoliša
Upravni odjel za zaštitu okoliša i komunalne poslove Šibensko-kninska županija
Trg Pavla Šubića I. br. 2
22000 Šibenik
Tel: 022 460745 / Fax: 022 460754
E-mail: zivana.lambasa.belak@sibensko-kninska-zupanija.hr

17.g. Vladimir Lay
Ekspert Plavog Plana
Travanjska 19
10000 Zagreb
Tel: 01 3872872
E-mail: lay.vladimir@gmail.com

18.g. Damir Lučev
Javna ustanova za prostorno uređenje Šibensko-kninske županije
Vladimira Nazora 14
22000 Šibenik
Tel: 022 217255 / Faks: 022 217256
E-mail: zavod-za-prostorno-uređenje@si.htnet.hr

19.g. Marko Lugović
pročelnik
Grad Vodice
Ive Čače 8
22211 Vodice
Tel: 022-444911
E-mail: gradonacelnica@grad-vodice.hr

20.g. Nebojša Makarin
Lučka Uprava Šibensko-kninske županije
Draga 14
22000 Šibenik
Tel: 022 219852
E-mail: nebojsa.makarin@cpa-sibenik-knin.hr

21.g. Anil Markandya
BC3 Basque Centre for Climate Change
Maximo Aguirre 7E
Bilbao 48011
SPAIN
E-mail: anil.markandya@bc3research.org

22.gđa. Martina Markov
Predsjednica
Pijaca Društva seoske izobraženosti bb
22243 Murter
Tel/Fax: 022-434827
E-mail: mail@argonauta.hr

23.gđa Sanja Slavica Matešić
Pročelnica
Šibensko-kninska županija
Upravni odjel za zaštitu okoliša i komunalne poslove
Tel: 022 460748 / Faks: 022 460754
E-mail: okolis.komunalno@skz.hr

24.g. Stipe Mudrovčić
Ravnatelj
Zavod za prostorno uređenje Ličko – senjske županije
Adresa: dr. Franje Tuđmana 4, 53 000 Gospić
Tel. + 385 (0) 53 588-214 /Fax.+ 385 (0) 53 588-286
E-mail: zavod@licko-senjska.hr

25.gđa. Branka Novoselić Belamarić
Upravni odjel za prostorno planiranje i zaštitu okoliša, Gradska uprava grada Šibenika
Trg palih branitelja Domovinskog rata 1
22000 Šibenik
Tel. 022 431067 / Faks: 022 431099
E-mail: branka.belamaric@sibenik.hr

26.gđa. Daria Povh Škugor
Centar za regionalne aktivnosti PPA
Kraj Sv. Ivana 11
21000 Split
Tel: 021 340478
E-mail: daria.povh@paprac.org

27.gđa. Tanja Radić Lakoš
Veleučilište u Šibeniku
Trg Andrije Hebranga 11
22000 Šibenik
Tel: 022 311060 / Faks: 022 216716

28.g. Denis Samohod
Šibensko-Kninska županija
22000 Šibenik,
E-mail: denis.samohod@si.t-com.hr

29.g. Ivan Sekovski
PAP/RAC
Kraj Sv. Ivana 11
21000 Split
Tel: 021 340480 / Faks: 021 340490
E-mail: ivansekovski@gmail.com

30.g. Neven Stipica
Voditelj Programa
PAP/RAC
Kraj Sv. Ivana 11
21000 Split
Tel: 021 340479 / Faks: 021 340490
E-mail: neven.stipica@paprac.org

31.gđa. Željka Škaričić
Ravnateljica
PAP/RAC
Kraj Sv. Ivana 11
21000 Split
Tel: 021 340471 / Faks: 021 340490
E-mail: zeljka.skaricic@paprac.org

32.gđa. Barbara Štrkalj
Šibensko-Kninska županija
22000 Šibenik
E-mail: barbara.strkalj@outlook.com

33.gđa Mirjana Švonja
Hrvatske vode
Tel: 021 309401 / 309439 / Faks: 021 309491
E-mail: mirjana.svonja@voda.hr

34.g. Ivica Trumbić
PAP/RAC
Kraj Sv. Ivana 11
21000 Split

Tel: 021 339520 / Faks: 021 340018
E-mail: ivica.trumbic@gmail.com

35.gđa Branka Unić Klarin
Voditeljica kvalitete
Zavod za javno zdravstvo Šibensko-Kninske županije
Put Groblja 6,
22000 Šibenik
Tel: 022 200 424
E-mail: branka.klarin@zzjz-sibenik.hr