

Strategic Environmental Assessment and Sustainable Development: Climate Change Perspective

Suzaul-Islam MD and Yanrong Z*

Department of Environmental Science, School of Environmental Science and Engineering, Huazhong University of Science and Technology, Luoyu Road, Wuhan, China

Abstract

Climate change is global and of tremendous significance because the face of our planet is changing due to climate change. It affects population groups, all sectors, and countries. It engages complex risks and requires specific solutions. The satisfactory reflection of climate change within strategic environmental assessment (SEA) is therefore seen as a great challenge. We need the acceptable solutions which can face the changing climate and this effort in this area mainly focused to reduce greenhouse gas emissions, to mitigate climate change. So, the integration of adaptation of climate change concerns into the planning process with the execution of SEA becomes more and more important. Sustainable development is a recognized vision for any kind of development but the truth is that how to reach the sustainable development process. SEA process is well-positioned to thoroughly help strengthen action of climate change adaptation and mitigation in planning as well as sustainable development. The purpose of the study is to describe the SEA may be an important tool to facilitate decision-making in respect of climate change and the role of SEA towards sustainable development by adaptation and mitigation of climate change. The implementation of SEA is a challenging job in developing as well in developed countries. It needs continuous effort to recognize the obstacles and opportunities and to act for addressing them. The findings reveal that the appropriate application of SEA in the policies, plans, and programs (PPPs) can create a way for sustainable development by global climate protection and climate adaptation. In all cases, SEA should consider definite institutional settings with the aim of capably adapt decision-making procedures and to ensure that it is not seen as a costly external instrument which make difficult development actions. Further research and possible ways ahead in creating a more climate change-enabled SEA.

Keywords: Strategic; Environmental assessment; Sustainable development; Climate change

Introduction

Climate change is main concern worldwide at the level of governments, community, and business due to rising understanding of climate change's inferences for trade, security, ecosystems, the economy and the well-being of humans and other species. SEA provides a framework for evaluating and managing a wide range of environmental dangers which can contribute to the incorporation (or "mainstreaming") of climate change considerations into policies, plans and programs [1]. SEA, involving the environmental assessment of existing and proposed policies, plans and programs (PPPs) and their substitutes, has been gaining general recognition as a supporting instrument for decision making to achieve sustainable development [2,3]. Regarding sustainability SEA, gives a sound base planned for knowledgeable decision making [4-8]. The conference program of the 2011 IAIA (International Association for Impact Assessment) Special Conference on SEA states that SEA systems are presently in place in some 60 countries. There is no exact general idea of the number of countries with formalized or legal SEA requirements, but it is obvious that 'SEA is undertaken, both formally and informally, in an increasing number of countries and international organizations' [9,10].

It is recognized by the United Nations that Climate change as one of the greatest challenges of our era and one that make threats to weaken the ability of all countries to reduce poverty and achieve sustainable development. The survival of biological diversity and of many societies is at risk. The Paris Agreement covers the way for a more rigorous and collective response (Sustainable Development Knowledge Platform, Goal 13), [11]. The SEA procedures are sound-conditioned to systematically assist make stronger the action of adaptation and mitigation of climate change in planning as well as development.

The mitigation of climate change is essential to reducing the

emissions of greenhouse gas. The Organization for Economic Co-operation and Development (OECD) guidance proposes that a sound performed SEA can fulfill one or more of the functions in relation to the adaptation of climate change [1] are: i. A separate analysis of the possible performance of presented or new PPPs in view of new climate change prophecies (without reference to climate change efficiently a form of climate proofing of PPPs organized); ii. An assessment process and integrated planning designed both to create and test PPP choices against various climate scenarios which are enthusiastically explored as part of the SEA; and iii. A study procedure focusing entirely on quantifying and predicting a the possible effects of climate change within a known area [10].

Nevertheless, far too small concentration has been paid to the relationship of SEA and sustainable development with regards of climate change adaptation and mitigation. Yet the empirical evidence and experience on the area of climate change mitigation and adaptation concerns in PPPs through SEA is not well developed. Therefore, more empirical research needs from scientific community which create the way for integration of climate change adaptation into PPPs with the application of SEA to reach the goal of sustainable development.

