A Role of Drainage in IWRM

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One of the IWRM components in the water sector in the arid zone is the integration of irrigation and drainage, i.e. consideration of their two-way influence aimed at effective use of water and land resources. In other words, the integration of water and land resources is provided by means of joint management of the water and salt regimes of irrigated lands using the tools of drainage and irrigation.

Irrigated lands can be represented as biologically active "living organism" with its inherent productivity, in which irrigation canals and other components (distributed ditches, irrigated furrows) play a role of "arteries and arterial capillaries," and drains and collector-drains play a role of "venous capillaries and veins." External surface of this "living organism" - soils play a role of a skin that absorbs solar radiation and is subjected to climatic changes, but, at the same time, soils are a generator of biological life of plants, supplying to them not only water but also nutrients (fertilizers) through "arterial capillaries."

If to consider land productivity in its dynamics (Figure 4.17) it is possible to see opportunities for its raising and also lowering.

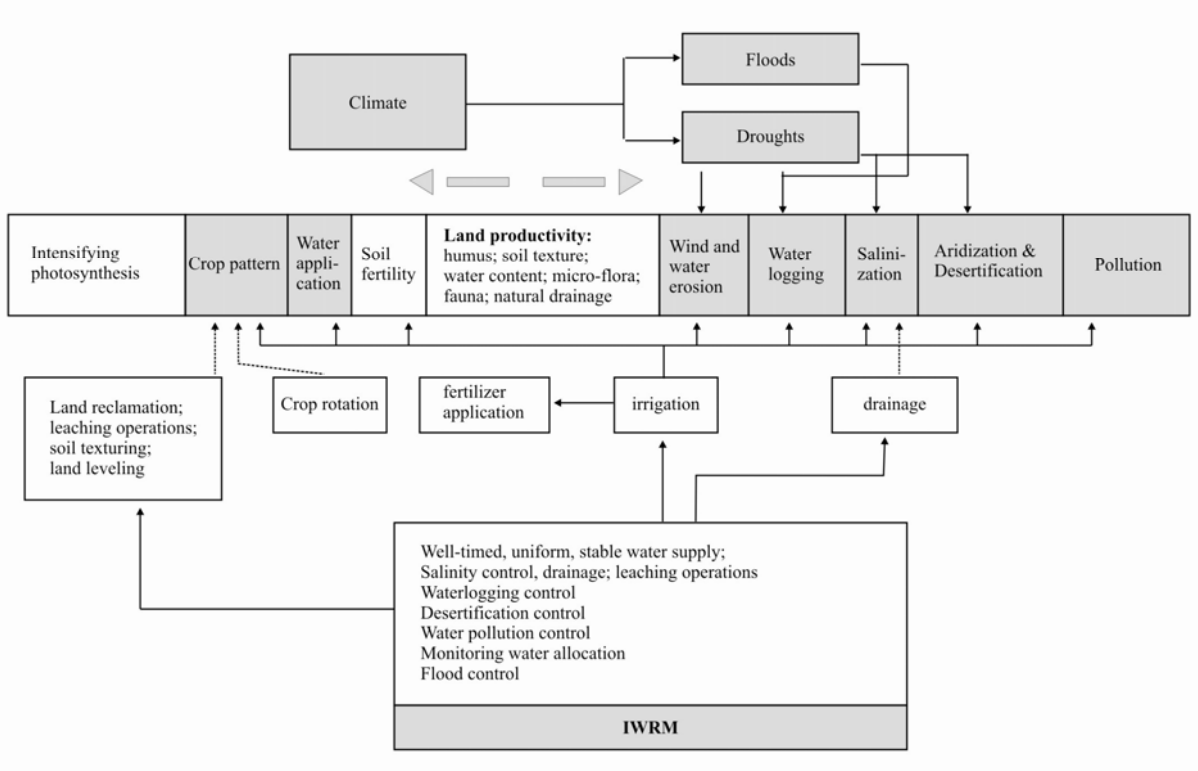

Figure 4.17 Irrigated Land Productivity Factors and IWRM

Key factors that predetermine irrigated land productivity are the following: i) fertilizers including organic manure; ii) maintaining the optimal water regime of soils; iii) structure-forming of soils and keeping of their aggregated structure; and iv) intensification of photosynthesis by means of mulching and other agro-

technical measures. On the other hand, lowering of irrigated land productivity can be caused by water erosion, wind erosion, waterlogging, salinization, desertification, and soil pollution.

Thus, factors that predetermine productivity of irrigated lands related to proper management of land reclamation activity, which is the combination of irrigation, drainage, agro-technical improvements, and fertilizer application. In exactly the same way, a decrease in productivity is the consequence of improper management of irrigation and drainage. A correct combination of drainage and irrigation depends on:

- Sustainable and equitable irrigation water supply in sufficient amounts;
- Prevention of waterlogging and salts accumulation in the root zone based on sustainable operation of the drainage system and employing of irrigation with the leaching fraction and leaching operations;
- Prevention of desertification by means of establishing the required water regime using specific methods of wetting, keeping natural soil moisture, accumulating rainfall, and planting drought-resisting trees and bushes;
- Prohibiting pollution of land and water resources;
- Monitoring water distribution; and
- Flood control and prevention.

From this point of view, confunction of drainage and irrigation should be accompanied by such land reclamation measures as deep ripping (up to 1.5 m), improving soil texture applying special amendments (as well as addition of sand to heavy (clayey) soils or clay to sandy soils), and recurrent land leveling.

The joint operation of irrigation and drainage is also important in the light of the following aspect: use of brackish water from collector-drains and drainage tubewells (as one of components of IWRM, which envisages joint usage of all available waters: surface water, ground water, and return water) is possible only when there is sufficient artificial drainage on irrigated lands and, at the same time, irrigation with the leaching fraction is employed. Under considering interaction of soil and plants, upward and downward depth-variation water fluxes controlled by irrigation and drainage, it is necessary to link them with spatial changes resulting from horizontal water fluxes in soil and subsoil depending on a mutual layout of field drains and plots under irrigation. Cascade-located irrigation schemes, which intensively interact with each other, can be a special example.

Apart from three dimensions of interaction of drainage and irrigation (over area, depth, and volume), it is necessary to keep in mind one more dimension – time i.e. in the frame of IWRM an aging of drainage infrastructure and the need of its rehabilitation needed to be considered. The most complicated issue of managing the drainage aspect in the frame of IWRM is the implementation of monitoring and repairing of the drainage systems, since the possibility of meeting the water requirements of crops depends on the sustainability of drainage and irrigation.

Thus, integrating of irrigation and drainage for rational water use and water saving should be based on:

- Science-based selection of design parameters of irrigation and drainage, and their integrating over area, depth and time;

- Correct layout of irrigation furrows and field drains preventing uneven joint effects; and

- Sustainable irrigation water supply that meets the requirements of irrigation with leaching fraction and drainage according to design parameters based on proper management and maintenance of inter-farm and on-farm irrigation and drainage networks.