# The Paradox of Agricultural Water Conservation Policy

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# Global Water Surveys

- Water is alarmingly scarce worldwide.
- Irrigated agriculture is world's largest water user.
- Agricultural water application efficiency is low world-wide

Policy Prescription: Improve field-level irrigation efficiency

Johnson et al., "Managing Water for People and Nature," *Science*, *Compass*, Vol 292, 11-May 2001.

Gleick, "Soft Water Paths," *Nature*, *Concepts*, Vol 418, 25-July 2002.

# USDA NEWS RELEASE

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## USDA Issues Two Biotechnology Reports

WASHINGTON, May 9, 2005-The U.S. Department of Agriculture today issued two reports on agricultural biotechnology that cover the evolving world requirements for the traceability and labeling of agricultural biotechnology products and on the complexities of predicting the use of these products in the future.

"These reports will help us to better understand how biotechnology is changing the face of agriculture," said Agriculture Secretary Mike Johanns. "Enhancing our understanding of the marketing regulations of biotech products and how producers and consumers may be affected by the adoption of this technology will help to guide USDA's future decision-making in this area."

The reports, developed by USDA's Advisory Committee on Biotechnology and 21st Century Agriculture (AC21), are entitled (1) Global Traceability and Labeling Requirements for Agricultural Biotechnology-Derived Products: Impacts and Implications for the United States; and (2) Preparing for the Future.

The first report considers the proliferation of mandatory biotechnology traceability and labeling requirements in other countries; how different segments of the United States food and feed supply chain are addressing those requirements; and marketplace issues and tools that are relevant to these developments.

The second report provides USDA with an analysis of the factors that will shape the use of biotechnology in the future. It identifies broad trends that are likely to influence the future in some predictable ways as well as key uncertainties that could drive the future in different directions. The report also provides three examples of scenarios for the future, not as predictions but as tools to provoke thought and further analysis, plus a series of questions to help understand the impacts of each scenario. The questions can be applied to help analyze any scenario that may be developed.

The AC21 was established by the Secretary of Agriculture in 2003 and examines how biotechnology is likely to change agriculture and USDA's work over the next five to ten years and other biotechnology issues sent to it by the Secretary.

The 18-member committee represents a broad spectrum of views and interests and is composed of farmers, technology providers, academics, representatives from the food manufacturing and shipping industries, and representatives from consumer and environmental organizations. The committee meets in public session three to four times per year.

# Second USDA Report: Preparing for the Future

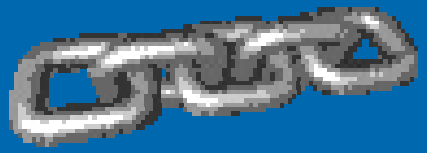
**WHAT WE KNOW (OR THINK WE KNOW)**
What are some key drivers likely to influence the next decade, regardless of other uncertainties?

The AC21 has honed in on the following:

**Water issues will become increasingly important domestically and internationally.** There will be increasing pressure on fresh water supplies, and less water will be available for agricultural uses. Overall world fresh water quality will decline. *Linkages between water conservation, new agricultural technologies, and no-till agriculture will become increasingly important*.

(p. 5, Italics added)

# Working Out the Linkages



- What does it mean for an irrigator to be more efficient in applying water at the field level?
- When does this lead to water conservation at the basin level, and are there undesirable side effects?
- How well does western water law deal with undesirable side effects?
- Effectiveness of economic water conservation policies

# Linkage According to Policy Makers

Increased On-Farm Application Efficiency = Agricultural Water Conservation

# Water 2025:

## *Preventing Crises and Conflict in the West*

- **Water is the lifeblood of the American West and the foundation of its economy. It is also the scarcest resource in some of the fastest growing areas of the country**

- Water 2025 is intended to focus attention on the reality that explosive population growth in western urban areas, the emerging need for water for environmental and recreational uses, and the national importance of the domestic production of food and fiber from western farms and ranches is driving major conflicts between these competing uses of water.

- **In some areas of the West, existing water supplies are, or will be, inadequate to meet the demands for water for people, cities, farms, and the environment even under normal water supply conditions.**

- Water 2025 recognizes that states, tribes, and local governments should have a leading role in meeting these challenges, and that the Department of the Interior should focus its attention and resources on areas where scarce federal dollars can provide the greatest benefits to the West and the rest of the Nation.

- **Water 2025** provides the basis for a public discussion in advance of water crises and sets forth a framework to focus on meeting water supply challenges in the future. This framework includes:

- **Six Principles** to guide Interior in addressing water problems.
- **Five Realities** that drive water crises.
- **Four Key Tools** to help proactively manage scarce water resources.

- **Six Principles**
  - Recognize and respect state, tribal, and federal water rights, contracts, and interstate compacts or decrees of the United States Supreme Court that allocate the right to use water.
  - Maintain and modernize existing water facilities so they will continue to provide water and power.
  - Enhance water conservation, use efficiency, and resource monitoring to allow existing water supplies to be used more effectively.
  - Use collaborative approaches and market based transfers to minimize conflicts.
  - Improve water treatment technology, such as desalination, to help increase water supply.
  - Existing water supply infrastructure can provide additional benefits for existing and emerging needs for water.

- Five Realities
  - Explosive population growth in areas of the West where water is already scarce.
  - Water shortages occur frequently in the West.
  - Over-allocated watersheds can cause crisis and conflict.
  - Water facilities are aging.
  - Crisis management is not effective in dealing with water conflicts.

- Four Key Tools
  - Conservation, Efficiency, and Markets
  - Collaboration
  - Improved Technology
  - Remove Institutional Barriers and Increase Interagency Cooperation

- Water 20025 will:
  - Facilitate a more forward-looking focus on water-starved areas of the country;
  - Help to stretch or increase water supplies to satisfy the demands of growing populations, protect environmental needs, and strengthen regional, tribal and local economies.
  - Provide added environmental benefits to many watersheds, rivers, and streams;
  - Minimize water crises in critical watersheds by improving the environment and addressing the effects of drought on important economies; and,
  - Provide a balanced, practical approach to water management for the next century.