***Corresponding author:** Yanrong Z, Department of Environmental Science, School of Environmental Science and Engineering, Huazhong University of Science and Technology, Luoyu Road 1037#, 430074, Wuhan, China, Tel: 862787541114; E-mail: yanrongzhang@hst.edu.cn

Received December 26, 2016; **Accepted** December 28, 2016; **Published** December 31, 2016

Citation: Suzaul-Islam MD, Yanrong Z(2016) Strategic Environmental Assessment and Sustainable Development: Climate Change Perspective. J Earth Sci Clim Change 7: 379. doi: [10.4172/2157-7617.1000379](https://doi.org/10.4172/2157-7617.1000379)

Copyright: © 2016 Suzaul-Islam MD, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Concept of SEA

"In strategic thinking SEA is conceptualized with respect to its capacity to influence decisional contexts and the formulation of strategic initiatives, adjusting to the flow and dynamics of strategic decision-making. That is the purpose of the guidance for better SEA practice, with strategic thinking for sustainability" [7,12]. SEA is perceived as having the prospective to make a constructive contribution to sustainability; both socioeconomic and environmental [13]. SEA was raised worldwide to make sure more effective concern of environmental issues in the improvement of PPPs [6]. "It helps in bridging problem perceptions with technical solutions and steering the impact assessment to facilitate the integration of environmental values into decision-making processes, influencing decision maker's capacity of acceptance of any plan" [14,15].

Posas reported that SEA has gathered international recognition, been institutionalized in entire regions [16-20], and been implemented by international organizations to make stronger development planning [18,21]. SEA is practiced in developing countries [18,22-26], generally about the requirements of development bank [18,27,28]. In developed countries, more systematically SEA is being practiced and frequently in association with proper requirements tied to EIA law or in the case of European Union member states, in association with the 'EU SEA Directive [18-20], SEA is a tool especially suited to exploring various policy options. It is capable to model scenarios for climate change adaptation solutions and test mitigation measures interactively with decision-makers and stakeholders. However, the particular challenges of climate change, such as future climate uncertainty and its cross-cutting nature, form sizeable methodical and conceptual challenges to the sufficient reflection of climate change within SEA. Climate change may be reflected within the structure of SEA by integrating and framing additional specific climate evaluation tools.

SEA and climate change

SEA may be an important tool to address the problems and support actions to climate change adaptation into the planning process in addition to highlight probable adaptation conflicts with other presented national/regional plans and program. It requires the sustainable planning and it is one of the main objective of SEA. If the climate change adaptation issues is not included into this process thus will lead to maladaptation and jeopardizes sustainable development. On the other hand, the concerns of climate change adaptation integrate in the planning process in an early stage will enhance sustainable development and will make sure that impacts with an upper level of uncertainty such as climate change are taken into consideration into the plans and program in the aspect of development.

Climate and climate change

'Climate' presents to the average meteorological situations in a particular place more than a long period [29], "climate change is a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and that persists for an extended period, typically decades or longer" [30], and "The term 'global warming' is occasionally used interchangeably with the change of climate, but the terms are different. Global warming presents to an average raise in near-surface temperatures, at the same time as climate change is a broader term that presents to any important change in events of climate (temperature, precipitation, wind, etc.) lasting for an extended time (decades or longer). Current climate change embraces but does not consist only of global warming and is known to be that the human activities influenced the climate change thus greenhouse gas

