

Inovagri: International Workshop on Technology Innovations in Irrigation

Theme 2, Round Table 4: Engineering of Land Drainage

Some developments in land drainage

Julián Martínez Beltrán

**Ex Drainage and Salinity Management Officer, FAO Land and Water Division,
Rome**

**Head of the Sustainable Land and Water Management Unit, Centre for Water
Studies, CEDEX, Madrid**

Fortaleza, Ceará, Brazil, 28-31 May 2012

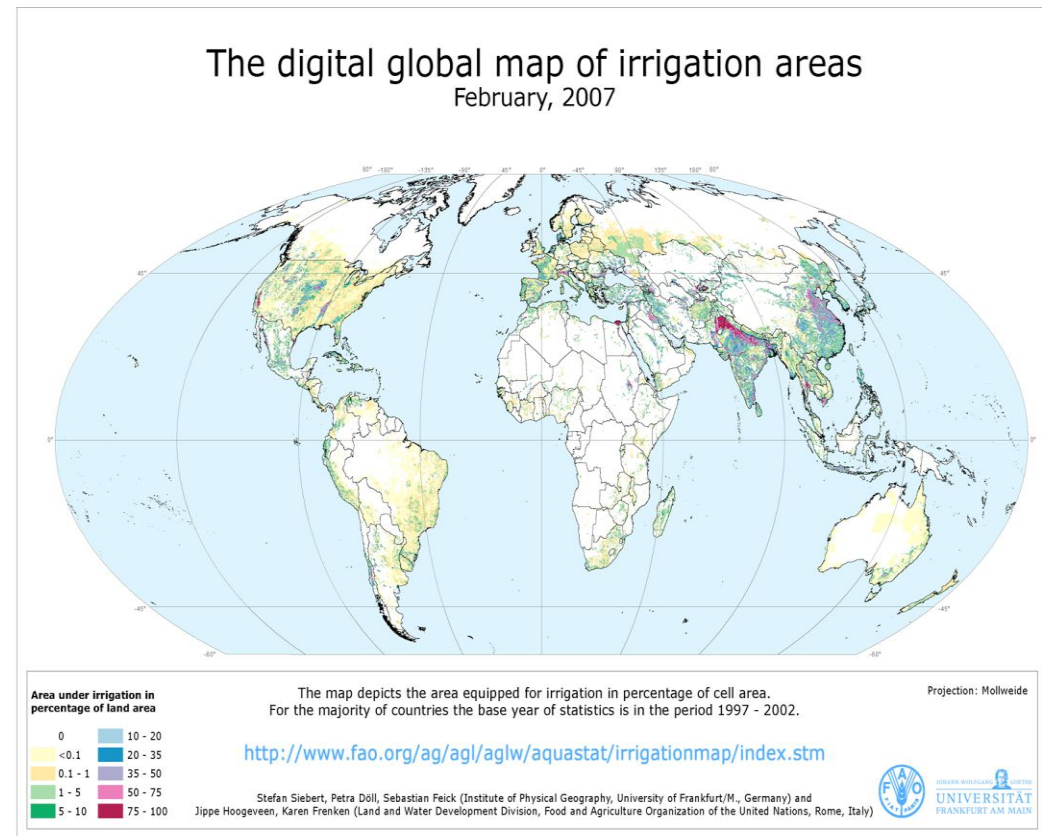
Contents

- Irrigated agriculture: benefits and problems.
- Land drainage to control waterlogging and soil salinity.
- Some technology developments.
- Conclusions.
- References.