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## VENEMAN ANNOUNCES $7 MILLION FOR CONSERVATION EFFORTS IN THE KLAMATH BASIN

WASHINGTON, March 26, 2003-Agriculture Secretary Ann M. Veneman today released $7 million to assist farmers in the Klamath Basin in Oregon and California. The funds are part of a $50 million fund for Klamath farmers made available through the Environmental Quality Incentives Program (EQIP) authorized in the 2002 Farm Bill.

"The Bush Administration is working to assist farmers and ranchers in the Klamath Basin," said Veneman. "This funding will help producers accelerate implementation of conservation practices on the ground this year."

**Additional Information**
Print this document

Eligible farmers will receive financial and technical assistance to improve the efficiency of on-farm irrigation systems and institute other measures that improve ground and surface water conservation. Conservation practices will result in net savings in groundwater or surface water resources on the agricultural operation of the producer.

In March 2002, President Bush established a cabinet-level Klamath River Basin Federal Working Group that includes the Departments of Interior, Agriculture and Commerce to address concerns raised by farmers, ranchers, fishermen, tribes and others affected by the difficult conditions in Klamath. As part of the working group, USDA is working with farmers and ranchers to implement a variety of conservation programs that are available through the department.

For example, the Natural Resources Conservation Service is working with a number of landowners to improve wetland and wildlife habitat through the Wetlands Reserve Program. This includes an additional 2,500 acres enrolled in permanent easements during 2002. The projects are located on Upper Klamath Lake and the Williamson River, both major water sources of the Klamath Basin. These projects will benefit water quality and improve wildlife habitat, thereby providing benefits to the endangered Lost River and Shortnose Sucker fish.

"Through the combined efforts of the Klamath Basin producers, local conservation districts and USDA, on-farm conservation measures will be implemented to reduce water demand and increase irrigation efficiencies," said USDA Deputy Under Secretary Mack Gray.

Farmers interested in applying for the EQIP funds may submit an application to their local NRCS office or USDA Service Center. Applications also are available online at www.nrcs.usda.gov . Program participants will receive funding when the conservation practices in their EQIP contract are completed.

# Court Settlements

Voluntary Settlement Agreement
Benton County Superior Court Cases No. 09-2-82852-7 and 97-2-01041-9

November 20, 2002

Plaintiffs and Defendants agree to settle this case on the following terms:

(1) Commitments of Defendants

(a) Defendants agree to issue Reports of Examination by January 15, 2003 granting the seven water applications at issue in this case. The ROEs will grant rights to water from the Columbia River in the amount set forth in the draft ROEs prepared by Defendants in September 2001, unless the applicants request less water. Ecology will offer each of the applicants a choice between one of the following two permit conditions:

(i) Option 1: The rights will be contingent on the applicant paying to Ecology, or an entity designated by Ecology, the amount of $10 per acre foot per year by March 1 of each year for the previous calendar year, for the full amount of water used under the rights, as determine through annual metering records. The $10/AF/year will be adjusted annually according to the Implicit Price Deflator. These permits will be subordinated to all prior existing water rights on the Columbia River, including the 1980 instream flow rules. However, the permits will stat that the payments made will have prepaid for replacement water at any time that the permits would otherwise be curtailed pursuant to the 1980 instream flow rules to avoid any interruptio

(b) Defendants also agree to propose rules (CR 102) as part of the Columbia River Initiative process which will on a voluntary basis allow water right holders subject to the 1980 instream flow rules to be uninterrupted due to the flows, contingent on either:

(i) paying to Ecology, or an entity designated by Ecology, an amount per acre-foot per year for the full amount of water to be used under each permit for which they wish to be uninterrupted by the 1980 instream flows; or

(ii) maintaining or installing state of the art (or best management practices) water application efficiencies on their interruptible rights given crop types and growing conditions in production, and trasferring the water conserved thereby to Ecology or an entity designated by Ecology…

# Yakima River Basin Water Enhancement Project

☎✆P.L. 103-434 (1994)

- $100 million appropriated to improve irrigation efficiency in Bureau of Reclamation's Yakima Project (462,000 acres).

- Congressional intent is for efficiency improvements to "reduce the amount of water that needs to be diverted from the Yakima River to maintain full crop production. This will reduce water demands and thereby improve the reliability of the water supply for both streamflows and irrigation.

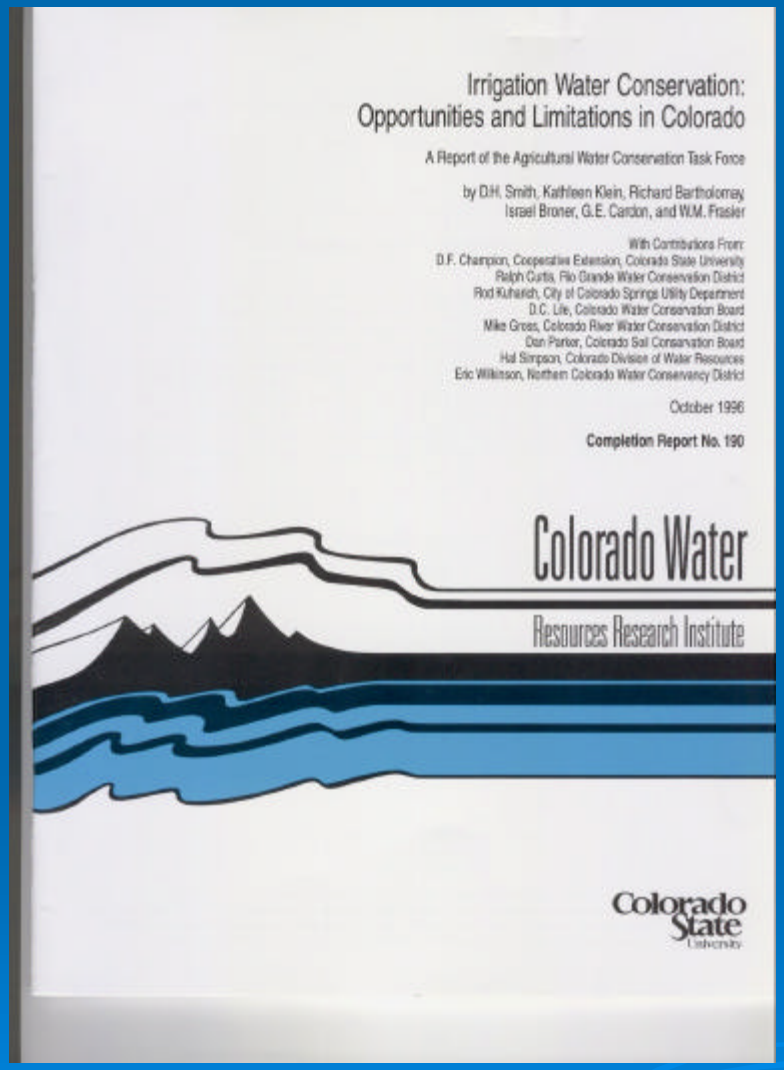
Rep. Miller (California), *Congressional Record* H 6520, August 1, 1994.

