

Differences in Perceptions, Attitudes, and Use of Ecosystem Services among Diverse Communities in an Arid Region: A Case Study from the South of Jordan

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ABSTRACT The aim of this study was to understand how local people interact with their surrounding ecosystem. The researchers focused on a dry terrestrial environment (Wadi Araba and Aqaba in southwest Jordan) and analyzed an assortment of communities in order to reveal how different groups perceive and use their environment in varying ways. The analytical tools in this study—derived from the social sciences—included preliminary interviews and a field survey of 150 randomly selected respondents from Wadi Araba (rural) and Aqaba (urban). The survey, based on a structured questionnaire, consisted of eight sets of nested multiple choice questions focusing on respondents' perceptions of, and attitudes toward, the surrounding hyper-arid ecosystem. Responses from rural residents reflected a greater average concern of, and awareness toward, their environment than responses from urban residents.

INTRODUCTION

Ecosystem services (ES) are commonly defined as “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment 2005; Wallace 2007). Different definitions of ecosystem services have caused difficulties in developing an effective typology of services (Wallace 2007; Boyd and Banzhaf 2007). If ecosystem services are to provide an effective framework for natural resource decisions and policy making, they must be classified in a way that allows comparisons and analyses of trade-offs amongst the relevant sets of potential benefits. In the language of the Millennium Ecosystem Assessment (MEA) (2005), this means that the full range of benefits reflecting human well-being from ecosystems must be represented in any effective typology of ecosystem services (Wallace 2007; Boyd and Banzhaf 2007) and thus into effective policies for ecological restoration. Effective classification means understanding ecosystem sustainability in terms of economic benefits, human values, and decisions in natural resources management (Costanza et al. 1997; De

Groot et al. 2002; Kremen 2005; Millennium Ecosystem Assessment 2005; Farber et al. 2006).

Resource management initiatives worldwide have embraced ES concepts as a means to align ecological conservation with socio-economic decisions related to the environment (Daily et al. 2009). ES approaches are based on a recognition that conservation targets cannot be achieved in formal protected areas alone, and thus there is a need to integrate conservation into the routine activities taking place on public and private lands – that is, on lands designated for production (for example, agricultural) and for non-production (for example, residential).

In the policy and decision making process, it is important to think about the economic and social gains (benefits) which humans derive from a specific well-functioning ecosystem. The concept of ecosystem services has been developed to strengthen the link between human welfare and ecosystems (Fisher et al. 2008; Carpenter et al. 2009; Von Haaren and Albert 2011). Human behavior, activities, and perceptions in ecosystem analysis are central to understanding environmental problems and for framing the appropriate policies and management plans properly to sustain and maintain ecosystem health and human livelihood (Pace and Groffman 1998; Endter-Wada et al. 1998; Holling 1998; O'Neill 2001).

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For the sake of structuring an appropriate policy to maintain ecosystem health in an arid environment such as southern Jordan, there was a need to conduct a classification and evaluation for its ecosystem services situation. To the best of the researchers' knowledge, a few studies have been done in southern Jordan concerning potentials for generating solar energy. Such potentials can be understood based on what services the ecosystem could provide in such a harsh environment. The desert of Wadi Araba in south-west Jordan, for example, harbors many valuable genetic plant resources which can be used for many purposes, including food, feed, energy, aesthetic, fiber, and medical. Furthermore, climate change has imposed additional stress on ecosystem services in this arid environment, so there is an urgent need to construct a natural management plan for long-term sustainability. This study is based on the reality of differing perceptions, attitudes, and uses amongst communities living in the same environment. Such differences in perceptions are incorporated in the construction of policies for ecosystem sustainability.

Objectives

The main objectives of this research are:

1. To assess the perception of rural and urban residents in south-west Jordan with regard to services received from their surrounding ecosystem and their attitudes toward, and reactions to, specific ecological issues.
2. To determine the extent to which selected socioeconomic characteristics influence perception of ecosystem services and current conservation efforts

METHODOLOGY

Study Area and Sampling

Wadi Araba is a 6,900 km² desert environment that extends 170 km from the southern Dead Sea shore (elevation of 400 m below sea level) to the Gulf of Aqaba at the Red Sea (130 m above sea level), and constitutes 2.4% of the total area of Jordan (Nawash and Al-Horani 2011). The city of Aqaba is situated on the Gulf of Aqaba and is the only coastal city in Jordan; it is therefore an important seaport and regional transportation

center. The population of the entire region is 136,200, of which 6,800 live in the Wadi north of Aqaba – the rest are concentrated in Aqaba (Department of Statistics 2010). In this research these two population sectors are treated as “rural” and “urban”, respectively.