Irrigated agriculture and agricultural production; a global view

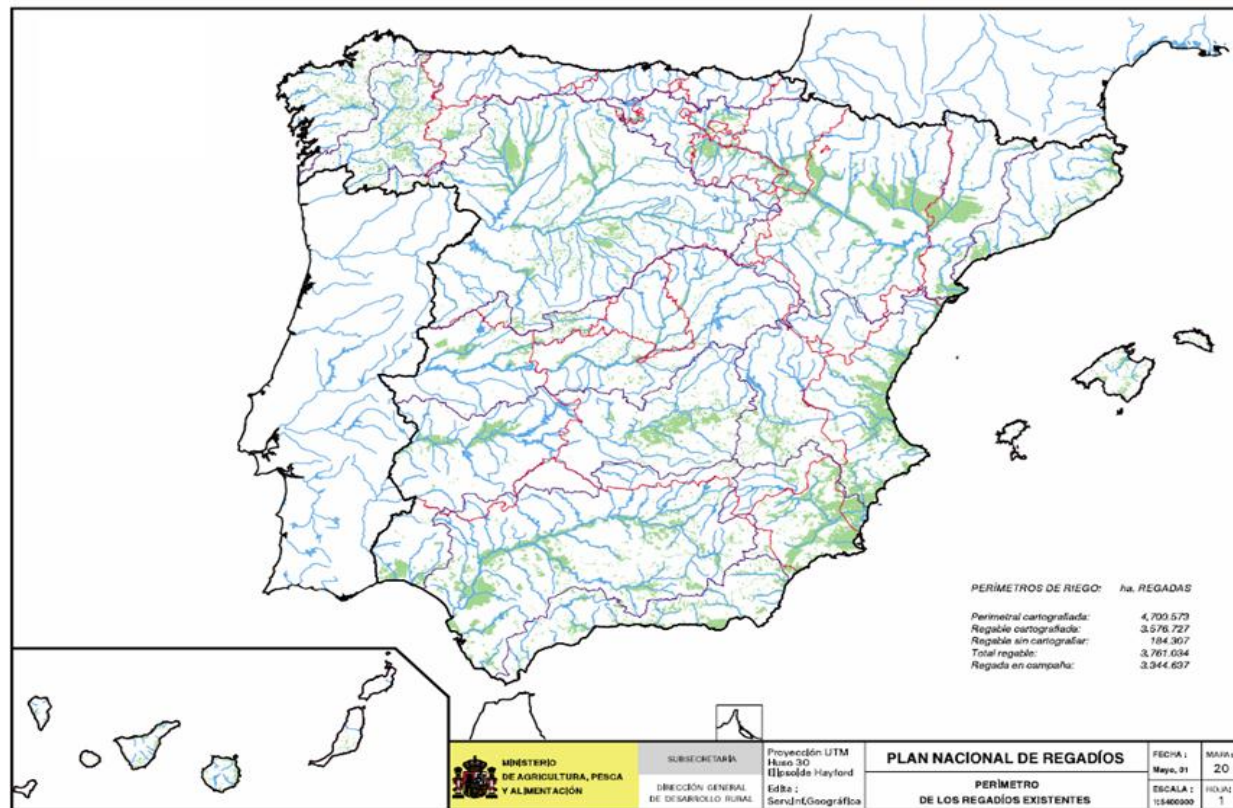
- Irrigated agriculture contributes to 40% of food production in 20% of the cultivated area (about 300 million hectares).
- Increase of about 6% of the irrigated area (mostly in developing countries) by 2050.
- Priority of improvement of land and water productivity in existing irrigated lands.



Irrigated agriculture in Spain

Approximately:

- 3.4 million hectares irrigated.
- In 13% of the cultivated area.
- 55% of agricultural production comes from irrigated lands.



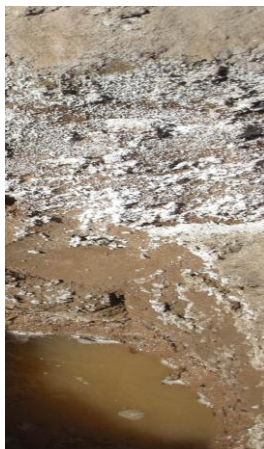
Some problems of irrigated agriculture

- Consumptive use of 70% of water resources.
- Water productivity is generally low.
- Waterlogging and salinity.
- Deterioration of the quality of the irrigation return flows (salts, micro-elements, fertilizers, pesticides).