# The Paradox

## Troubling News from Hydrologists

"In situations where nonevaporated fractions of irrigation diversions return to the fresh water resource for reuse by others, conservation programs may not stretch water supplies or "save" water in the region. In fact, [they] are really project water "sustainment" programs since they sustain the water supply for one project at the potential expense of downstream projects, cities and perhaps the environment."

Allen, Willardson, Fredriksen (1997), " Water use definitions and their use for assessing the impacts of water conservation," in Hydrologic Impacts of Water Conservation.



Irrigation Water Conservation:
Opportunities and Limitations in Colorado

A Report of the Agricultural Water Conservation Task Force

by D.H. Smith, Kathleen Klein, Richard Bartholomay, Israel Broner, G.E. Cardon, and W.M. Frasier

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October 1996

Completion Report No. 190

Colorado Water Resources Research Institute

Colorado State University

"Within any given basin, wide-spread adoption of conservation practices designed to increase diversion efficiencies has the potential of altering basin hydrology by reducing the magnitude of return flows. [This] could negatively impact water users who depend on these return flows." (p. 46)

# Troubling Real-World Case Studies

- "Policies Drain the North China Plain"
  (International Water Management Institute Research Report 71, 2003)

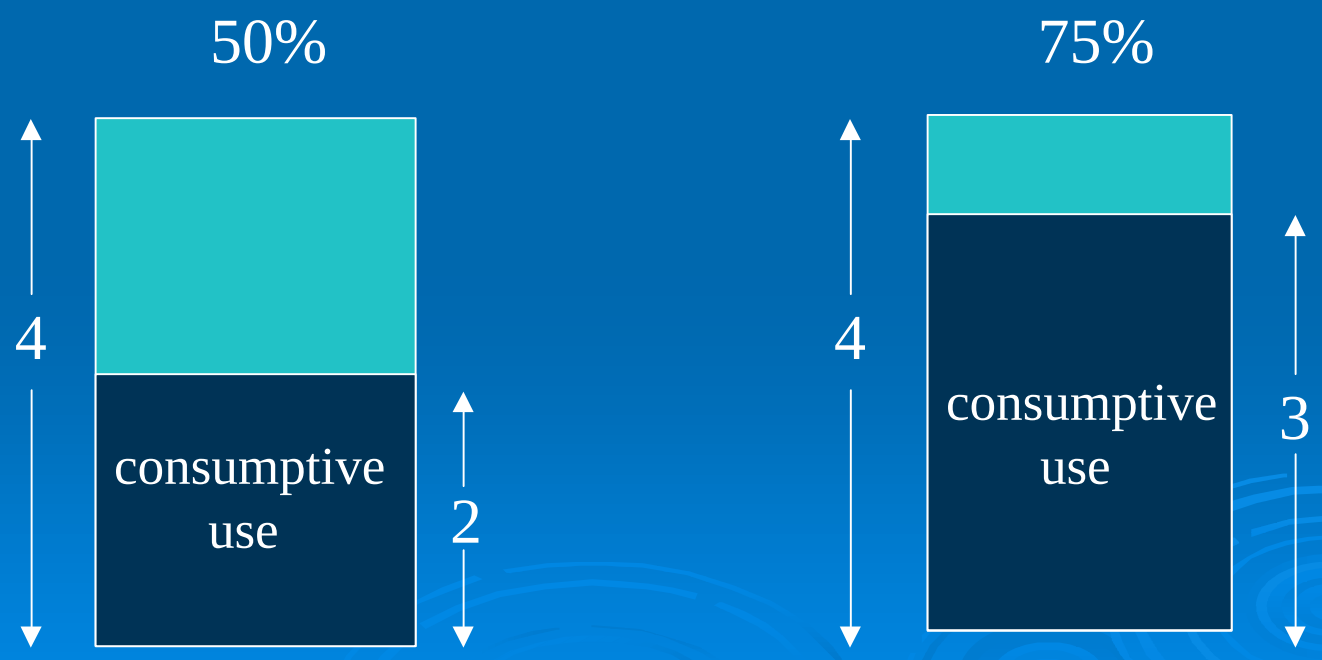
- "The Invisible Drought" Snake River Plain Aquifer