Aqaba is characterized as a quickly expanding tourist city, where the local population enjoys a relatively high income and more leisure time than elsewhere in Jordan overall. Aqaba also provides a recreational venue for citizens from other cities in Jordan (El-Naqa et al. 2009), forming an integral part of Jordan's Golden Tourism Triangle. Tourist highlights of the region include the natural and man-made wonders of Petra, the desert and cliffs of Wadi Rum, and the stunning coral reefs in Aqaba itself.

Through frequent field visits to the study areas, a high level of homogeneity in ecosystems had been noticed in both the urban and rural areas; a convenient random sample of 75 residents from each area (total of 150 respondents) was chosen for the study. While the random selections targeted respondents from different backgrounds and ages, there was no specific profile for selecting respondents beyond their willingness to participate in this study.

Instrumentation

A structured questionnaire was utilized in this study which aimed to capture the opinions of respondents using a total of 8 questions split into 8 sets. The question topics were selected following meetings with ten key persons in Wadi Araba and Aqaba; those key persons were selected according to their professions and relations to the community. Throughout these meetings, the residents were unfamiliar with the concept of “Ecosystem Services”, which influenced the questionnaire type and structure. The researchers had to provide a list of ecosystem services rather than leaving the residents to express types of services they perceived. The questionnaire was pre-tested by distributing it to 15 people and was slightly modified accordingly regarding specific topics.

The questionnaire was divided into two parts. Part one collected demographic and economic information including age, gender, educational level, income level, marital status, period of residency, and reasons for living in their area. Part two consisted of nested questions in

8 categories regarding the respondents' various interactions with their natural environment and their perceptions of the environment. The respondents were asked to rate their perceptions and their relation to the surrounding ecosystem; this was done by scaling their levels of interaction with the surrounding environment. The rating was conducted on a 5 point scale, with one being strongly negative, three being "neutral", and five being strongly positive. The 8 scales were:

1. Scale of satisfaction with various characteristics of the natural environment (scale of satisfaction): 15 statements exploring how much residents enjoyed/appreciated different environmental qualities in dry areas such as heat, aridity, openness, brightness, sand dunes, quiet, mountains, shrubs, and animals.
2. Scale of intensity of activity within the surrounding environment (scale of intensity): 10 statements exploring how frequently residents interact with the surrounding environment through engagement in activities such as walking outside, hiking, riding bicycles/riding and hunting of animals, swimming, and bird watching.
3. Scale of economic dependency on natural resources or environmental conditions (scale of economic dependency): 9 statements exploring the subject's financial reliance on local natural resources including water, soil, sun, insects, birds, animals, minerals, aridity, and open land.
4. Scale of perceptions regarding regional development (scale of perception): 17 statements exploring the residents' opinions about changes in population density, changes in tourists' numbers, economic benefits from different infrastructures (for

example airports, hotels), and the trade-offs between environmental protection and development.

5. Scale of concern about well-being: 10 statements exploring how much subjects cared or were concerned about people in their communities including people in the community, all humans on the planet, respondents' subsistence in the future, animals, plants, health, and future generations.
6. Scale of environmental concerns: 8 statements exploring respondents' level of concern about the following issues: climate change, water availability and quality, pollution, storage and disposability of toxic waste, protection of biodiversity, public access to beaches, and recreational activities.
7. Scale of environmental behavior: 9 statements used to explore residents' levels of "environmental" behavior, for example saving electricity and water, recycling, re-use of bags or use of cloth bags for shopping, and the use of bikes or walking instead of driving.
8. Scale of opinions about environmental changes in the last 10 years (scale of opinions): 9 statements exploring perceptions of environmental change for example has environmental quality improved, has quality of living improved, has there been a decrease in availability of water, and have there been developments in eco-tourism.

Statistical Analysis

There were eight scales within the survey instrument. For each scale the means were calculated and interpreted as seen in Table 1.