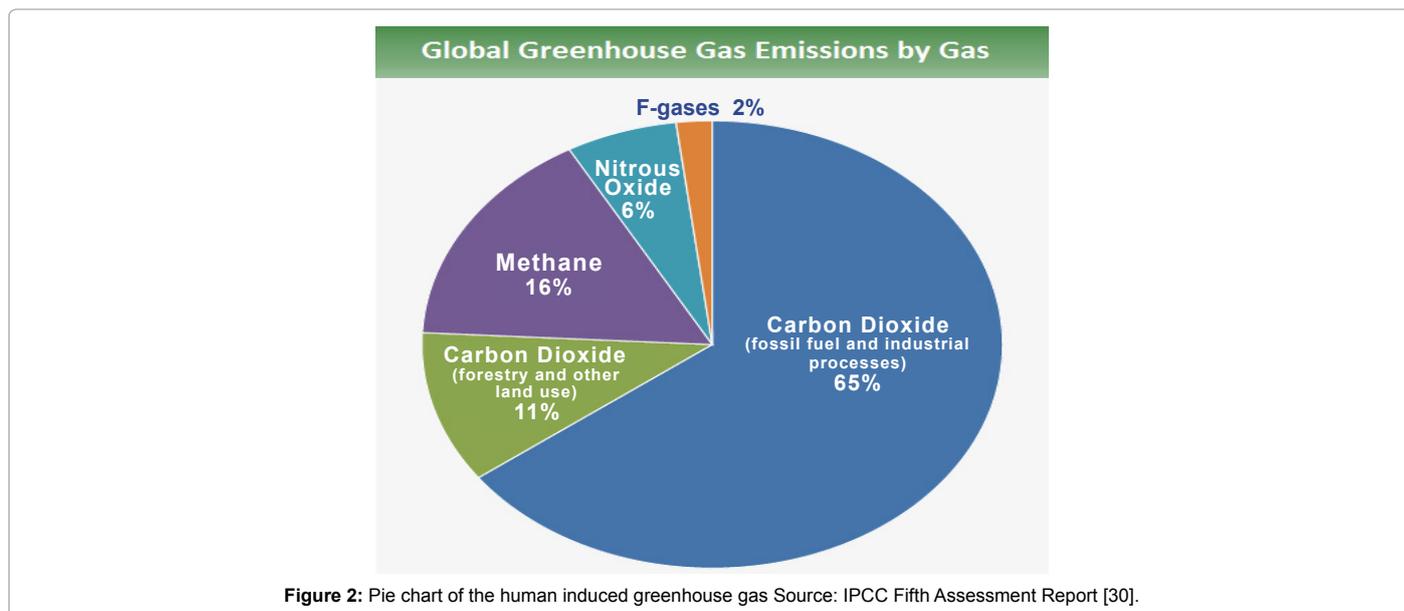
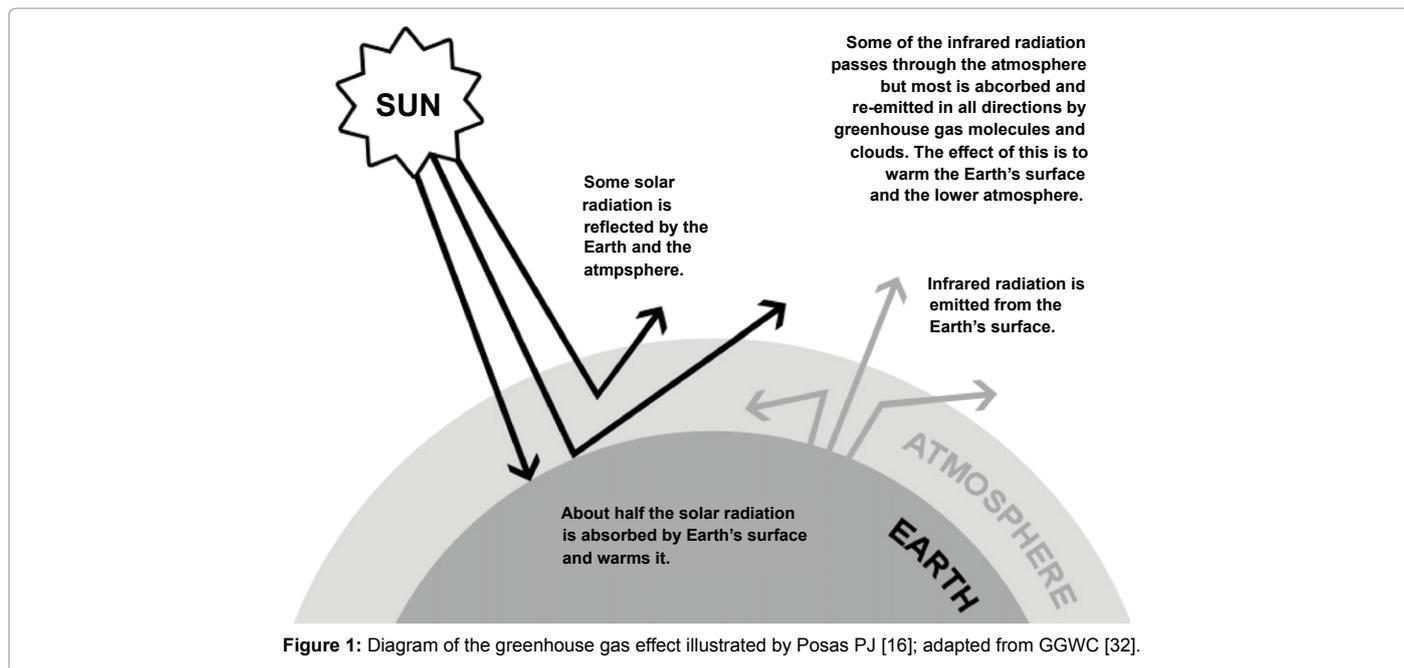
emissions increase significantly into the atmosphere. In the atmosphere greenhouse gases entrap the heat that creates the earth warmer. The sun energy heats the surface of the earth. The earth's surface is hitting by light rays either absorbed or reflected. Absorbed light is transformed into heat. The earth's surface absorbed the some of the heat, some of the heat is conducted to the atmosphere, and few is emitted and go back upward as infrared radiation (heat), that either is absorbed by greenhouse gases in the atmosphere or get its way into space. This heat absorbed by greenhouse gases and radiates it slowly back to the atmosphere. The amount of warming is connected to the type and amount of greenhouse gases in the atmosphere. By this process Figure 1 represents the greenhouse gas effect.