# A Return to First Principles of Irrigation Effectiveness

- Field-level irrigation application efficiency
- Adequacy
- Uniformity

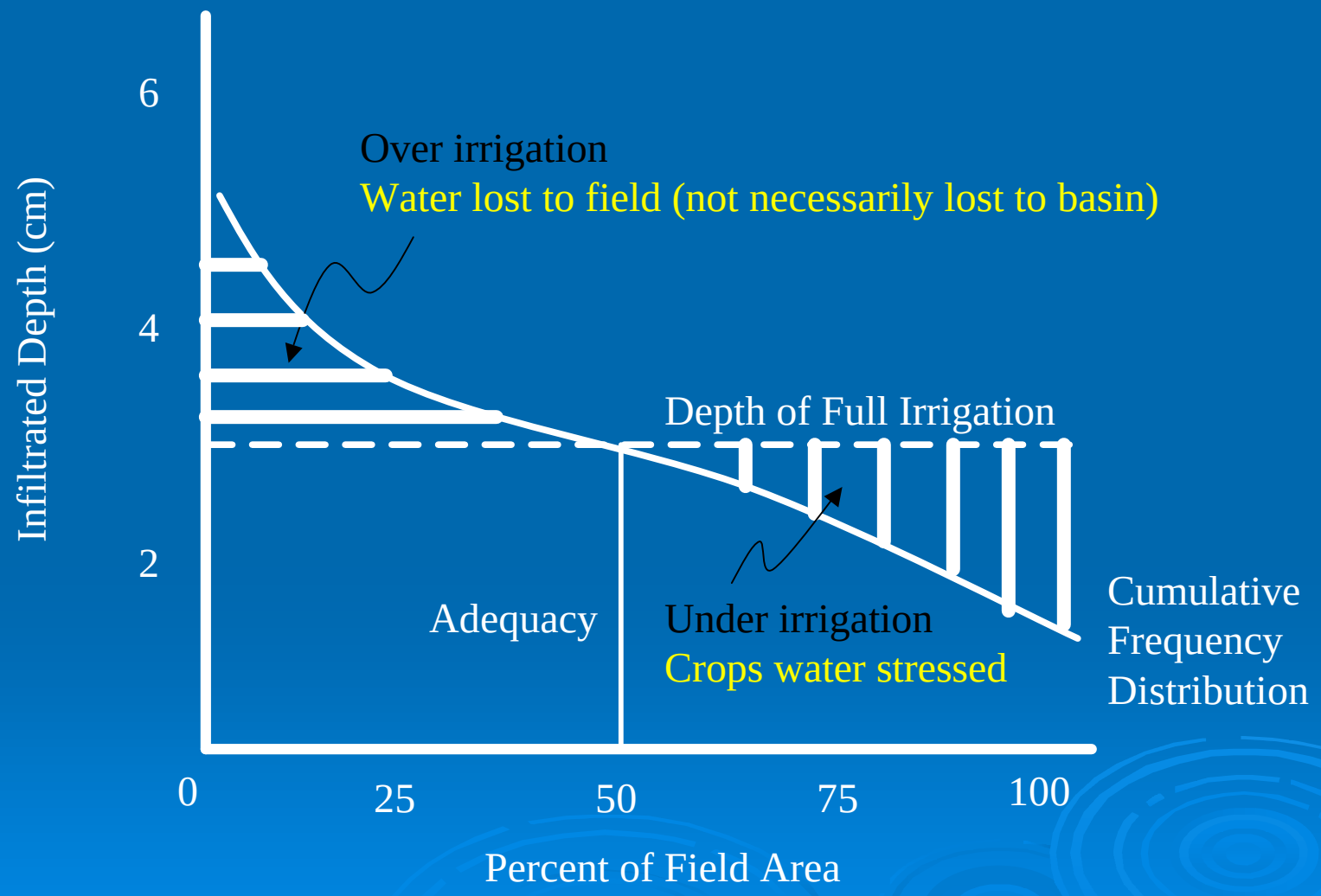
# Field-Level Irrigation Application Efficiency

$$\text{Application Efficiency} = \frac{\text{Consumptive Use}}{\text{Applied Water}}$$



