University of Illinois System

Collaborative Research on Environment & Water

Braz-IL CREW

Prasanta K. Kalita
University of Illinois at Urbana-Champaign
Department of Agricultural and Biological Engineering
Urbana, Illinois 61801, USA. pkalita@Illinois.edu
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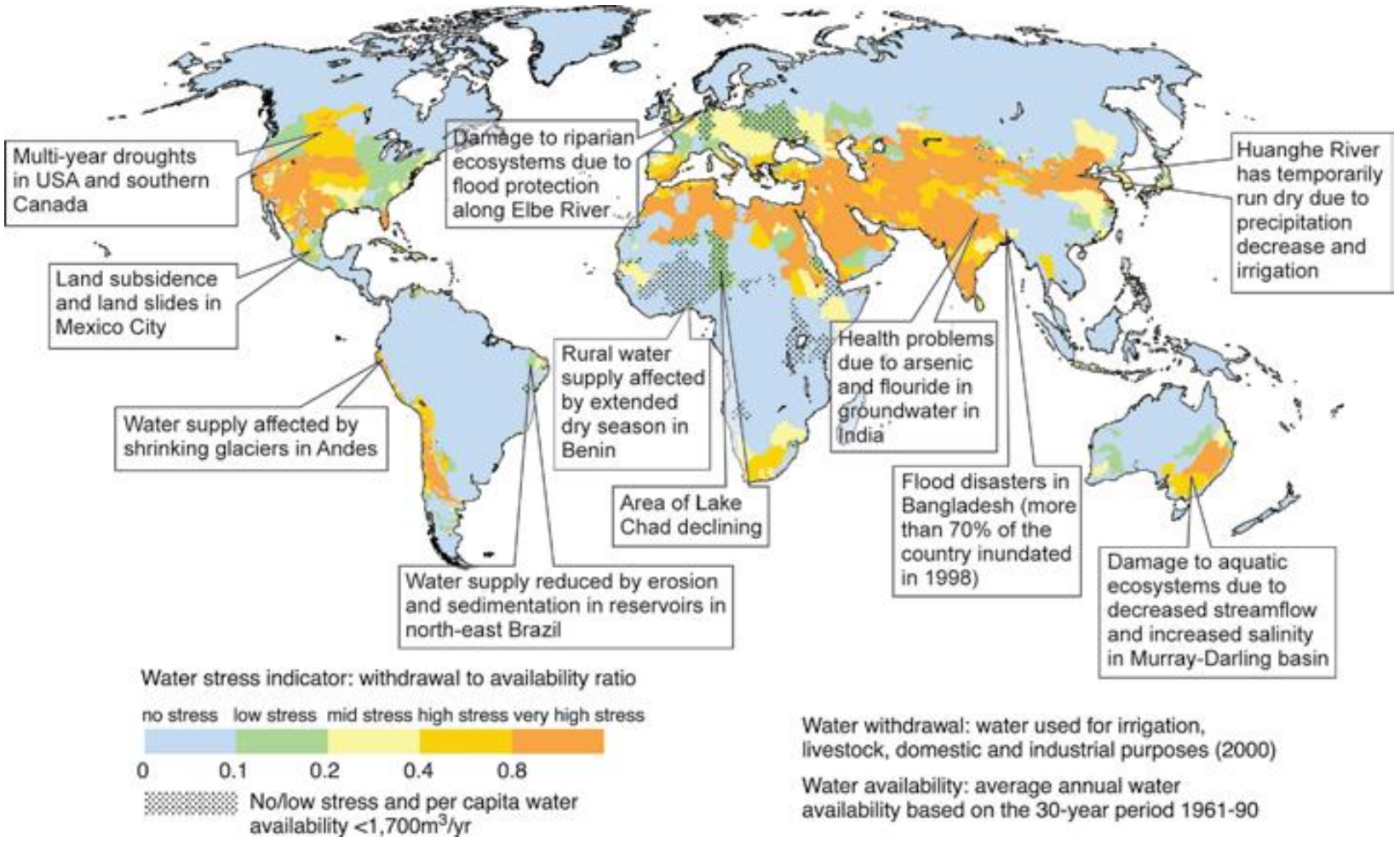
Water – at the center of the climate crisis

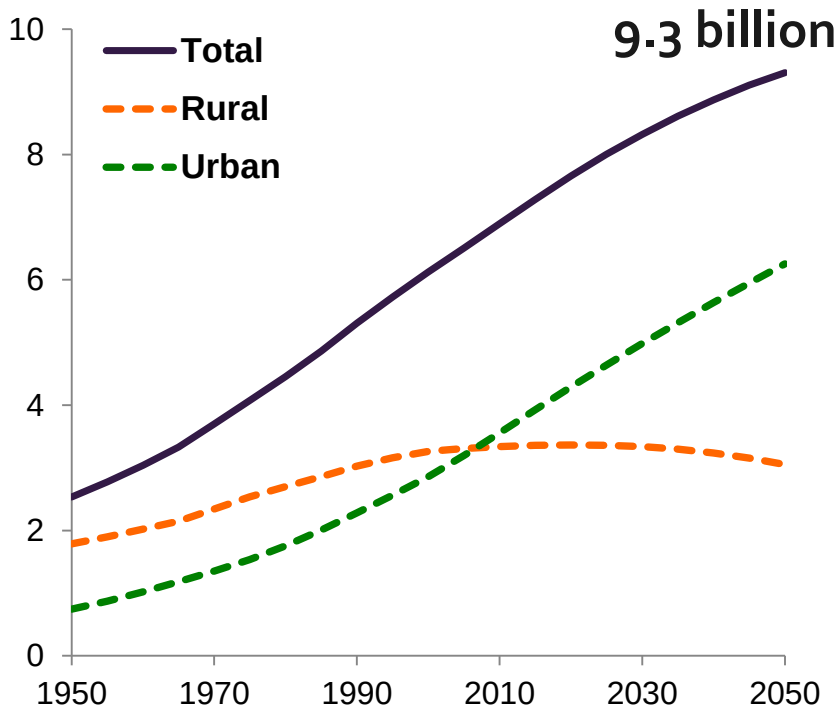


Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems.