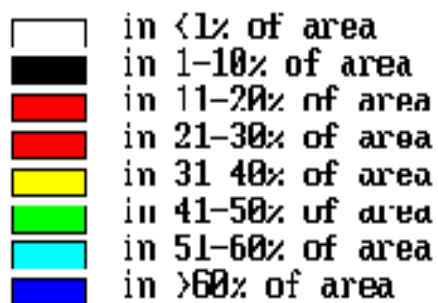
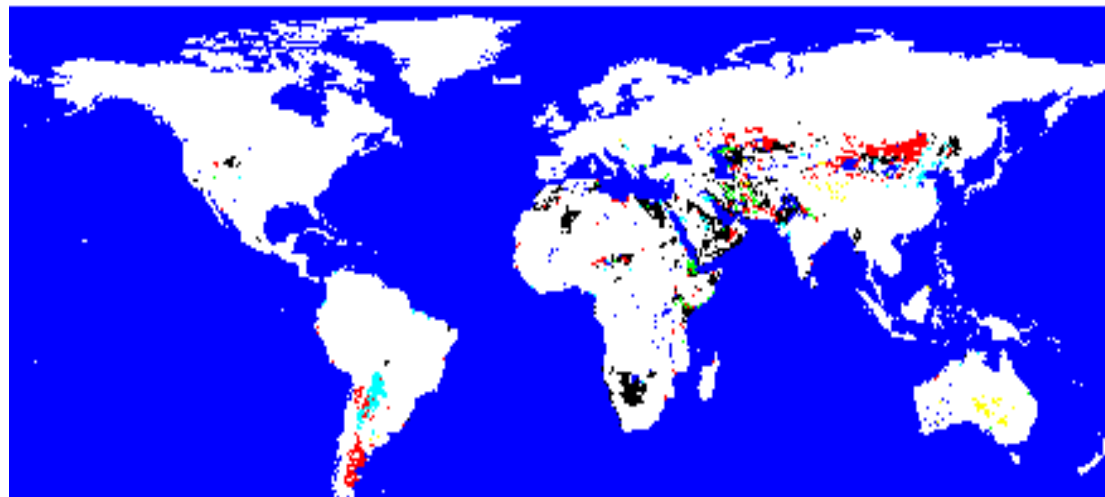
Land degradation by salinity of groundwater

About 11 percent of the global irrigated lands are affected by salinity



Irrigated lands affected by soil salinity,
Mendoza, Argentina

Global map of salt-affected soils



Source: Global Network on Integrated Soil Management for Sustainable Use of Salt-affected Soils, FAO

Integrated management of salt-affected soils

Hydraulic aspects:

Irrigation
Drainage
Leaching

Chemical aspects :

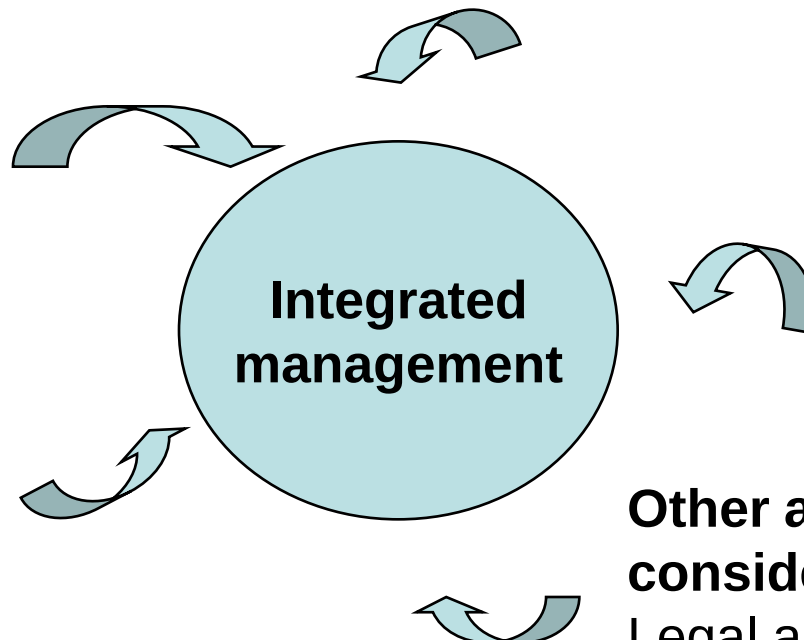
Amendments
Mineral fertilization

Agronomic aspects:

Organic matter
Mulching
Green manure
Cropping techniques
Saline agriculture

Physical/mechanical aspects:

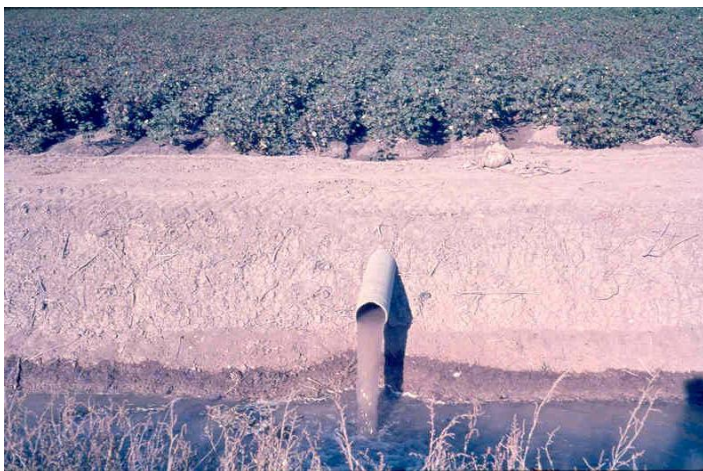
Land smoothing
Land levelling
Deep ploughing
Subsoiling
Sanding



Other aspects to consider:

Legal and environmental
Socio-economic aspects

Land drainage to control waterlogging and soil salinity



Drainage systems,
Lower Guadalquivir,
Spain



Subsurface drainage to control saline groundwater tables



Heavy clay soils with primary salinity,
Lower Guadalquivir, Spain



Benefits of land drainage and environmental impacts



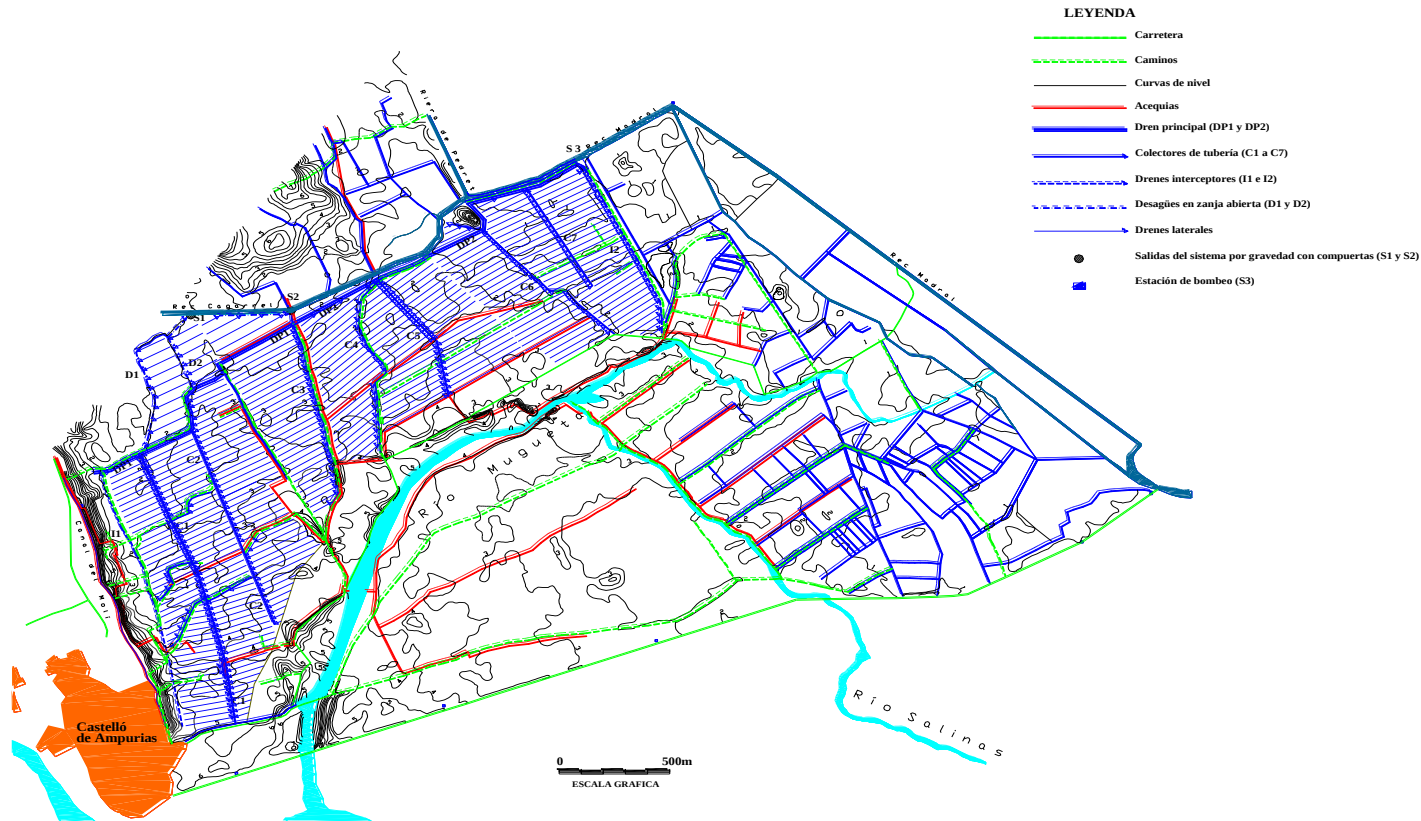
Reclamation of salt affected soils, Bardenas Area, Spain