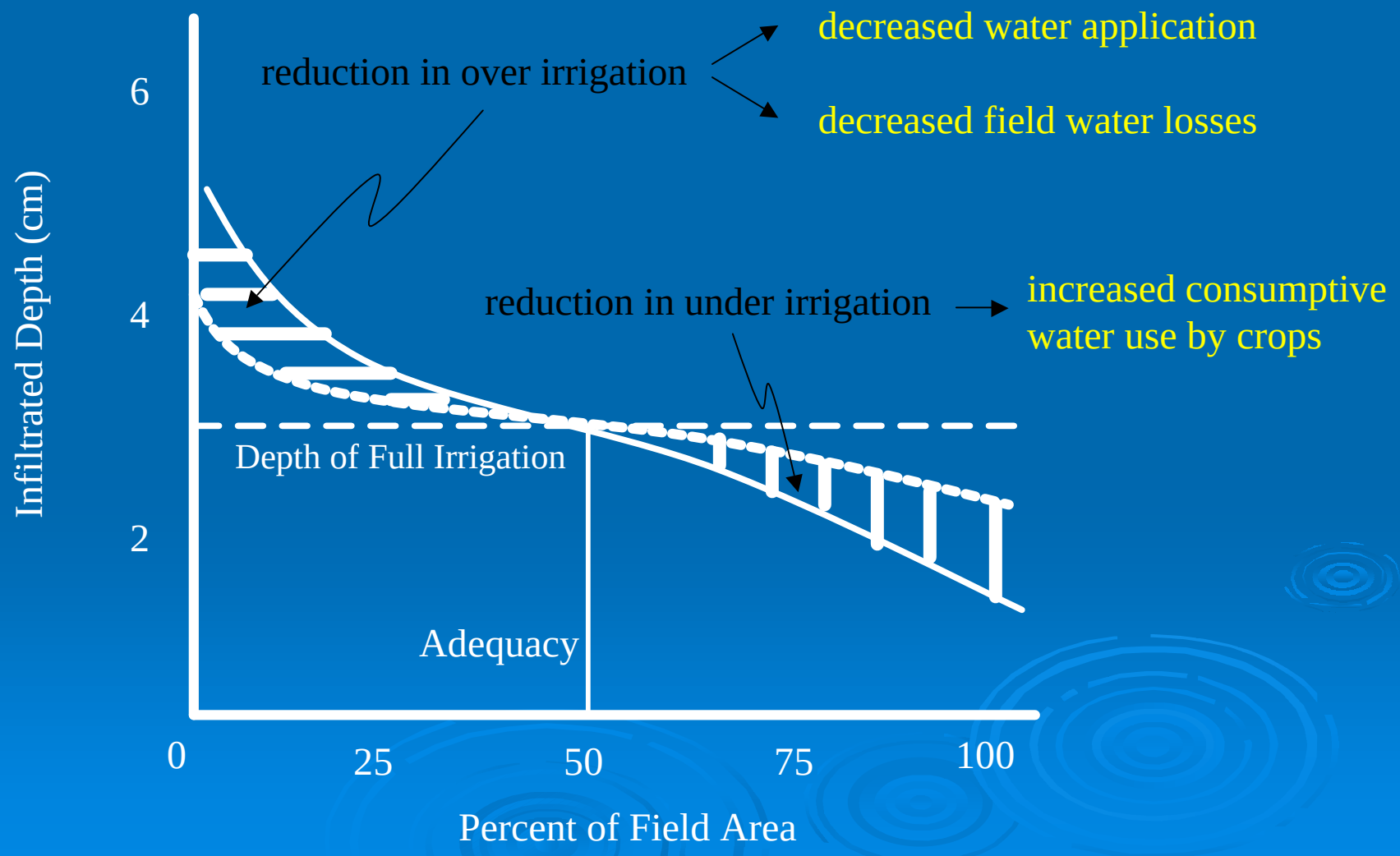
# Irrigation Effectiveness

## Linking Adequacy, Uniformity, and Application Efficiency



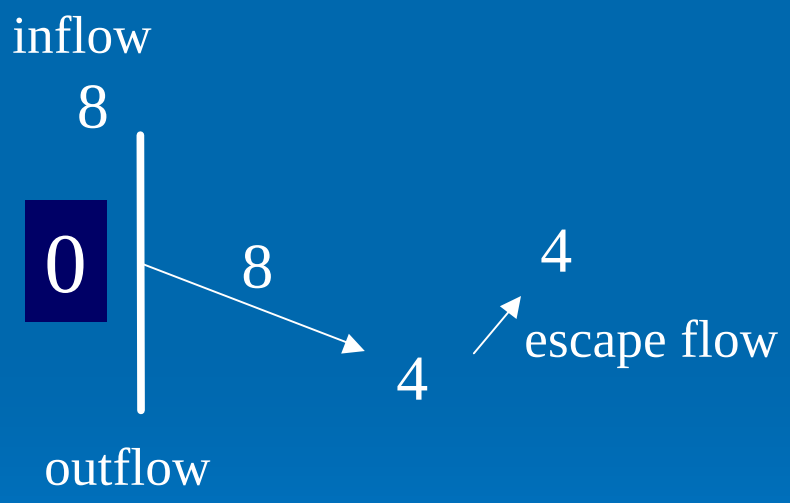

"Principles of Farm Irrigation System Design," L. James, Wiley & Sons, 1988, pp. 94-98.

