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# ENVIRONMENTAL CAPACITY: NEOTERIC APPROACH IN SUSTAINABLE ENVIRONMENTAL MANAGEMENT

**Abstract:** *Forecasting changes in the environment, creating preventive actions and defining the corresponding measures are in the focus of contemporary scientific researches in the area of sustainable environmental management. An essential part of preventive thinking is consideration of the concept of environmental capacity. The aim of this study is to examine determinants of environmental capacity, vulnerability and resilience based on the principles of sustainable development. The study is based on observing relevant components and structure of the environmental capacity, vulnerability and resilience concept. In that sense, this paperwork represents an assay to highlight the basic attributes of the abovementioned concept, and to identify the specific linkages between them.*

**Key words:** environmental capacity, determinants, management.

## INTRODUCTION

The scientific use of the concepts of environmental capacity is central to many areas of environmental protection and environmental quality management processes, and is a basic tool for the analysis of adverse effects of environmental problems both regarding state of the environment (eco-centric point of view) and potential of environmental services to humans (eco-anthropogenic point of view).

There is no doubt that the development of environmental capacity concept was contributed by the activities of the Rome's club and a Conference on the environment held in Stockholm in 1972. year (United Nations Conference on the Human Environment) where The Declaration of the United Nations Conference on the Human Environment, or Stockholm Declaration, was adopted on 16th June.

In parallel with the strengthening of environmental awareness in the world, within that time present European Economic Community was published the first wave of the directives pertaining to the issue of environmental quality management. For the first time, these directives are talking about environmental quality standards, which are divided into two groups (regarding water quality): the emission and the emission standards. In terms of respecting the capacity of the environment the imission standards respects the environmental component when defining the maximum allowable input of pollutants in a particular recipient. These documents can be recognized as first studies regarding the environmental component of the environment capacity concept.

However, after more than 30 years, only with catastrophic events such as the Indian Ocean earthquake and tsunami began the researches that relates to the active role of humanity in the process of environmental capacity management, and consideration of economic and social components of environmental capacity, which is shown on Figure 1.

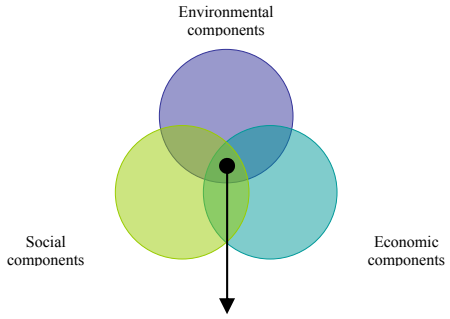


**Figure 1.** *Environmental capacity components*

In formal sense, the term of environmental capacity is for the first time defined by group of authors working within unique Research framework as "a property of the environment and its ability to accommodate a particular activity or rate of an activity ... without unacceptable impact" (GESAMP, 1986). The environmental capacity concept is therefore central to the promotion of sustainable development. Importantly, it requires us to address the cumulative impacts of whole sectors of activity, and ideally all economic activity, on the ecosystem within a specified area.This definition clearly states the environmental or biophysical component of environmental capacity, but following chapters will explain that environmental capacity concept goes far beyond only this dimension.

## UNDERSTANDING ENVIRONMENTAL CAPACITY

Scientific and historical records the data and the results of statistical analysis shows and point to a steady, but

ever-present, increase in risk, the number, type and intensity of hazards, either man-made or environmental and the increasingly complex and severe consequences that threaten not only humanity but the total biosphere of the Earth (Blaikie, 1994). Conducted researches, analysis and forecasts indicate the possibility of the occurrence of large-scale droughts and sudden floods, even where it has been never occurred. These new climate changes are highly conducive to the development of new epidemics, affecting the growth of hunger, poverty and massive migration of citizens. Harmful processes to people and property, environmental degradation, and especially their consequences, do not recognize national boundaries, but increasingly have trans-regional dimensions, with a tendency to diffuse in sense of global expansion (Cardona, 2004).