The key greenhouse gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), fluorinated gas (F-gases) emitted by human activities. Each of these gases's effect on climate change depends on three major factors: how much? How long? How powerful?. Figure 2 signifies the pie chart where the dimension of every pie represents the warming amount of each gas is presently causing in the atmosphere because of emissions from the activities of peoples.

Without explicit extra attempts to reduce greenhouse gas emissions atmospheric concentrations in baseline exceeds 450 parts per million (ppm) CO₂ eq (Carbon dioxide equivalent) by 2030. They reach CO₂ eq concentration levels from 750 to more than 1300 ppm CO₂ eq by 2100 and result in projected global mean surface temperature increases in 2100 from 3.7°C to 4.8°C compared to pre-industrial levels (range on the basis of median climate reaction; the range is 2.5°C to 7.8°C when counting climate uncertainty), [30]. So we must attempt for minimize of future greenhouse gas emissions. Considering the fact that planning, resembling the SEA, tends to promote and patron sustainable development, it can in revolve "enhance both mitigative and adaptive capacities, and reduce emissions and vulnerability to climate change" [29,31,32].

Based on strategic environmental assessment and climate change: Guidance for Practitioners [33], Figure 3 states the main aspects of climate change that are relevant to SEA:

1. Such "mitigation measures" we can take the direct action for reduction of human impacts on climate change system, especially, by reducing greenhouse gas emissions, which include strengthening a sustainable energy supply, improved energy efficiency, increased proviso of renewable energy, raised insulation of buildings.
2. Additionally, it is now widely recognized that greenhouse gases must be reduced from future activities so as to diminish climate change, above and over the unavoidable changes because of our past actions.
3. In the future climate change will occur regardless of what we do now, due to our past actions. It will include changes in the temperature and rainfall, raised sea levels, changes in the incidence of events such as cyclone, droughts and storm.
4. Impacts severity will also depends on what "adaptation measures" are put in place, i. e. how we develop and respond new behavior and put into practices to respond to or expect climate change. Such measures are improved the risk management of flood, prevention of improper new construction in floodplains.
5. These changes will certainly have consequences. Likely, negative impacts include more people dying from extreme heat, more flooding, excessive drought subsidence because of