# Increased Application Efficiency
## Increased Uniformity

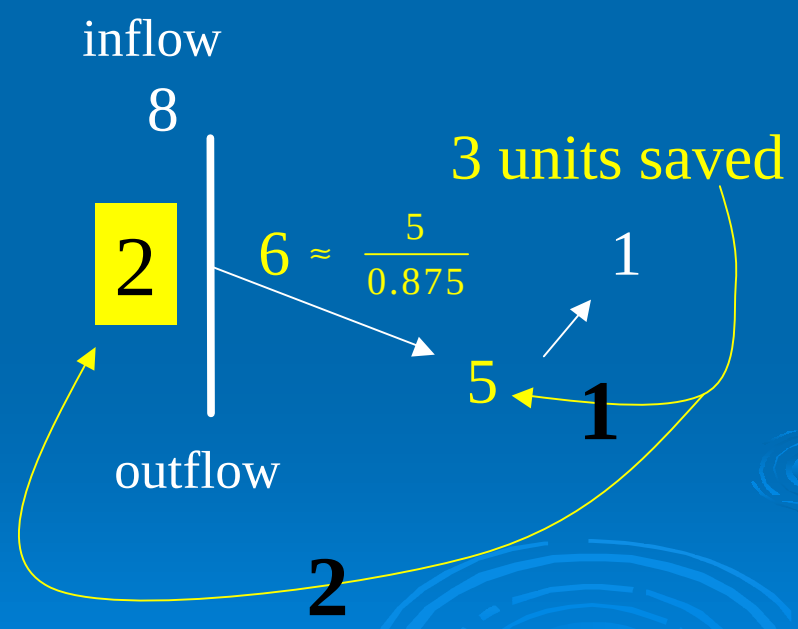


# Escape Flow Regime

Status Quo
50% application efficiency




87.5% application efficiency

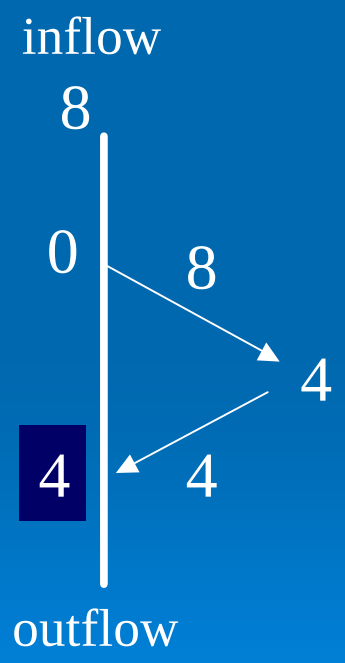



# Conservation

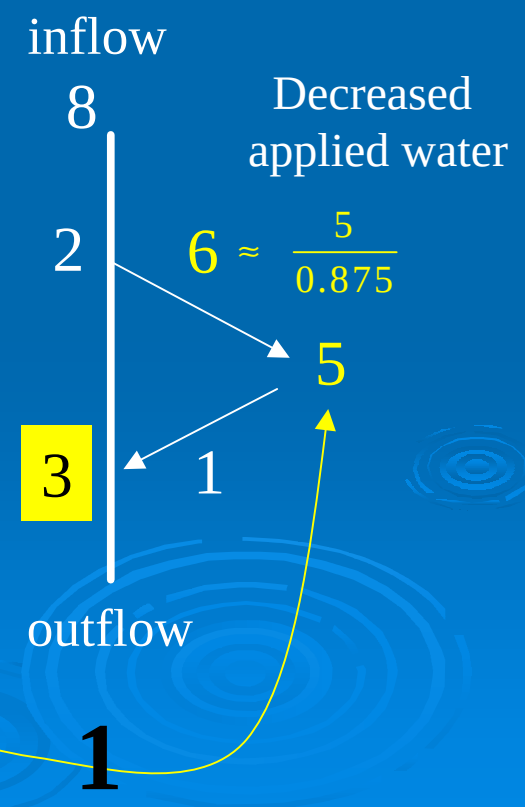
# Return Flow Regime

Application Efficiency

Status Quo: 50 %




87.5 %

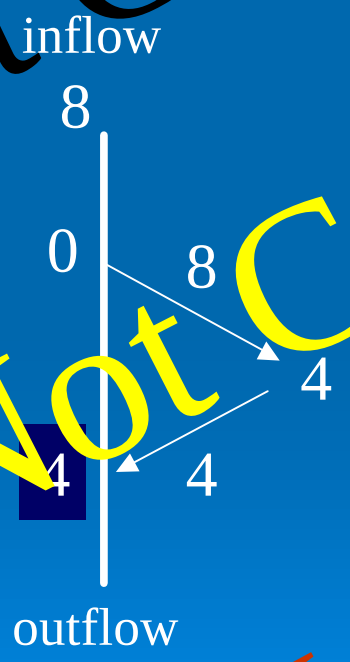


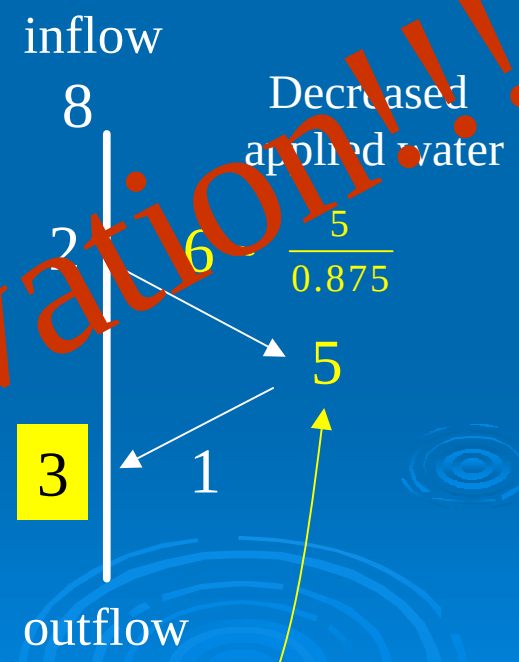
# Return Flow Regime

Application Efficiency

Status Quo: 50 %

87.5 %




Not Conservation!!!

Not Conservation!!!

Not Conservation!!!

Not Conservation!!!

# State Law: Prior Appropriation Doctrine

- Person gains **usufructory (user's) right** to publicly-owned water diverted to a beneficial use on a fixed tract of appurtenant land.

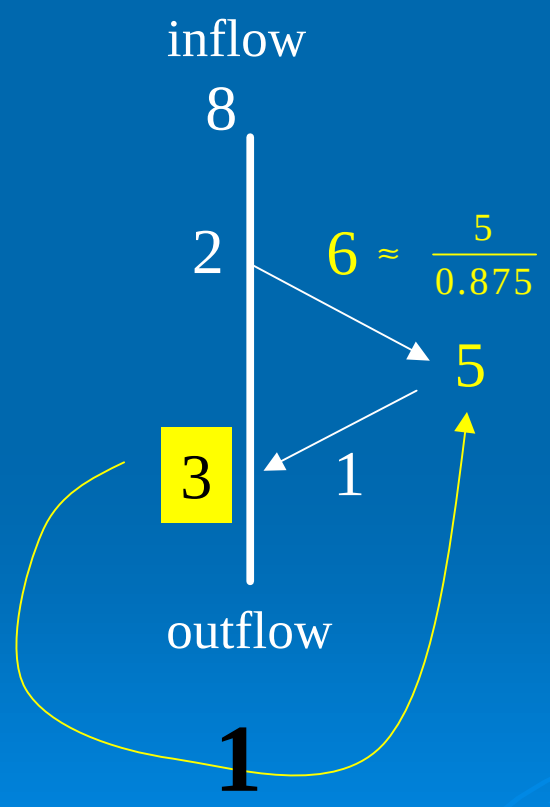
- '**Water Duty**' defines quantity of water under right.
  - Measured as amount of water sufficient to irrigate an average mix of crops with the *irrigation technology prevailing* when right perfected.

- **Priority of right** reaches back to date of first diversion and use.
  - Seniors protected from appropriation out-of-turn by juniors
  - Juniors protected from overexpansion of senior rights