All statement items in all eight scales in the survey had factor loadings of .40 or above and

Table 1: Rank classes and scales for each question (scale) included in the survey

<i>Rank class</i>	<i>Scale of opinions (8), scale of concerns about wellbeing (5),scale of environmental concerns (6),scale of perceptions (4)</i>	<i>Scale of intensity (2), scale of economic dependency (3)</i>	<i>Scale of environmental behavior (7)</i>	<i>Scale of satisfaction(1)</i>
1.00 – 1.80	Strongly disagree	Never	Always	Hate it
1.81 – 2.60	Disagree	Once or twice a year	Sometimes	Dislike it
2.61 – 3.40	Neutral	Once or twice a month	Once in a while	Neutral
3.41 – 4.20	Agree	Once or twice a week	Never	Like it
4.21 – 5.00	Strongly agree	Almost every day	-	Love it

the reliability ranges from 0.61 to 0.87. Five out of eight scales were above the minimum criteria of 0.70 Cronbach's alpha.

Descriptive statistics (mean and the frequency for each scale included in the survey) were calculated for each set of questions. Next, a Mann Whitney test was utilized to identify significant mean differences between the two population sectors for each tested scale. When specifying socio-economic factors affecting resident's perceptions, the Kendall's tau_b correlation tool was utilized to determine the orientation of explanatory factors that demonstrate residents' behavior and their interaction with their surrounding ecosystem. The tested socio-economic variables were: gender, age, education and income.

RESULTS AND DISCUSSION

Sample Attributes

The sample was biased toward male respondents in the urban sector (62.67%), while there was relatively equal representation of genders in the rural sector. The respondents were young in both areas, as the mean age was found to be approximately 30 years. 58.67% of the surveyed rural sample had been living in the rural areas for all or most of their lives; only 36.0% of the respondents from the urban area had been in that area for all or most of their lives.

Thirty-three percent (33%) and forty-five (45%) of the respondents reported having 3-5 children in the rural and urban areas, respectively. Average household size was close to the national average (5.4 people) in both areas (Department of Statistics 2007). Even though the

respondents were relatively young, they were responsible for households of the average national size (5.4 people). Educational attainment follows the expected pattern, with higher levels of education in urban areas (68.00% hold university degrees) relative to rural areas (29.30% hold university degrees); an advanced education is generally a prerequisite condition for good jobs in urban areas. Also as expected, residents in urban areas had a higher average income than those in rural areas. 21.33% of residents from the urban area had a monthly income of 200-300 JD compared to 34.70% from rural areas in the same income class, where the income level is aligned with the national income rate per month.

This profile is representative of the demographic situation of Wadi Araba valley; limited economic activities exist in rural areas, compared to the rapid economic development seen in urban areas. This disparity has imposed wide differences in economic and living conditions for rural and urban communities residing in the same arid ecosystem.

Communities' Perception of, Attitudes Toward, and Uses of ES in Southern Jordan

This comparison is based on the level of interaction between residents and their surrounding environment. The surrounding environment is considered the area where residents interact and receive services from the ecosystem (Table 2). Compared to rural residents, residents in urban areas had a higher appreciation for their surrounding environment expressed by the scale of intensity (2.17, $p < 0.01$) and scale of environmental concerns (2.83, $p < 0.00$).

The natural characteristics of the Wadi Araba provide many activities practiced by the ma-

Table 2: Average interaction of urban and rural communities with the surrounding environment

<i>Scales</i>	<i>Rural community (Mean)</i>	<i>Urban community (Mean)</i>	<i>MW[#]Sig. level</i>	<i>Cronbach's alpha^{##}</i>
Scale of satisfaction	2.99 (0.43)	2.87 (0.41)	0.101	0.66
Scale of intensity	1.89 (0.51)	2.17 (0.60)	0.006**	0.73
Scale of economic dependency	1.36 (0.54)	1.15 (0.46)	0.001**	0.88
Scale of perception	2.54 (0.62)	2.59 (0.54)	0.661	0.78
Scale of concerns about (wellbeing)	1.59 (0.36)	1.78 (0.46)	0.022*	0.76
Scale of environmental concerns	2.83 (0.87)	2.18 (0.85)	0.000**	0.83
scale of environmental behavior	2.78 (0.56)	2.22 (0.61)	0.000**	0.66
Scale of opinions	2.39 (0.47)	2.59 (0.54)	0.010**	0.62

[#] MW test: Mann Whitney, ^{##} Cronbach's alpha (reliability measure) ranged from 0.62 to 0.88

* sig at 0.05, ** sig at 0.01

majority of the urban community in this arid ecosystem. These include such recreational activities as surfing, swimming, and hiking.