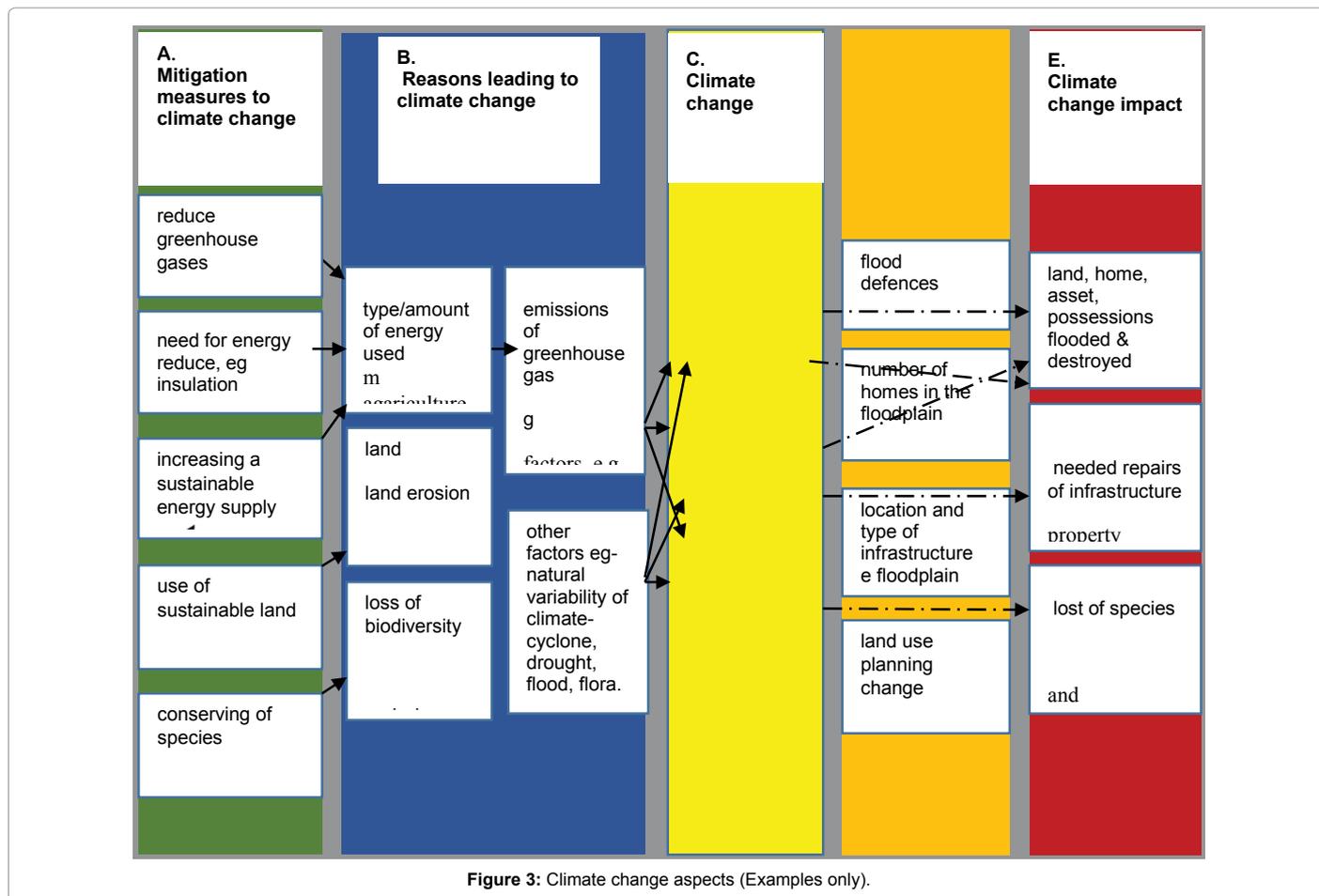
soil environment. Fewer winter cold deaths could include as a possible benefits... The severity or type of impact varies from region to region.

