

Theme 1 - Drought Management Strategies in Water Stressed/Scarce Regions

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Theme members

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WORKING GROUP ON WATER MANAGEMENT IN WATER STRESSED REGIONS (WG-DROUGHT)

Theme 1 – Drought Management in Water
Stressed/Scarce Regions

Theme 2 – Coping with Water Scarcity in Water Stressed
Regions

Theme 3 – Rainfall harvesting and management for
sustainable agriculture in water stressed /
scarce regions

Mandate

- Theme 1
Drought Management in Water Stressed/Scarce Regions
 - To capture field experiences of the implementation of drought risk management strategies.

Outline

1. Foreword
2. Definitions
3. Levels of Strategies
4. Actions taken at each level of strategies
5. Cases of various countries

Outline

1. Foreword
2. Definitions
3. Levels of Strategies
4. Actions taken at each level of strategies
5. Cases of various countries

Former studies

- Dr. Vijay K. Labhsetwar, “Irrigation Strategies for Crop Production under Water Scarcity”
- Dr. Saeed Nairizi, “Working Group on Irrigated Agriculture under Drought and Water Scarcity (IADWS-WG)”
- Dr. Saeed Nairizi, “Irrigation under Drought and Water Scarcity”
- Dr. Saeed Nairizi, “Drought Management Strategies”
- Graziano Ghinassi (2006), “Guidelines for Crop Production under Water Limiting Conditions”
-

IRRIGATION STRATEGIES FOR CROP PRODUCTION UNDER WATER SCARCITY

- Dr. Vijay K. Labhsetwar

- **Strategies for Crop Production under Water Scarcity**
 - Use of modern irrigation technology – drip and sprinkler irrigation.
 - Application of agricultural bio-technology for crop improvement
 - Developing new cropping patterns based on water availability (water efficient crops)
 - Use of poor quality water - drainage/brackish water.
 - Water harvesting
 - Use of waste water in agriculture
 - Transfer of surface water from surplus areas.
 - Practicing deficit irrigation.

Working Group on Irrigated Agriculture under Drought and Water Scarcity (IADWS-WG)

- Dr. Saeed Nairizi

- *Risk = Hazard*Vulnerability/capability*
- *Reducing Vulnerability*
 - *Supply oriented*
 - *Demand oriented*
- *Increasing Capability*
 - *Damage reduction in agriculture, environment and economy Toleration*
 - *Organization and co-operation*
 - *International co-operation*

IRRIGATION UNDER DROUGHT AND WATER SCARCITY

- Dr. Saeed Nairizi

Chapter 1: Background and Introduction

Chapter 2: Literature overview/synthesis

Chapter 3: Indices to describe and quantify the implications of drought and aridity

Chapter 4: Suitable technologies and irrigation practices for utilization of water under conditions of drought and water scarcity

Chapter 5: Application of long-term weather forecasting for drought prediction

Chapter 6: Policy guidelines for the evaluation of social, economic and political impacts of drought and aridity

Chapter 7: Conclusion and Recommendations

Drought Management Strategies

- Dr. Saeed Nairizi

- *Drought management process*
 1. *Assessment and forecast of drought events*
 2. *Prevention methods*
 - *Supply-oriented methods*
 - *Development of new supplies.*
 - *More efficient use of existing water recourses.*
 - *Use of non-conventional water resources.*
 - *Demand-oriented methods*
 - *Reducing water losses.*
 - *Modification of water demand at farm level .*
 - *Using low water consumption systems in industry and urban development .*
 - *Development of cropping pattern for less water consumption*
 - *Development of non-structural approaches for reduction of water demand .*
 - *Developing appropriate regulations and guidelines*
 3. *Instruments of damage reduction*
 4. *Toleration and risk assessment*
 5. *Organization and coordination*
 6. *International cooperation*
 7. *Research , development and education*

GUIDELINES FOR CROP PRODUCTION UNDER WATER LIMITING CONDITIONS

- Graziano Ghinassi (2006)