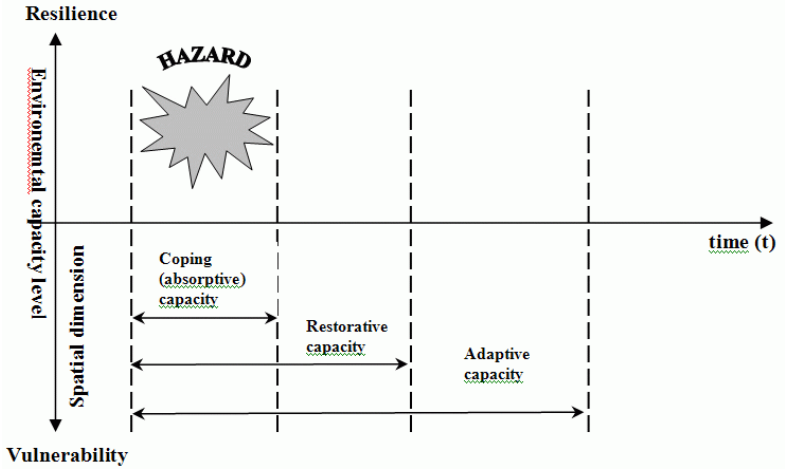


**Figure 2.** *Time and spatial dimension of environmental capacity*

Science and practice today focus on further development of the complex actions of timely recognition and forecast of the threats. Evaluation of new challenges, risks and threats, must be based on complex analysis and in particular the prediction of new hazards and it's consequences, with emphasis on the planning and undertaking of preventive measures of monitoring and supervision of implementation of the measures that directly or indirectly affect the reduction of the risks and consequences (Cardona, 2005). Previous findings obtained by the science as evidenced by the positive experiences from practice show that the risk factors and the risk can not be totally identified, monitored, evaluated and predicted (Cardona, 2006). For such reasons, humanity and environment will remain vulnerable to hazards, but it is necessary to identify level of vulnerability to different hazards and capacity to manage them.

When talking about environmental capacity, it is necessary to bear in mind that there are different levels of environmental capacity in general, either on vertical or horizontal scale, i.e. taking into account time or spatial dimension, which is shown in Figure 2.

In terms of terminology, contemporary literature provides a considerable number of definitions that refers to the terms introduced in the Figure 2. UN/ISDR - UN Office for DRR (Disaster Risk Reduction) sets next definitions:

***Capacity*** *- the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals,*

***Coping capacity*** *- management activities that address and seek to correct or reduce disaster risks which are already present,*

***Adaptive capacity*** *- generally alludes to a longer time frame that coping capacity and implies that some learning either before or after an extreme event or change in conditions has occurred. The IPCC (*2007*) defines adaptive capacity in relation to climate change as "the ability of a system to adjust to climate change (including climate variability and extremes),*

***Restorative capacity*** *- the ability of a system (ecosystem) to be restored in previous state, either before occurrence of a short-time hazard or after continual pollution load,*

***Hazard*** *- a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage,*

***Resilience*** *- the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions,*

***Vulnerability*** *- the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard*

Observed in time, environmental capacity has its:

- short time component - coping (absorptive) capacity,
- medium time component - restorative capacity and
- long time component - adaptive capacity.

Table 1. shows the development of coping and adaptive capacity definitions (Thomalla, 2006).

**Table 1.** *Development of coping capacity and adaptive capacity definitions*

| Reference | Coping capacity or coping strategies | Adaptive capacity or adaptation |
|---|---|---|
| Davies (1993) | Short-term response to an immediate and in habitual decline in access to food | Permanent change in the ways in which food is acquired |
| Kelly and Adger (2000) | Ability to respond to an occurrence of harm and to avoid its potential impacts | Ability to transform structure, functioning or organisation to survive under hazards' threatening existence |
| Yohe and Tol (2002) | Range of actions available to respond to the perceived climate change risks in a given policy context | Ability to change the set of available inputs that determine the level of coping capacity |
| Eriksen et al. (2005) | The responses that people employ to maintain wellbeing in the face of environmental stress within the existing structures | Changing the framework within which coping takes place |
| IPCC (2007, 2001) | 'Coping Range' (2001 TAR) The variation in climatic stimuli that a system can absorb without producing significant impacts | Adaptation: adjustment in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits benefits. Adaptive capacity: the ability of a system to adjust to climate change to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. |
| Birkmann et al. (2009) | Immediate responses to hazards such as a specific flood event | Medium - and long term strategies for changes in institutional frameworks |
| Lemos and Tompkins (2008) | Design and implementation of risk management institutions - such as disaster preparedness plans - that can mitigate the most immediate climate impacts | Socioeconomic and political reforms that addresses the inequalities at the root of differential vulnerabilities |
| Pelling (2011) | The strategies used by those living with rapid onset disasters such as flash floods, and chronic disasters, including drought and food insecurity | Change in those practices and underlying institutions that generate the root and proximate causes of risk, frame capacity to cope and further rounds of adaptation to climate change |

With no less importance is the definition provided by The Law on Environmental Protection of the Republic of Serbia which defines a level of environmental capacity as "*the ability of the environment to accept a certain amount of pollutants per unit of time and space without irreparable damage to the environment*".