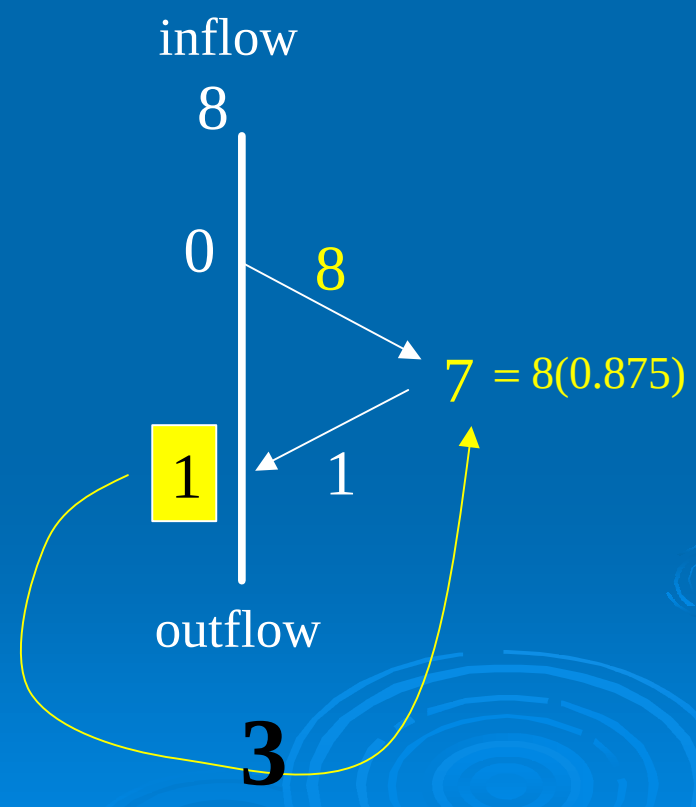
- **'Use it or lose it'**

# Return Flow Regime

Decreased applied water

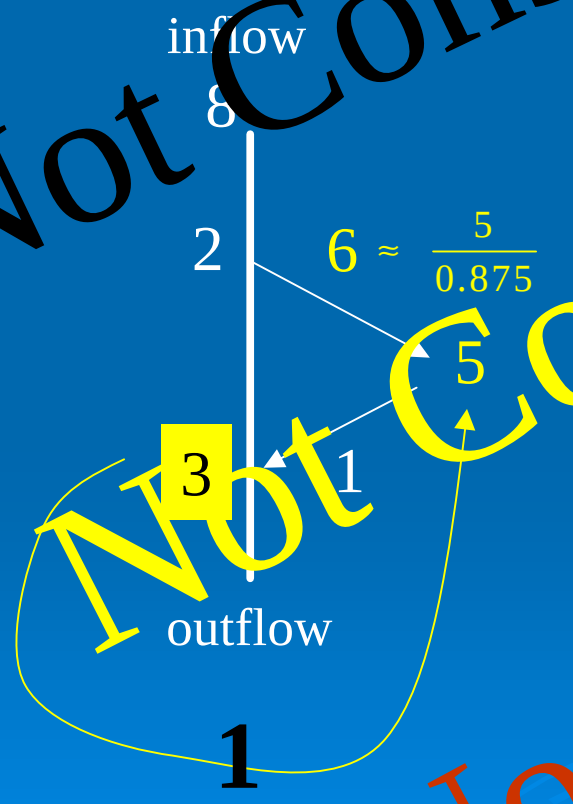



Full legal diversion

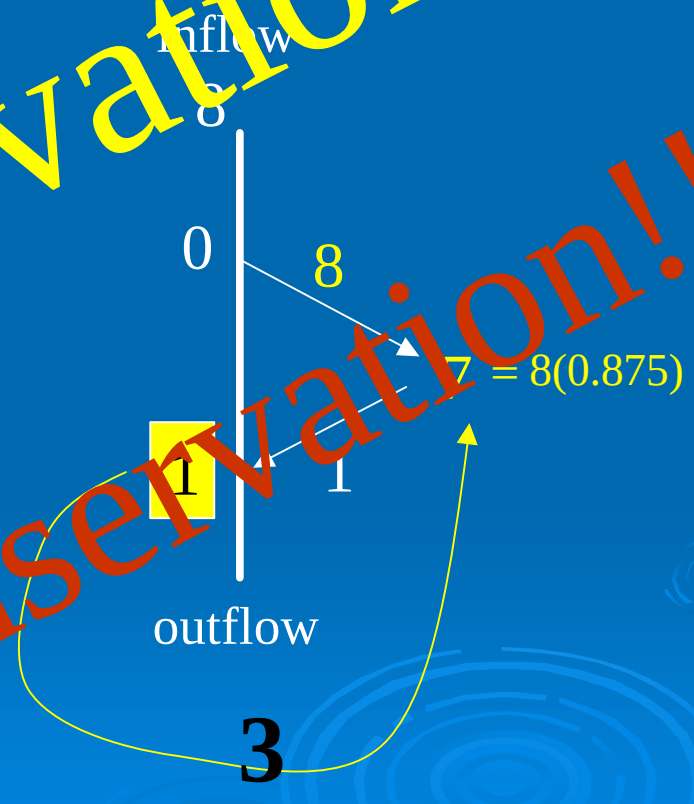


# Return Flow Regime

Decreased applied water




Full legal diversion




Not Conservation!!!

Not Conservation!!!

Not Conservation!!!

# A Problem of Scale

## Effective On-Farm Application Efficiency

- The on-farm application efficiency corrected for water which is restored to the water source without a reduction in quality:

$$\text{Effective Application Efficiency} = \frac{\text{Consumptive Use} + \text{Return Flow}}{\text{Applied Water}}$$

$$= \begin{cases} \dfrac{\text{Consumptive Use}}{\text{Applied Water}} & \text{(Return Flow = 0)} \\ 1 & \text{(Return Flow = Applied Water-Consumptive Use)} \end{cases}$$