Disposal of drainage effluents



Major components of a land drainage project cycle

1. Planning.
2. Design.
3. Construction.
4. Operation and maintenance.
5. Evaluation of performance.



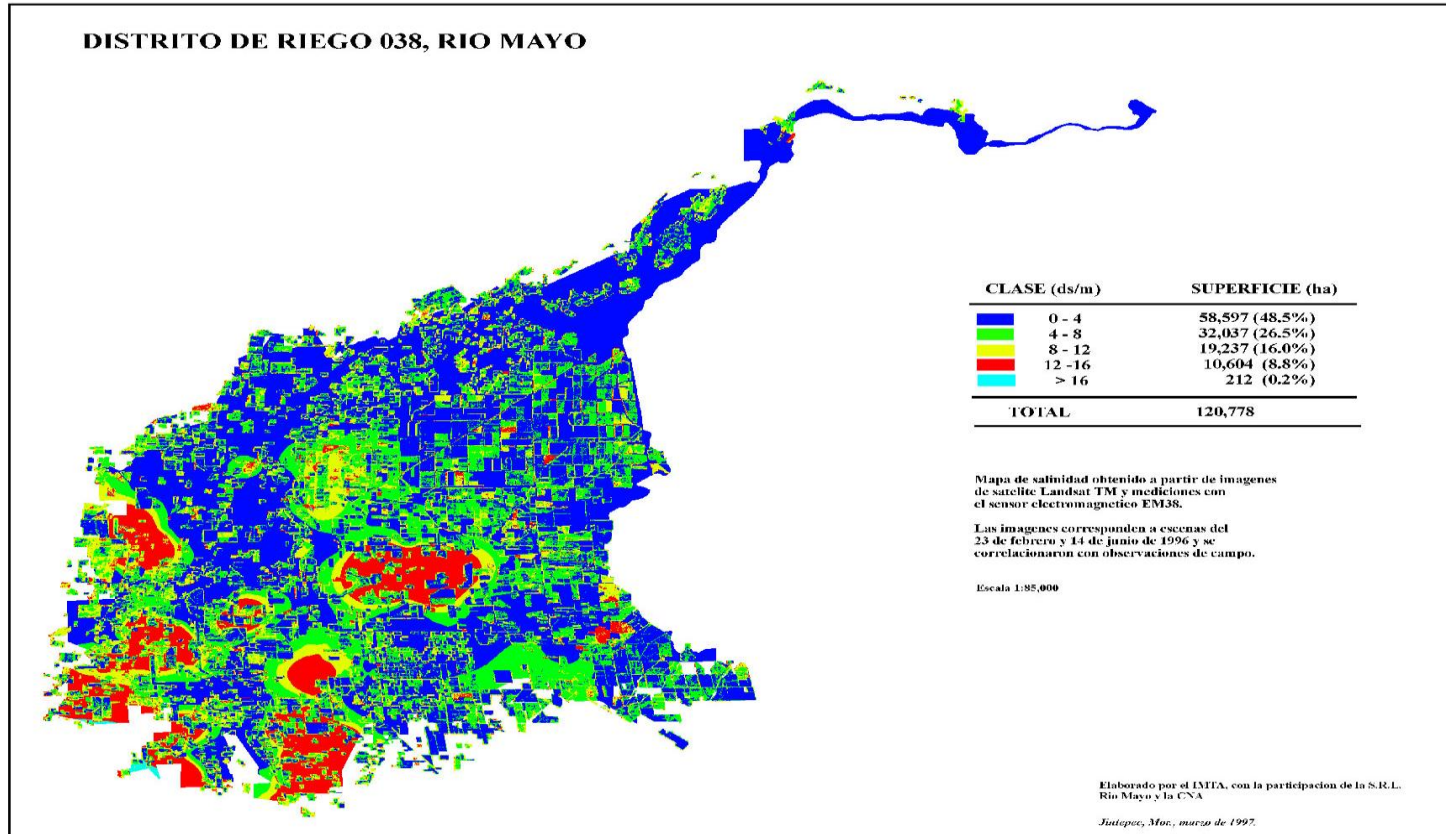
1a Planning of land drainage systems



FAO Irrigation and Drainage Paper 62
“Guidelines and computer programs for the planning and design of land drainage systems”

