Vulnerability Assessment of Water Resources to Environmental and Climate Changes in the Mountains of Oman

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Overview

- The Study Area
- What is the Problem?/ Research Objective
- Methodology
- Results of the Assessment
  - Environmental Changes
  - Climate change Impacts
- Conclusions & Recommendations
Al Jabal Al Akhdar (Green Mountain)

- Temperatures: 12°C lower than lands
- Annual mean Rainfall: 250-400 mm

15-20%
3000 m
Main Activities: Agriculture/Animal Husbandry

- **Agriculture** is the fundamental ecosystem for people’s livelihood (70% inhabitants).
- Pomegranates & rose extraction are main contributors to farmer income and agricultural revenue
- Traditional irrigation by flooding
What is the Problem?
Water Shortage

- **Water** is critical to the survival of the mountain agro-ecosystems and communities.
- Rainfall amount and availability, the dominant factors in supply of water resources:
  - Groundwater (wells): drinking resources
  - *Aflaj* (irrigation channels): fed by groundwater, springs or *wadis*.
  - Artificial dams
- **Objective**: Assess the vulnerability of water resources to environmental and climate changes in Al Jabal Al Akhdar
Vulnerability Index (VI) = f (RS, DP, EH, MC)
(least vulnerable) 0 < VI < 1 (most vulnerable)
The vulnerability assessment indicated VI (0.436): High (0.4-0.7); highly vulnerable and experiencing high stresses.

- **Ecosystem deterioration**: 27%
- **Water pollution**: 4%
- **Water exploitation**: 6%
- **Water variation**: 9%
- **Conflict management capacity**: 18%
- **Water use inefficiency**: 19%
- **Water stress**: 17%
Results: VI Contribution by Category

- **Management Capacity**
  - Competition between sectors; agriculture is the main water consumer
  - No application of modern irrigation system
  - Imbalance between water supply and demand
  - No implementation of conservation practices
  - No communication and implementation capacity
  - Absence of adequate vegetation cover
  - Land degradation/use changes & sustained urbanization
  - Overwater consumption, decreased rainfall

- **Ecological Health**
  
- **Water Resources Stress**
  - 26%

- **Development Pressure**
  - 6%

37%
Environmental Changes: Population

- **1970-2010:**
  - Population increased by 276%

- **1993-2010**
  - Households increased by 30%
  - Housing units: 108%
Environmental Changes: Tourism

- Increase of tourists from 85,000 to 135,000 (by 58%)
- Summer (May-October): 67%
- Winter (November-April): 33%
- July-August: 266,000 (32%)
- Number of hotels increased from one in 2006 to 5 in 2017
Climate Change Impacts

- **Tmin Increase**: 0.8°C/decade
- **Tmean Increase**: 0.3°C/decade
- **Tmax Increase**: 0.2°C/decade
- **Rainfall**: -9.42 mm/decade

Highly significant correlation: \( r = -0.60, p < 0.01 \)
Climate Change Impacts

Highly significant correlation: ($r = 0.70, p < 0.01$)
Groundwater levels declined by 44%
Highly significant correlation: \((r = 0.6 \ p < 0.01)\)
Aflaj flow rates decreased by 85%
Conclusions & Recommendations

The comprehensive vulnerability assessment indicated high VI (0.436). System deterioration is the dominant parameter (27%).

Other parameters include degree of water use inefficiency (19%), conflict management capacity (18%), water stress (17%).

Management capacity is the dominant category (37%) highly influenced by ecological health (31%), water stress (26%).

Indicators for vulnerability of water resources to environmental and climate changes in the area.

Prove irrigation water use efficiency, conservation technologies, water harvesting, reuse of treated wastewater/grey water to reduce some of the agricultural pressures.

Mitigation and adaptation to climate change impacts require coordination, integration and awareness programs should be closely connected to development plan, policies and integrated water resources management across all sectors.
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Thank You