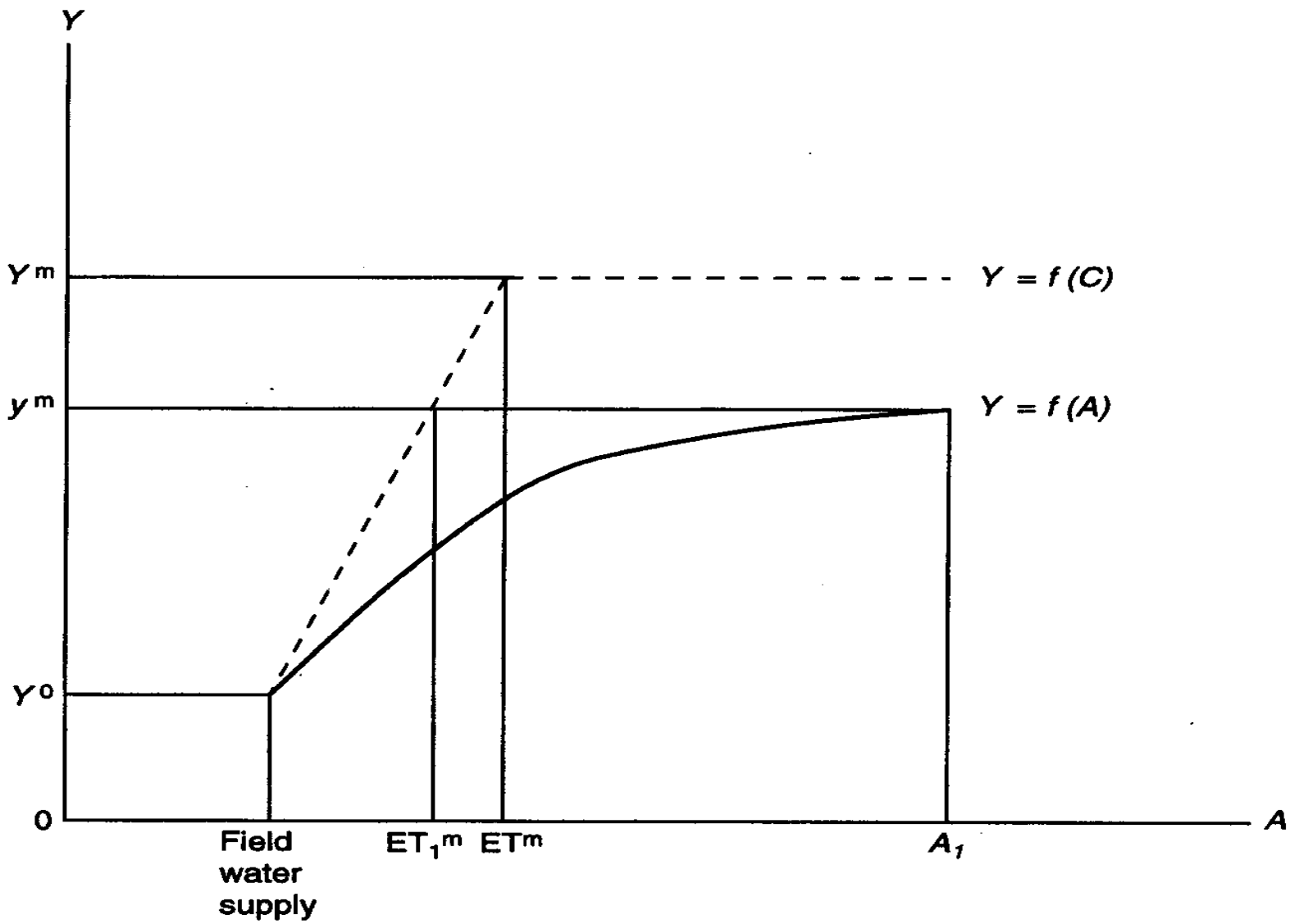



**Figure 2.** Hypothetical crop yield response (*Y*) to applied and consumed water. *Source*: Adapted from Bernardo & Whittlesey (1989, figure 1).

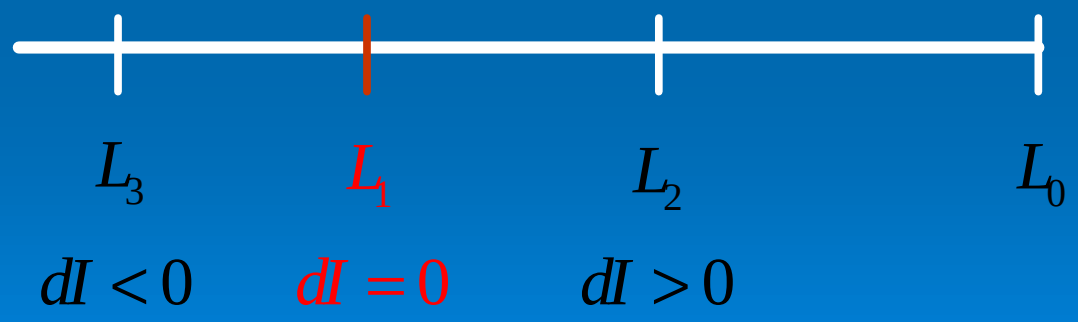
# Profit-maximizing Response to Increase in Cost of Applied Water

$\downarrow$ Applied Water $(A)$

Decrease in applied water measures conserved water in non-return-flow system

$\downarrow$ Acreage $(L)$

Ensuing decrease in consumptive use measures conserved water in return-flow system



# Profit-maximizing Response to Cost-Share Initiative

## Return Flow

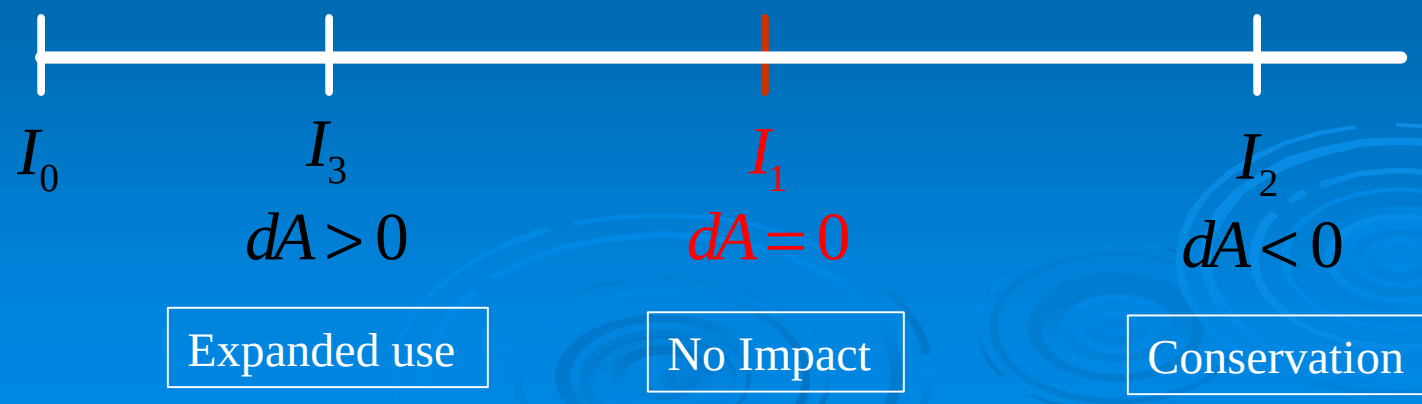
$\uparrow$ Investment in Irrigation Application Efficiency ($I$)

$\uparrow$ Acreage ($L$)

Ensuing expansion in consumptive use measures expanded use in return-flow system

## No Return Flow

$\uparrow$ Investment in Irrigation Application Efficiency ($I$)



# The End