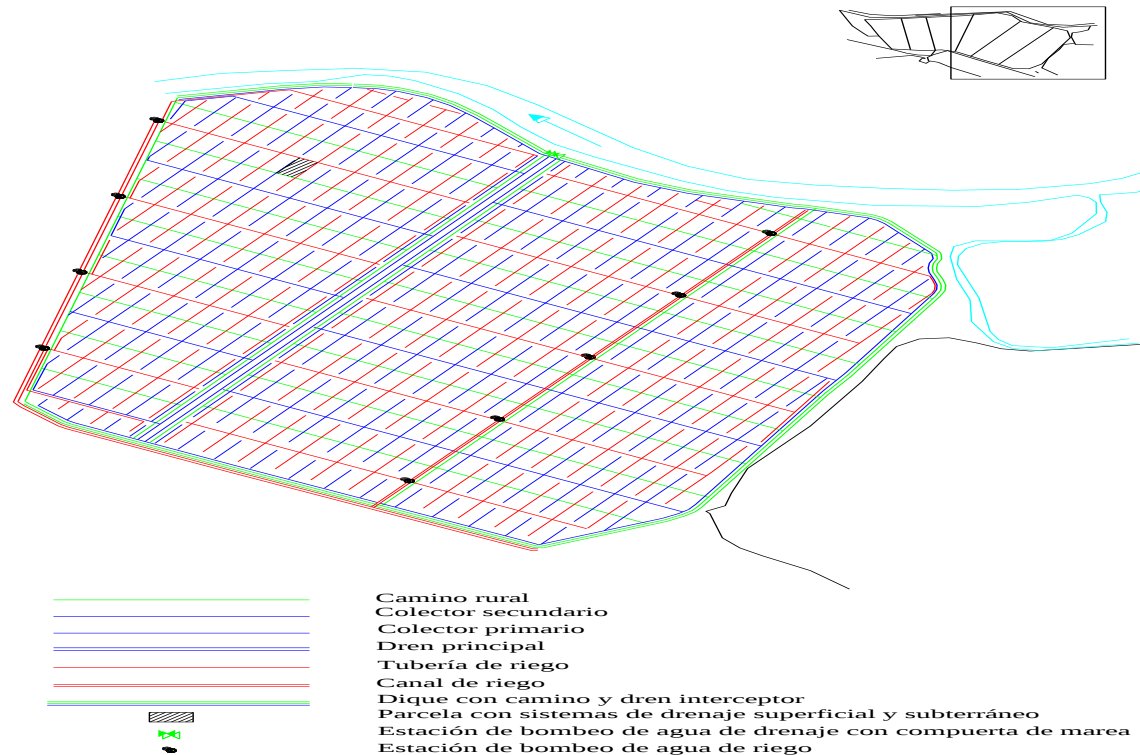


1b Planning of land drainage systems



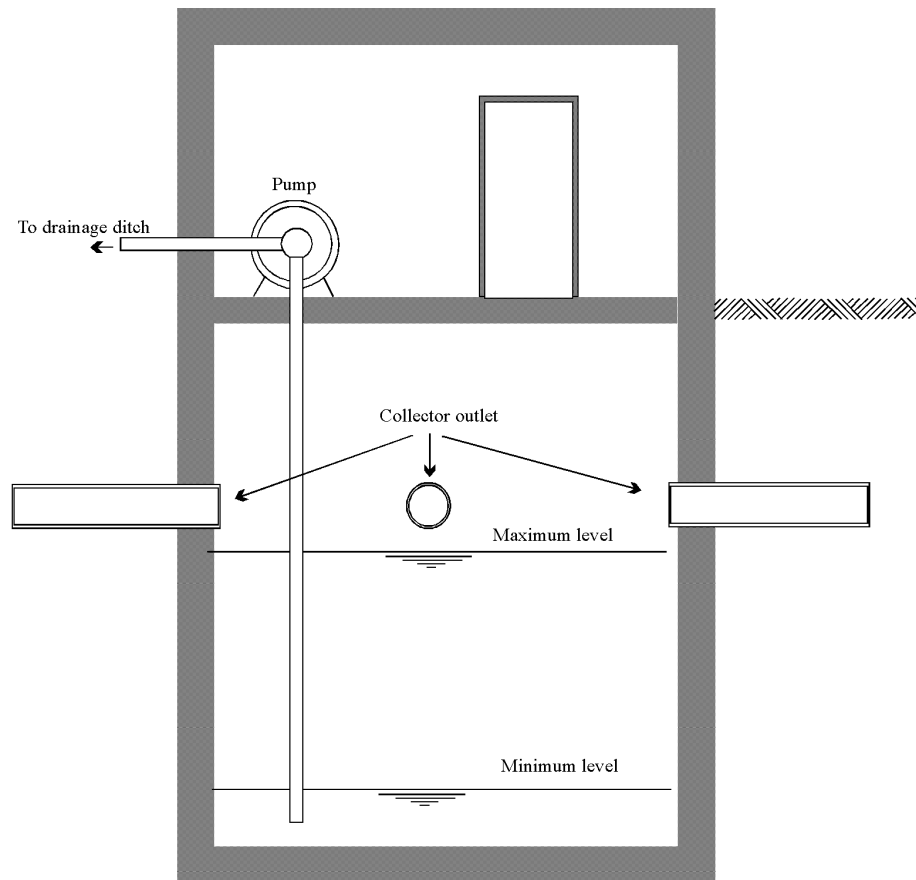
1st step for a socio-economic evaluation: mapping the salt- affected lands by using remote sensing techniques and field work

2 Design of land drainage systems



FAO Irrigation and Drainage Paper 62 “Guidelines and computer programs for the planning and design of land drainage systems”

3a Construction of land drainage systems



FAO Irrigation and Drainage Paper 60 "Materials for subsurface land drainage systems"

3b Construction of land drainage systems



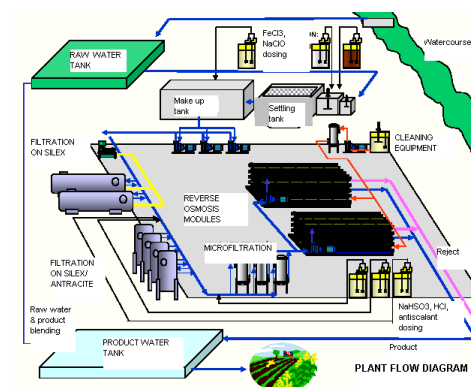
ILRI Publication 60 “Subsurface Drainage Practices; Guidelines for the implementation, operation and maintenance of subsurface pipe drainage systems”, Alterra, ILRI, Wageningen, The Netherlands, 2005.