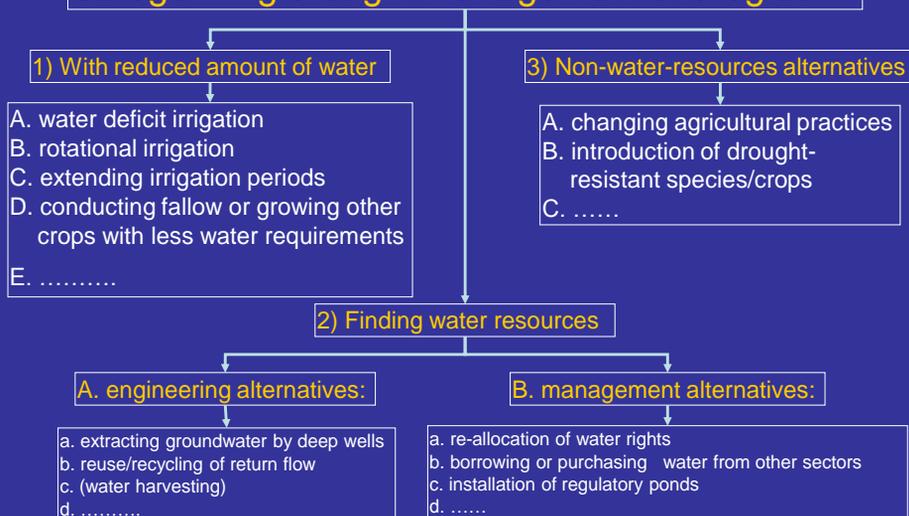
- *reduction of the irrigated area;*
- *improvement of crop drought resistance;*
- *increase of irrigation efficiency;*
- *planning of suitable cropping systems;*
- *deficit irrigation strategies.*

Classification of irrigation techniques

- Irrigation techniques could further be classified based on certain rules or principles.

Strategies based on water-availability

Categorizing drought management strategies



Or

Categorizing drought management strategies

1) Supply-oriented strategies

- A. Development of new supplies.
- B. More efficient use of existing water resources.
- C. Use of non-conventional water resources.
- D. others.

2) Demand-oriented strategies

- A. Reducing water losses.
- B. Modification of water demand at farm level .
- C. Using low water consumption systems in industry and urban development .
- D. Development of cropping pattern for less water consumption
- E. Development of non-structural approaches for reduction of water demand .
- F. Developing appropriate regulations and guidelines

3) Use of modern irrigation technology

- Long term strategies.
- others.

a re-allocation of water rights

And

Measures under strategies

- deficit irrigation
- rotational irrigation
- extending irrigation periods
- reuse/recycling of return flow
- water harvesting
- conducting fallow or growing other
- crops with less water requirements
- introduction of drought-resistant species/crops
- changing agricultural practices
-

However

- These categories are basically still the various forms of classifying irrigation methods.

Minutes of the Fourth Meeting in Tehran, Iran

• **Item 4 : Drought management strategies in water stressed / scarce regions - Theme 1**

- It was clear that more country experiences were required, and that these need to be documented in a consistent way.
- Discussions followed on drought response strategies in member countries. It was recommended by the vice-chairman that members of this theme focus on **policies, plans and strategies** rather than ways and methods of coping with water scarcity.

1. Past studies
2. Definitions
3. Levels of Strategies
4. Actions taken at each level of strategies
5. Cases of various countries

Definition of “Drought”

- Drought
 - Is a normal , recurring feature of climate; it occurs in virtually all climatic regions, It is the consequence of a natural reduction in the amount of precipitation received over an extended period of time, relative to the normal status of water demand, originated by living macro and micro organism.
 - Source: S. Nairizi, “Drought Management Strategies”

Drought (cont'd)

- The continuous abnormal dry weather in an area has resulted in the insufficiency of water supply, and has caused loss in domestic, agriculture and industries.
 - *Source: Taiwan Encyclopedia*
- When the daily precipitation has not reach 0.5 mm in over 20 consecutive days.
 - *Central Weather Bureau, Taiwan*

Defining “strategies”

1. Longman: <http://www.ldoceonline.com/dictionary/strategy>
a planned series of actions for achieving a combination of the ends (**goals**) for which the firm is striving and the means (policies) by which it is seeking to get there.
2. <http://www.managementstudyguide.com/strategy-definition.htm>
an action that managers take to attain one or more of the organization's **goals**.
2. a strategy is all about integrating organizational activities and utilizing and allocating the scarce resources within the organizational environment so as to meet the present **objectives**.

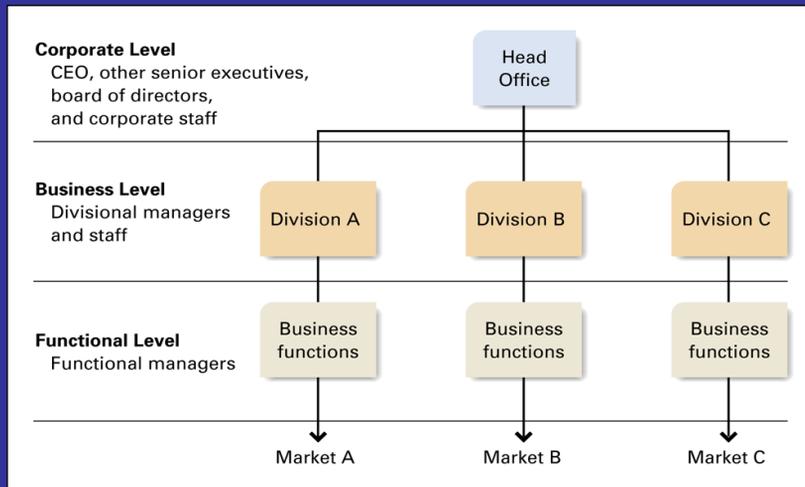
Various forms of objectives

- **Mission**
 - The reason for existence – what an organization does
- **Vision**
 - A statement of some desired future state
- **Values**
 - A statement of key values that an organization is committed to
- **Major Goals**
 - The measurable desired future state that an organization attempts to realize