The rural residents reported a higher level of concern regarding different environmental issues and climate change; these concerns were expressed by high levels in the scale of environmental behavior (2.78, $p < 0.00$) and the scale of opinions (2.59, $p < 0.01$).

Despite living in the same arid ecosystem, both urban and rural residents expressed different concerns about the surrounding environment: urban residents' perceptions depended on how often they interact with the environment. They displayed limited interest in and concerns with environmental issues such as the climate change. On the contrary, with such an arid ecosystem and limited economic activities, rural residents expressed significant concerns about climate change and different environmental issues-water quality and availability, pollution, etc.- expressing strong concerns regarding human well-being and the well-being of future generations living in this environment.

Socio-economic Factors Affecting the Attitudes and Perception of Communities in Arid Regions

To explain comparison results in the previous section, the eight scaled observations have been linked to socio-economic characteristics (age, gender, education and income). Initial analysis affirmed robust and significant correlations between education and income (Table 3).

Education and income showed a significant relation between perception and attitude scales used in previous section. Referring to the index presented in Table 1, education level had an in-

verse relationship to the level of appreciation for and attitudes toward the surrounding environment. These results are consistent with the previous results, but simultaneously contradict common understanding: residents with higher education levels are thought to have more appreciation and concerns for the environment and its perceived services. The incomes of the residents affect the environmental behavior as the same as with the education level, a negative correlation was demonstrated between studied scales for community perception and attitudes.

Differentials in Communities' Perceptions of, Attitudes Toward, and Uses of ES in the Study Area

Comparisons between rural and urban communities revealed different scales of satisfaction (Table 4). Scales of satisfaction regarding environmental qualities were categorized in five groups: hate, dislike, neutral, like and love. The discussion in this section will mainly focus on differentials in communities for this level of satisfaction.

Of particular interest is the conclusion reached through this study regarding sand dunes and their ability to provide natural habitat for specific plants in Wadi Araba. This explains the importance of the sand dunes perceived by rural residents. Urban communities in southern Jordan viewed sand dunes with a more positive level of satisfaction (2.61-3.40). The urban community is not in close contact with sand dunes, in contrast to those in rural areas, where they might be seen as part of their dry environment. According to local knowledge, many herbal and medicinal plants are grown up near sand dunes – a natural habitat for such

Table 3: Summary of the correlation between level of perceptions and attitudes with resident socio-economic characteristics

Index	Socio- economic variables			
	Age	Gender	Education	Income
Scale of satisfaction	0.002	-0.267*	-0.221*	-0.128**
Scale of intensity	-0.062	-0.374*	-0.029	0.010
Scale of economic dependency	-0.003	0.002	-0.046	0.017
Scale of perception	0.003	0.021	-0.075	0.030
Scale of concerns about wellbeing	-0.014	-0.011	0.101	0.079
Scale of environmental concerns	-0.115	0.073	-0.213*	-0.144**
Scale of environmental behavior	-0.032**	-0.052	-0.269*	-0.138**
Scale of opinions	0.042	-0.095	-0.286*	-0.051

* Sig at 0.05, ** sig at 0.01

Table 4: Comparison of the levels of satisfaction between various characteristics of the natural environment amongst the urban and rural communities in southern Jordan