4a Operation and maintenance



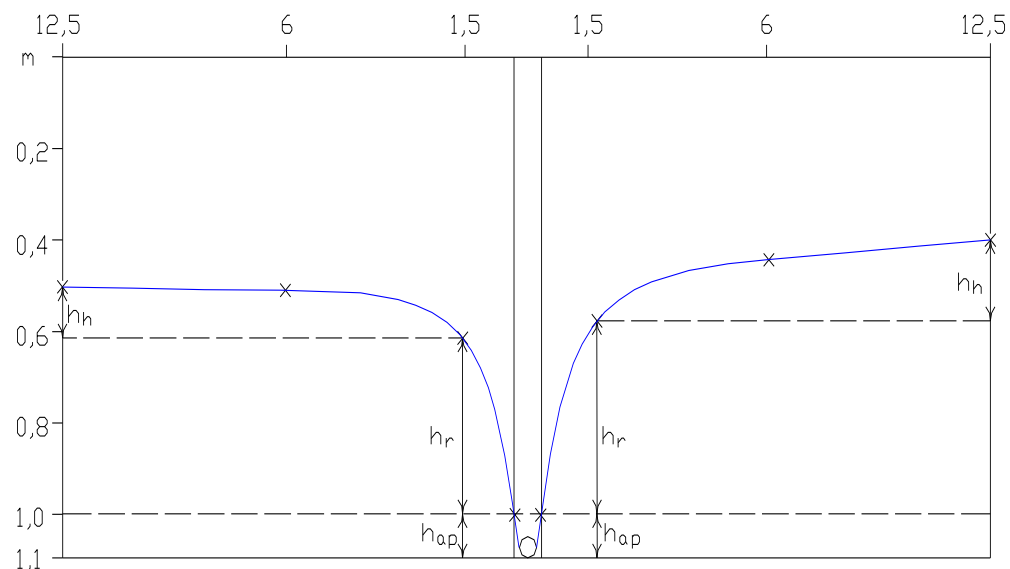
ILRI Publication 60 “Subsurface Drainage Practices; Guidelines for the implementation, operation and maintenance of subsurface pipe drainage systems”, Alterra, ILRI, Wageningen, The Netherlands, 2005.

4b Operation of drainage systems



FAO Irrigation and Drainage Paper 61 “Agricultural drainage water management in arid and semi-arid areas, Rome, 2002.

5 Evaluation of the performance of land drainage systems



Guidelines for the evaluation of the technical, economic and environmental performance of drainage systems (in preparation)

Conclusions

Irrigated agriculture is essential for agricultural production.

Increasing the land and water productivity in existing irrigated lands is a priority.

In arid and semi-arid zones, one problem associated to irrigated agriculture is soil salinity.

Land drainage is a key aspect to control waterlogging and soil salinity.

Relevant innovations in the major components of the land drainage project cycle have developed during the past decade.

Some developments due to FAO and Alterra-ILRI were highlighted in this presentation.



CEDEX International Course on Irrigation and Drainage Engineering

PROGRAMA:

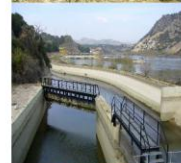
- Fundamentos de clima, hidrología, suelos y cultivos relacionados con el regadío
- Recursos hídricos para riego
- Viaje de estudios a regadíos de la cuenca del Ebro
- Redes de conducción y distribución del agua de riego
- Sistemas de riego parcelario
- **Drenaje de tierras regables y control de la salinidad de los suelos regables**
- Modernización de regadíos existentes
- Planificación de una nueva zona regable
- Operación y mantenimiento de zonas regables
- Planificación de regadíos a escala nacional, regional y de cuenca hidrográfica

www.cedex.es

www.cedex.es

CURSO INTERNACIONAL de INGENIERÍA DE REGADÍOS

5 de septiembre al 15 de diciembre de 2011



PROGRAMA GENERAL

1. Fundamentos de clima, hidrología, suelos y cultivos relacionados con el regadío
2. Recursos hídricos para riego
3. Viaje de estudios a regadíos de la cuenca del Ebro
4. Redes de conducción y distribución del agua de riego
5. Sistemas de riego parcelario
6. Drenaje de tierras regables y control de la salinidad de los suelos regables
7. Modernización de regadíos existentes
8. Planificación de una nueva zona regable
9. Operación y mantenimiento de zonas regables
10. Planificación de regadíos a escala nacional, regional y de cuenca hidrográfica

LUGAR Y DURACIÓN

Centro de Estudios Hidrográficos del CEDEX
Paseo Bajo de Virgen del Puerto, 3
MADRID

Duración: 336 horas lectivas

INFORMACIÓN

CEDEX - Gabinete de Formación y Documentación
C/ Alfonso XII, 3 - 28014 Madrid (España)
E-mail: mastrans@cedex.es
www.cedex.es

References

- <http://www.fao.org/nr/water/jsp/publications/search.htm>
- http://www.alterra.wur.nl/NL/publicaties+Alterra/ILRI_publicaties/
- <http://www.cedex.es/castellano/eventos/masters.html>