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Levels of Strategic Management

- Hill & Jones, “Strategic Management Theory – An Integrated Approach”, 6th ed., Houghton Mifflin Company, 2004



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Strategic Managers

- **Corporate Level Managers**
 - Oversee the development of strategies for the whole organization
 - The CEO is the principle general manager who consults with other senior executives
- **General Managers**
 - Responsible for overall company, business unit, or divisional performance
- **Functional Managers**
 - Responsible for supervising a particular task or operation e.g. marketing, operations, accounting, human resources

Levels of strategies for drought management

- National level strategy
- Water Management level strategy
- End-users' level strategy

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A Typology of Farmers' Drought Management

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Abstract: Drought is a slow-onset natural disaster that has widespread consequences. Planning at macro and meso levels often assumes that farmers react to and manage drought in similar ways. If this assumption of homogeneity is incorrect, the potential effectiveness of drought mitigation efforts is likely to be dangerously inhibited. This research investigated the validity of the homogeneity assumption among Iranian farmers. More specifically, it examined whether farmers use different strategies to mitigate drought and, if so, whether a typology to classify their management approaches can be developed. A multistage, stratified random sample (n=258) of farmers in Fars province who suffered drought was surveyed. The research identified that different strategies were used and that a drought management typology comprising three types of drought management could be constructed: (i) technical (TDM) (ii) psycho-economic (PDM) and (iii) integrated (IDM). These three drought management approaches were discussed and recommendations made to improving drought mitigation and preparedness.

Key words: Drought management · Typology · Impact · Farmers · Iran

“A Typology of Farmers' Drought Management”

- American-Eurasian J. Agric. & Environ. Sci., 7 (4): 415-426, 2010
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Drought Management

- Drought management is carried out at the macro, meso and micro levels.
- At the macro level,
 - national governments plan and execute programs, laws and regulations to mitigate drought, often seeking international support
- At the meso level,
 - local governments try to mitigate drought with regard to national opportunities and local challenges.
- At the micro level
 - what farmers do with regard to drought.

Levels of strategies for drought management

- ***National*** level strategy
 - Government
 - Macro
- ***Water Management*** level strategy
 - Regional
 - Meso
- ***End-users'*** level strategy
 - Farmers'
 - Local
 - Micro

1. Past studies
2. Definitions
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4. Actions taken at each level of strategies
5. Cases of various countries

- National level strategy
- Water Management level strategy
- End-users' level strategy

Objectives for the National strategy

- To ensure food security
- To reach the sustainable use of farm land
- To minimize the impacts to the environment
-

Government strategies to manage drought

- Drought relief (exceptional circumstances) payments
- Rights to water expressed as a water share
- Development of water trading
- Desalination
- Recycled water

Measures / Actions at National level strategies to manage drought

- Drought relief payments (compensation)
- Rights to water expressed as a water share
- Development of water trading
- Policies on “Virtual Water”
- Desalination
- Recycled water
-

- National level strategy
- Water Management level strategy
- End-users' level strategy

Objectives for the Water Manager's Strategies

- Effective Use of Soil and Water
- Optimal distribution of regional water resources
-

Measures/Actions under Water management strategies to manage drought

- Seasonal allocations
- Urban restrictions
- More use of re-cycled water
- More water-efficient operation
- More use of groundwater

- National level strategy
- Water Management level strategy
- End-users' level strategy

Objectives for the End-users' strategies

- To minimize loss
-

The strategic objectives of the end-users

- Objectives of the end users :
 - To ensure the income from fields

Measures/Actions under the objectives of End-user's strategies to manage drought

- More efficient watering systems
- Financial planning
- Water trade
- Substitution
- Deficit irrigation
- Abandoning part of enterprise
- Off-farm work

Measures/actions at the end-users level

- Decrease of the irrigation depth
- Extension of the irrigations periods
- Fallow / crop change
- Installation of pipe system
- Digging of regulatory ponds
- Drilling shallow wells

1. Past studies
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Case of Taiwan

Corresponding organizations for various levels of strategies in Taiwan

- **National level strategy**
 - Council of Agriculture (COA)
 - Water Resources Agency (WRA)
- **Water Management level strategy**
 - Irrigation Associations
 - Regional Water Resources Bureaus
- **End-users' level strategy**
 - Work Stations / Irrigation Teams
 - Farmers