<i>Scale of satisfaction statements</i>	<i>MW*</i>	<i>Rural community</i>		<i>Urban community</i>	
	<i>Sig. level</i>	<i>Mean</i>	<i>Percentage of statement out of the total</i>	<i>Mean</i>	<i>Percentage of Statement out of the total</i>
Heat	0.01	1.80	38.00	2.20	28.28
Aridity	0.00	1.23	73.83	1.55	45.42
Openness	0.02	3.25	21.46	2.75	26.22
Brightness/glare	0.79	3.25	21.46	2.75	26.22
Sand dunes	0.00	3.31	23.24	2.07	30.38
Quiet	0.00	4.67	65.94	3.85	29.60
Dust/sand storms	0.00	1.35	75.75	1.68	42.79
Mountains	0.01	4.36	41.05	3.87	88.35
Landscape	0.00	4.67	61.00	4.24	39.16
Animals and birds	0.13	2.83	21.35	3.13	22.74
Insects	0.05	1.57	47.98	1.81	36.68
Shrubs	0.77	3.95	25.00	3.92	22.81
Acacia trees	0.01	3.76	32.27	3.31	26.01
Corals	0.00	3.73	26.86	4.16	38.03
Distance	0.01	2.24	27.54	2.40	24.87

* MW test: Mann Whitney

plants. Development in the city of Aqaba affected residents' negative perception of insects and sand dunes.

A range from neutral to high preference levels of appreciation was expressed by both communities for: openness, quiet, mountains, Acacia trees, and corals. These environmental qualities were seen as indisputably positive attributes for a dry environment.

According to Table 4, urban and rural communities differed in value-ranking statements such as "openness" and "acacia trees"; these services are attributes of the residents' location and are highly appreciated for their importance in rural communities' daily activities (for example, collecting fire wood and grazing).

Both communities had expressed their positive appreciation for quiet, mountains, and corals. These environmental qualities were recognized as having significant impact on the tourism industry in such an arid ecosystem. Both urban and rural residents in Wadi Araba noted the apparent change in their economic situation.

This change is a consequence of the recent economic reforms in this region. These reforms were structured and applied after investigating all relative economic advantages. Environmental attributes were utilized by developing this area with: ecological hostels and camps, diving clubs, stations for motor racing and horse riding. It's clear that, even though residents were not familiar with the concept of ecosystem services,

they were able to recognize positive environmental attributes through current developmental policies.

Scale of intensity with the surrounding environment (scale of intensity) was standardized into five groups: never interacted, interacted once or twice a year, interacted once or twice a month, interacted once or twice a week, and interacted every day (Table 5). Out of all question indicators regarding level of intensity of interaction with the surrounding environment, only 3 different indicators were found with a significant differential among the studied communities.

It is most likely that walking for recreational purposes is a regular activity in this area. At least 20.01% and 25.94% of respondents expressed their participation in this activity by the rural and urban residents, respectively. 45.78% of the urban residents engaged in bird watching and hunting at least once or twice a year, which is significantly different ($p < 0.00$) from the habits of the rural community; respondents reported less frequent participation in rural areas.

A small number of activities executed as a part of resident's intensity of interaction with the surrounding environment. These activities are related to the recreational services provided by this arid ecosystem. Recreational interaction with the environment had been fortified by tourism, which is a critical sector in southern Jor-

Table 5: Comparison of the levels of intensity with the environment amongst the urban and rural communities in southern Jordan

<i>Scale of satisfaction statements</i>	<i>MW*</i>	<i>Rural community</i>		<i>Urban community</i>	
	<i>Sig. level</i>	<i>Mean</i>	<i>Percentage of statement out of the total</i>	<i>Mean</i>	<i>Percentage of Statement out of the total</i>
Walking outside (for recreation)	0.00	3.21	20.01	3.73	25.94
Hiking outside of the community	0.01	2.37	24.66	1.88	33.97
Bicycle riding outside the community	0.00	1.05	97.37	1.36	59.86
Riding on animals	0.34	1.75	41.48	1.60	48.37
Motorcycle riding (or other off-road vehicle) outside the community	0.00	1.81	36.32	2.77	22.10
Swimming in the Gulf of Aqaba	0.10	1.47	56.44	2.68	42.15
Bird watching	0.00	1.08	89.76	1.81	45.78
Outdoor camping	0.76	2.07	31.80	2.01	31.66
Relaxing/building fires	0.00	2.63	28.07	3.21	22.38
Collecting animals / plants / minerals	0.60	1.49	48.09	1.59	44.36

* MW test: Mann Whitney

dan; relaxation and spa-going are significant activities related to such a unique dry environment.

Scale of environmental behavior is a reflection of human concerns about the environment and surrounding natural resources. To understand residents' behavior in this area of Jordan, a list of actions was assembled. Importance of frequent actions was ranked on a scale of [1.00-1.80]. Less frequent actions were scaled from [1.81-2.60].