Whether the environmental capacity is observed in the time or spatial dimension, there is a general rule (author's note) that at every instance there are substantial interlinkages between economic, social state of those who are users of environmental services and bio-physical state of environment. There are integrative frameworks focused on interaction between properties of ecological-social-economic systems (Janaćković, 2013; Malenović Nikolić, 2015). At the other hand, there are researchers that distinguish biophysical (or natural, environmental) component of environmental capacity as external factor from social and economic (or socioeconomic) component of environmental capacity as an independent, internal factor, when observing human society (Adger, 2000; 2005).

## What about environmental vulnerability?

The concept of vulnerability often has been used to describe the susceptibility of physical, biotic, and social systems to harm or hazard, either accidental or hazard that are continual in it's nature due to different human activities. United Nations/International Strategy for Disaster Reduction (UN/ISDR), for example, defines vulnerability as the ''*conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of a community to the impact of hazards*''. Numerous authors outline concept of vulnerability more generally as susceptibility of observed system to damage, due to the sensitivity or exposure of a system, people, or places to impacts, stresses, or perturbations. Apart from the concept of general vulnerability or biophysical vulnerability, there is also social component of vulnerability, which is related to the characteristics and experiences of communities and people who must respond to and recover from the environmental hazards or stressors to which they are exposed, either accidentaly or in continual sense. Nowadays, the concept of vulnerability has been continuously widened and broadened towards a more comprehensive approach encompassing susceptibility, exposure, coping capacity and adaptive capacity, as well as different thematic areas, such as physical, social, economic, environmental and institutional vulnerability (Adger, 2000; 2005) .

## CONCLUSION

The concepts of environmental capacity (coping, restorative, adaptive), vulnerability, resilience, exposure and sensitivity are interrelated and have wide application to global change science. The subject of this paperwork was aimed towards examination of environmental capacity concept as a novel approach in the field of environmental quality management. This aims towards clearly and unequivocally proving the causal relationships between attributes and determinants of environmental vulnerability, resilience, and capacity. This is only a first step in further research that should be focused on demonstrating the necessity of assessing environmental vulnerability, resilience, and capacity determinants.

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## BIOGRAPHY

**Dejan Vasović** was born in Prokuplje, Serbia, in 1982.
He received the diploma in environmental protection engineering and the Magister of technical sciences degree in same field from the University of Nis, Faculty of Occupational Safety in Niš.
His main areas of research include environmental protection, environmental capacity management, water quality, environmental security, etc.
He is currently working as an teaching assistant at the Faculty of Occupational Safety in Nis, University of Nis.

# KAPACITET ŽIVOTNE SREDINE: SAVREMENI PRISTUP U ODRŽIVOM UPRAVLJANJU ŽIVOTNOM SREDINOM

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**Rezime:** *U oblasti održivog menadžmenta životnom sredinom, savremena istraživanja su uglavnom usmerena ka kreiranju preventivnih aktivnosti i korektivnih mera, kao i prema predikciji promena u životnoj sredini. U tom smislu, razmatranje koncepta kapaciteta životne sredine predstavlja neizostavnu komponentu preventivnog delovanja. Uvažavajući principe održivog razvoja, cilj ovog rada je usmeren ka pregledu determinanti kapaciteta životne sredine, kao i ranjivosti i otpornosti iste. Tematika istraživanja je usmerena ka relevantnim komponentama i strukturi koncepta kapaciteta životne sredine, ranjivosti i otpornosti. U tom smislu, ovim radom se ističu osnovne karakteristike pomenutih koncepata, kao i specifične veze izmedju njih.*

**Ključne reči:** kapacitet životne sredine, determinante, upravljanje.