The Case in Taiwan for the objectives of National level strategies

- **Water Resources Agency :**
 - To reduce the loss due to water hazards from Safety perspective, and the slogan was “zero deaths, less damages, and low loss.”
- **Council of Agriculture :**
 - Provide guidance as well as assistance to Irrigation Associations on the preparing of measures under various degree of water shortages

The case on the objectives of water management level strategies in Taiwan

- Taoyuan Irrigation Association :
 - Try every effort to extend the water-supply from reservoir in order to lower the risk of water shortage

The case of Measures/actions at Water Manager's level in Taiwan

- Taoyuan Irrigation Association
 - Increase of the gate operation frequencies as well as precision alternatives
 - Conjunctive use with ponds to extend irrigation periods and
 - Decrease of irrigation depth
 - Fallow
 - Partial / overall cease of irrigation

Case of Australia

- **National**
 - the National Government saw a need for a greater say in water resource management, constitutionally a State responsibility. Environmental versus irrigation demands became a hot topic.
- **Regional**
 - water sharing rules between States and water entitlement holders within States came under scrutiny.
- **Local**
 - irrigation practices, both delivering water to farms and efficiency on-farm can be improved, at a cost.

Case of USA

Case of Italy

Case of Iran

Case of Japan

Case of

Categorizing strategies for drought management

1. General strategies
2. Strategies among management levels
 - 1) government
 - 2) local water managers
 - 3) farmers
3. Strategies based on time-span
 - 1) long-term
 - 2) short-term

Objectives and actions to be taken for each strategy

- National strategy:
 - To ensure food security
 - To reach the sustainable use of farm land
 - To minimize the impacts to the environment
 -
- Water Manager's strategies:
 - Effective Use of Soil and Water
 -
- Farmers' strategies
 - To minimize loss
 -

Proposed Chapters

1. Foreword ("Drought" as a phenomenon in the world)
 2. Levels of drought management strategies
 3. Case studies (experiences in various areas/countries of the world)
 4. Measures (or actions or irrigation methods) taken at each level of drought management strategies
 5. Issues concerned
 6. Conclusions
- References
- Appendix

Thank you for your attention.

SOME EXPERIENCE FROM TUSCANY, ITALY

- Local Administrations, called Regions, have the possibility to promote and manage specific policies aiming to develop initiatives to improve the use of water in all production sectors.
- Some local Institutions(i.e., Region) embarked on strategy programs aiming to develop different approaches to improve the water use in agriculture.
- In Italy, most of the irrigated area is under the control of WUA's called Consorzi di Bonifica. Until few years ago, users paid water according to the irrigated area. In such a way, water was used without any limiting threshold. Some WUA's introduced something like "water credit cards" to access water, the contribution (water price) increasing when the given amount of due water was used.
-

Drought strategies (the National Drought Mitigation Center, USA)

1. Modification of agricultural practices such as herd reduction for cattle and dairy farmers, reduction of acreage in production, planting of crops needing less water for maturity, etc.
2. Allocation of available water to crops based on their value.
3. Allocation of available water using a priority system which gives priority to perennial crops, trees and bushes. This allows a farmer to save his crops that take a long time to grow and produce but destroys any annual crops that have been planted.
4. Land fallowing.
5. Increasing irrigation efficiency.
6. Using groundwater in lieu of surface water.
7. Groundwater recharge programs that add water to the underground storage basins during times of excess water and remove it during times of water scarcity.
8. Using water of lesser quality such as agriculture drainage water or brackish groundwater.
9. Using enough water to keep crop alive but not enough to gain a harvest from the crop.
10. Removing lawn areas in communities and replacing with drought tolerant plants. For example, in Las Vegas, Nevada the water district has a "cash for grass" program where they will pay you cash for each square foot of grass that you remove from your yard.
11. Importing water from other water basins that are not as severely affected by the drought. This can only be done where the infrastructure exists to move the water from one basin to another.

OPTIMIZATION OF VIRTUAL WATER USAGE TOWARDS FOOD SECURITY USING CLASSIC AND MODERN OPTIMIZATION METHODS

Mohammad Hossein Karimi Pashaki, Ali Saremi and Hosein Sedghi

- The water that would be needed if a certain commodity were to be produced is called the "virtual water". If one country exports a water-intensive product to another country, it exports water in virtual form. For water-scarce countries it could therefore be attractive to achieve water security by importing water-intensive products instead of producing them domestically.
- In IRAN with low average annual precipitation and lack of other sources of water, the concept of virtual water and its trade is used as a strategy for optimal operation of water resources in many fields. Recently, in IRAN, net virtual water import reached to (15-20)*10⁹ m³ per year and is one of the top ten virtual water importing countries.