SEA role to sustainable development in respect of climate change

The role of SEA in planning is today mainly oriented towards the support of the policy of sustainable development. Considering basic principles, procedural and methodological framework and planning system separately, the SEA patrons a sustainable development by the promotion of ecological, social and economic aspects [31]. In the planning process the appropriateness of the application of SEA is a key to the majority successful outcomes. This SEA experience proposes that SEA carried out in parallel with the formulation of plan could

have resulted in improved planning effects and options to bring the long-term benefits of continuous development in environmental sustainability as well as ecological systems functionality that are important to reach sustainable development and welfare of the society [14]. SEA makes easy identification of development choices and different plan that are more sustainable (i.e., contributes to the general sustainable development strategy as put down in Rio 1992 and defined in the specific values or policies of a country) [34].

According to Dalal-Clayton and Sadler [18] the rationale for SEA into categories of project environmental impact assessment (EIA) strengthening, addressing large scale and cumulative effects, and advancing the agenda of sustainability. Sustainable development is extensively held to be the ultimate goal of SEA in regarding third rationale, as has been tracked in definitions of SEA since the early



1990s [35]. While occasionally a contested concept, many authors see sustainable development's value as the potential for incorporation it provides [36-38]. Strydom [38] identifies sustainable development a 'cultural form with practical efficacy.' 'Issues previously seen as separate - such as world deforestation, overpopulation, stratospheric ozone depletion, desertification, basic needs for human existence, poverty in poor countries, *per caput* resource consumption and waste production in industrialized countries, and global climate change-are now apt to be considered firmly together in political and intellectual debates' [37]. Therefore, it is essential for better environmental management system and protection, in addition to planning system in SEA, the political will is needed to address the problems of climate change. Figure 4 shows the SEA system with climate linkage.

In the angle of sustainable development, Connelly and Richardson [36] view SEA's role as follows: " we can see SEA which is oriented towards achieving sustainable development not as generating a definable output, but as providing a framework for approaching the integration of difficult environmental risks, challenges, conflicts, and trade-offs into everyday decision-making." It seems that SEA helps to ensure the improvement of PPPs in an extra environmental alert system, by which at an early stage environmental impacts are tackled in decision-making; and that individual plans are placed into action in a better sustainability framework [7-8,39-41]. With definite relation to climate change, Pizarro [42] calls a consensus amongst a numeral authors that 'sustainable development is perhaps the most appropriate conceptual and practical framework to identify problems, to involve the

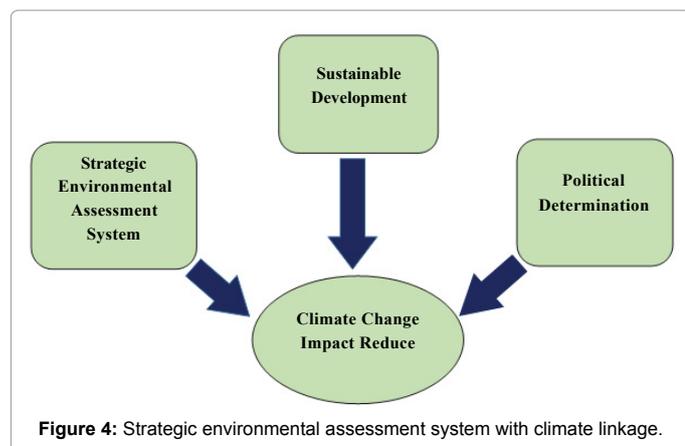
public, and to devise strategies to deal with [climate change] mitigation or adaptation in communities large or small in countries of the "First" or the "Third World".