Actions which are executed only once in a while or never were ranked from [2.61-3.40] and [3.41-4.20], respectively.

As might be expected, electricity saving is a significant behavior in which most residents in both communities participate (Table 6).

Turning off appliances and lights when not in use is recognized as an environmental action in this area as well as in Jordan as a whole. This behavior is also followed by using energy efficient light bulbs – followed by 42.79% of residents in urban areas compared to 28.75% of residents from rural communities. Not all energy-efficient bulbs are available at affordable prices and thus accessible by poorer people in the area, which explains the differences in significance ($p < 0.00$) for average behavior levels between residents from these communities.

This behavior could be attributed to awareness campaigns by the authorities to save energy. Jordan is importing 98% of its energy requirements.

Recycling paper/cans/bottles and walking instead of driving (for environmental purposes)

Table 6: Comparison on the scale of environmental behavior amongst the urban and rural communities in southern Jordan

<i>Scale of satisfaction statements</i>	<i>MW*</i>	<i>Rural community</i>		<i>Urban community</i>	
	<i>Sig. level</i>	<i>Mean</i>	<i>Percentage of statement out of the total</i>	<i>Mean</i>	<i>Percentage of Statement out of the total</i>
Turning off appliances and lights when not in use	0.76	1.56	48.44	1.49	51.18
Recycling: paper/cans etc.	0.00	3.72	38.24	2.95	23.80
Walking/riding bicycles instead of driving (for environmental reasons)	0.00	3.95	89.76	3.19	28.14
Saving water (short showers, turning off water when washing dishes, etc.)	0.70	1.69	42.61	1.76	37.88
Using energy efficient light bulbs	0.00	2.31	28.75	1.57	42.79
Re-using bags or using cloth bags when shopping	0.00	3.47	53.24	2.39	25.58

* MW test: Mann Whitney

were rarely-followed behaviors by residents in urban areas and were not practiced at all in rural areas. Differences in significance ($p < 0.00$) for such behaviors was observed among these communities.

CONCLUSION

The perception toward ecosystem services in dry environments varied according to type of residents' subsistence type in both rural and urban communities. Studies related to ecosystem services tend to focus on the economic dimension of these services for the end users. The relationship between humans and nature has received less attention in exploring ecosystem services. The need to include the social background in such interaction is recommended for designing and constructing policies in dry environments. These policies should consider the differentials in perceptions, attitudes, and uses of ecosystem services according to the locations of the residents.

This study encompassed key demographic factors: age, gender, education and income. The eight scaled observations (mentioned in Table 2) displayed statistically significant relationships with these demographics. A robust relationship was exhibited between respondents of differing education and income demographics with regard to perceptions and attitudes of resources in southern Jordan.

Residents' perception of the surrounding environment and its services often extends through the lens of personal circumstance and cognitive understanding of ES. In this research, there was an attempt to express interaction with a dry environment through eight scaled observations by urban and rural residents. Six out of these eight indicated significant differences between rural and urban communities. Rural residents expressed an outstanding level of concern about the environment and development in this area.

Daily life of the rural residents and direct contact with the environment shows a highly devoted behavior and perception toward the Wadi Araba. The notion that community features may shape residents' behavior and attitude toward the surrounding environment.

A deeper understanding of community perceptions, attitudes, and uses of ecosystem services perceived from the surrounding environ-

ment is conducive to understanding, designing and implementing developmental policies – policies recognized as environmentally oriented for sustainable development. This research helps to refine and enrich the knowledge-base for managerial decision-making. The gap between rural and urban livelihoods, and the inequality of resources and available ecosystem services, should be rectified with the help of research findings and efforts to enrich environmental investment. This study has successfully carried out a method of acquiring the necessary data to inform the community-based policy makers. This kind of social approach, developed for and applied to a rural, arid environment, can influence positive social change and can be modified for usage in other environments. There is a need to construct policies based on differences in residents' perceptions rather than on the environmental understanding alone. It has been suggested that "Good ecological restoration entails negotiating the best possible outcome for a specific site based on ecological knowledge and the diverse perspectives of interested stakeholders; to this end it is as much process as product oriented."

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