Conclusion

Climate change will increase existing risks and make new risks for human and natural systems. It is a threat to sustainable development and equitable as well. It is necessary to prevent the effects of climate change to achieve sustainable development, equity as well as poverty eradication. Now the strategies and actions can be followed that will move to climate-resilient pathways for sustainable development, whereas at the same time helping to get better livelihoods, economic and social well-being and successful environmental management.

SEA is new and important instrument to reach the goal of sustainable development by adapting and mitigating climate change impact. There is lack of empirical experience, guidance and knowledge, information for adaptation and mitigation of climate change impact with the application of SEA. Therefore, it is the right time to create a database of adaptation, mitigation and impact studies that apply sectoral, regional, and global developments for application in decision-making and evaluations.

SEA is an especially suitable tool for the implementation of climate protection at the local or regional level, or in sectoral planning, such as transport planning. SEA may be a real 'policy integration tool' [43] to encourage larger attention in policy formation for mitigation of climate



change. Within this strategic procedure to play an important role for the protection of climate however, some basic features must be taken into account or adapted. First, the EU should describe the protected asset “climatic factors” more clearly in the SEA Directive than has till now been the case, specially, too, for the purposes of climate adaptation and global climate protection [44,45].

It is commonly stated that concern of climate change features in the SEA was insufficient, and that it is needed to add climate change in a more systematic and comprehensive manner. Therefore, further research is needed to develop systematic and comprehensive approach to include climate change feature in the SEA for sustainable development.

References

- OECD (2010) Strategic environmental assessment and adaption to climate change.
- Noble BF, Storey K (2001) Towards a structured approach to a strategic environmental assessment. *J Environ Asses Policy Manag* 3: 483-508.
- Brown AL, Therivel R (2000) Principles to guide the development of strategic environmental assessment methodology. *Impact Asses and Proj Appra* 18: 183-189.
- Kim Y, Park D, Um-Jin M, Lee H (2015) Prioritizing alternatives in strategic environmental assessment (SEA) using VIKOR method with random sampling for data gaps. *Expert Sys With Applic* 40: 8550-8556
- Geneletti D (2013) Ecosystem services in environmental impact assessment and strategic environmental assessment. *Environ Impact Asses Rev* 40: 1-2.
- Rega C, Bonifazi A (2014) Strategic environmental assessment and spatial planning in Italy: sustainability, integration and democracy. *J Environ Plan Manag* 57: 1333-1358.
- Partidario MR (2015) A strategic advocacy role in sea for sustainability. *J Environ Asses Policy Manage* 17: 1-8.
- White L, Noble BF (2013) Strategic environmental assessment for sustainability: A review of a decade of academic research. *Environ Impact Asses Rev* 42: 60-66.
- Sadler B, Dusik J, Fischer T, Partidario M, Verheem R, et al. (2011a) Taking stock of SEA. pp: 1-18.
- Tetlow MF, Hanusch M (2012) Strategic environmental assessment: the state of the art. *Impact Asses Project Apprais* 30: 15-24.
- International Cooperation and Development Commission (2010) Tools and method series guidelines No 6, European Commission.
- Partidário MR (2012) Strategic environmental assessment better practice guide-A Methodological Guidance for Strategic Thinking in SEA. Amadora: APA and REN.
- Noble BF (2002) The Canadian experience with SEA and sustainability. *Environ Impact Asses Rev* 22: 3-16.
- Mukherjee D, Rajvanshi A (2016) Application of strategic environmental assessment as a land use planning tool in India: A case of Gurgaon-Manesar development plan, Haryana, India. *J Environ Asses Policy Manage* 18: 21.
- Vicente G, Partidário MR (2006) SEA-Enhancing communication for better environmental decisions. *Environ Impact Asses Rev* 26: 696-706.
- Posas PJ (2011) Exploring climate change criteria for strategic environmental assessments. *Progr Plan* 75: 109-154.
- IAIA (2002) Strategic environmental assessment performance criteria.
- Dalal-Clayton B, Sadler B (2005) Strategic environmental assessment: A sourcebook and reference guide to international experience. London: Earthscan.
- Fischer TB (2007) Theory and practice of strategic environmental assessment—Towards a more systematic approach. London: Earthscan.
- Sheate WR, Byron HJ, Smith SP (2004) Implementing the SEA Directive: Sectoral challenges and opportunities for the UK and EU. *Europ Environ* 14: 73-93.
- OPCS (2004) From adjustment lending to development policy lending: Update of World Bank policy.
- Bao C, Lu Y, Shang J (2004) Framework and operational procedure for implementing Strategic Environmental Assessment in China. *Environ Impact Asses Rev* 24: 27-46.
- Briffett C, Obbard JP, Mackee J (2003) Towards SEA for the developing nations of Asia. *Environ Impact Asses Rev* 23: 171-196.
- Chaker A, El-Fadl K, Chamas L, Hatjian B (2006) A review of strategic environmental assessment in 12 selected countries. *Environ Impact Asses Rev* 26: 15-56.
- Centre for Scientific and Industrial Research, Department of Environmental Affairs and Tourism (CSIR/DEAT) (2004) Strategic environmental assessment in South Africa. Guideline Document. Pretoria: CSIR/DEAT.
- Lee N, George C (2000) Environmental assessment in developing countries and transitional countries: Principles, methods, and practice. New York: Wiley.
- Alzina V, Teixeira I (2005) SEA experience in Latin America: a general view. International experience and perspectives in SEA.
- Blanco H (2006) Sustainability impact assessment of trade policy and its application in the context of Latin America. *Impact Asses Project Appra* 24: 285-297.
- IPCC (2007) Climate changes: Impacts, adaptation, and vulnerability. contribution of working group ii to the fourth assessment report of the intergovernmental panel on climate change pp: 7-22.
- IPCC (2014) Climate change 2014: Synthesis report, contribution of working groups i, ii and iii to the fifth assessment report of the IPCC. IPCC, Geneva.
- Crncevic T, Marić I, Josimović B (2011) Strategic environmental assessment and climate change in the republic of Serbia-support to development and adjustment process. *SPATIUM International Review* 26: 14-19.
- GGWC (2009) Global warming. Global Greenhouse Warming.
- Strategic environmental assessment and climate change (2004) Guidance for practitioners.
- Frey B, Olearius A, Palerm J (2011) Strategic environmental assessment- a governance tool for sustainable development, lessons learnt from applying strategic environmental assessment within development cooperation focusing on aid effectiveness. pp: 1-35.
- Bina OC (2003) Re-conceptualizing strategic environmental assessment: Theoretical overview and case study from Chile.
- Connelly S, Richardson T (2005) Value-driven SEA: Time for an environmental justice perspective? *Environ Impact Asses Rev* 25: 391-409.
- Dovers SR, Handmer JW (1993) Contradictions in sustainability. *Environ Conser* 20: 217-222.
- Strydom P (2002) Risk, environment, and society. pp: 167-180.
- Morrison-Saunders A, Therivel R (2006) Sustainability integration and assessment. *J Environ Asses Policy Manag*.

-
40. Noble BF, Harriman-Gunn J (2009) Chapter 6: strategic environmental assessment. pp: 103-130.
41. Therivel R (2013) Strategic environmental assessment in action.
42. Pizarro RE (2009) The mitigation/adaptation conundrum in planning for climate change and human settlements: Introduction. *Habitat Intern* 33: 227-229.
43. Cashmore M, Richardson T, Hilding-Ryedvik T, Emmelin L (2010) Evaluating the effectiveness of impact assessment instruments: theorising the nature and implications of their political constitution. *Environ Impact Asses Rev* 30: 371-379.
44. Helborn H, Schmidt M, Glasson J, Downes N (2011) Indicators for strategic environmental assessment in regional land use planning to assess conflicts with adaptation to global climate change. *Ecolo Indic* 11: 90-95.
45. Wend D (2012) Climate change mitigation and adaptation in strategic environmental assessment. *Environ Impact Asses Rev* 32: 88-93.