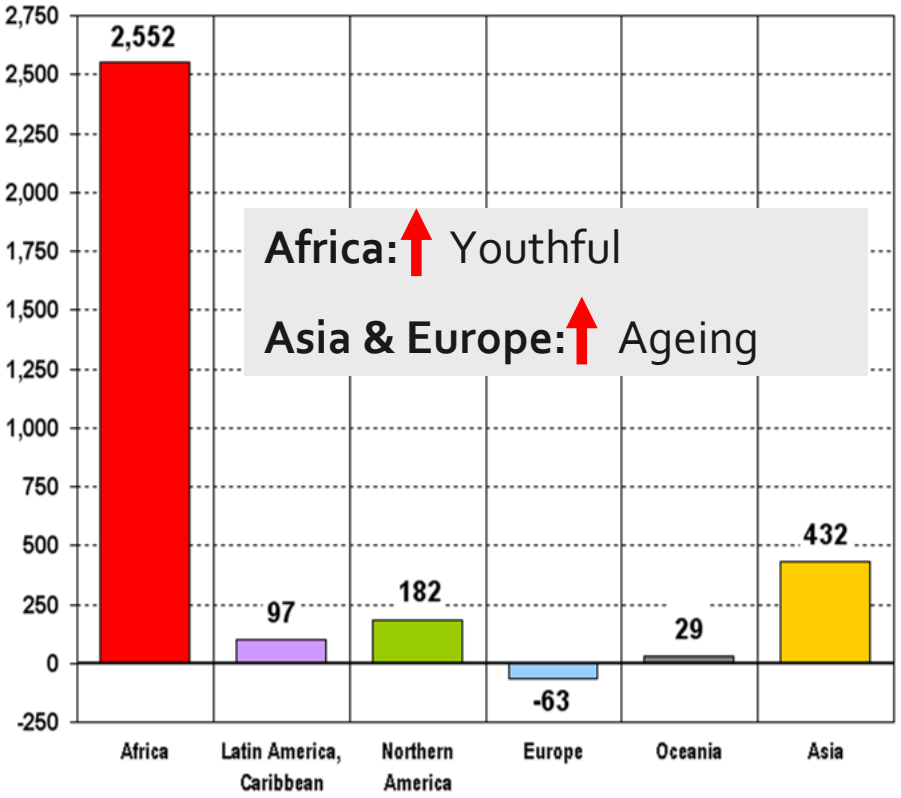
WATER CRISIS
FOR BIG CITIES AROUND THE WORLD

Increasing Population and Demographic Shifts

World population (billions)



Population change by region, 2010-2100 (millions)



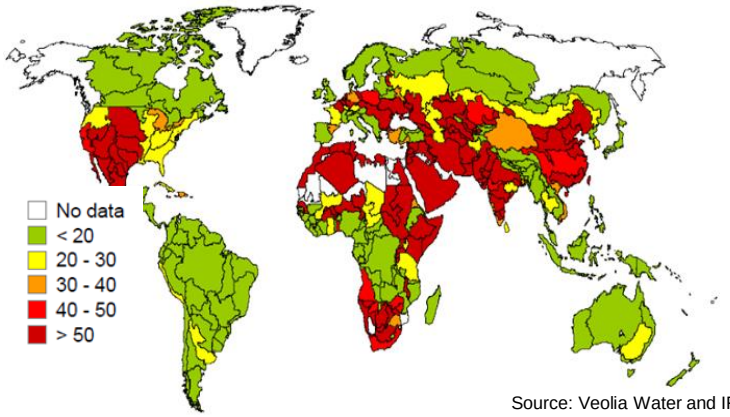
Larger and more urban population will demand more and better food

Agriculture Adds to Growing Water Challenges

Agriculture uses: 70% of WATER CONSUMPTION

Source: Farming First 2012

Water stress
Total renewable water withdrawn, BAU, 2050 (%)



Source: Veolia Water and IFPRI 2011

Water stress risk

36%	population	52%
39%	grain production	49%
22%	global GDP	45%

TODAY

Total population living in water scarce areas

2.5 BILLION PEOPLE

Global GDP generated in water scarce regions

US$9.4 TRILLION

By 2050

Total population living in water scarce areas

4.7 BILLION PEOPLE

90%

Global GDP generated in water scarce regions

US$63 TRILLION

570%

Source: Veolia Water and IFPRI 2011

Water Challenges

Water quantity issues

- Increasing demand of water in all sectors
- Over exploitation of groundwater
- Irrigation efficiency is low/waste of water
- Poor operation and maintenance of water structures
- Wide gap between irrigation potential created and potential utilized

Water/soil quality issues

- Bacteriological and chemical contamination of water
- Untreated/partially treated industrial/municipal effluent disposal in natural streams
- Over-extraction of ground water from deep aquifer
- Nonpoint source pollution- Fertilizers, herbicides, sediment, pathogens

Collaborative Research themes between Brazil and Illinois (*BRAZ-IL CREW*)

1. Water resources management

   - Save Water & Increase Food Production

2. Subsurface Drainage/stormwater management

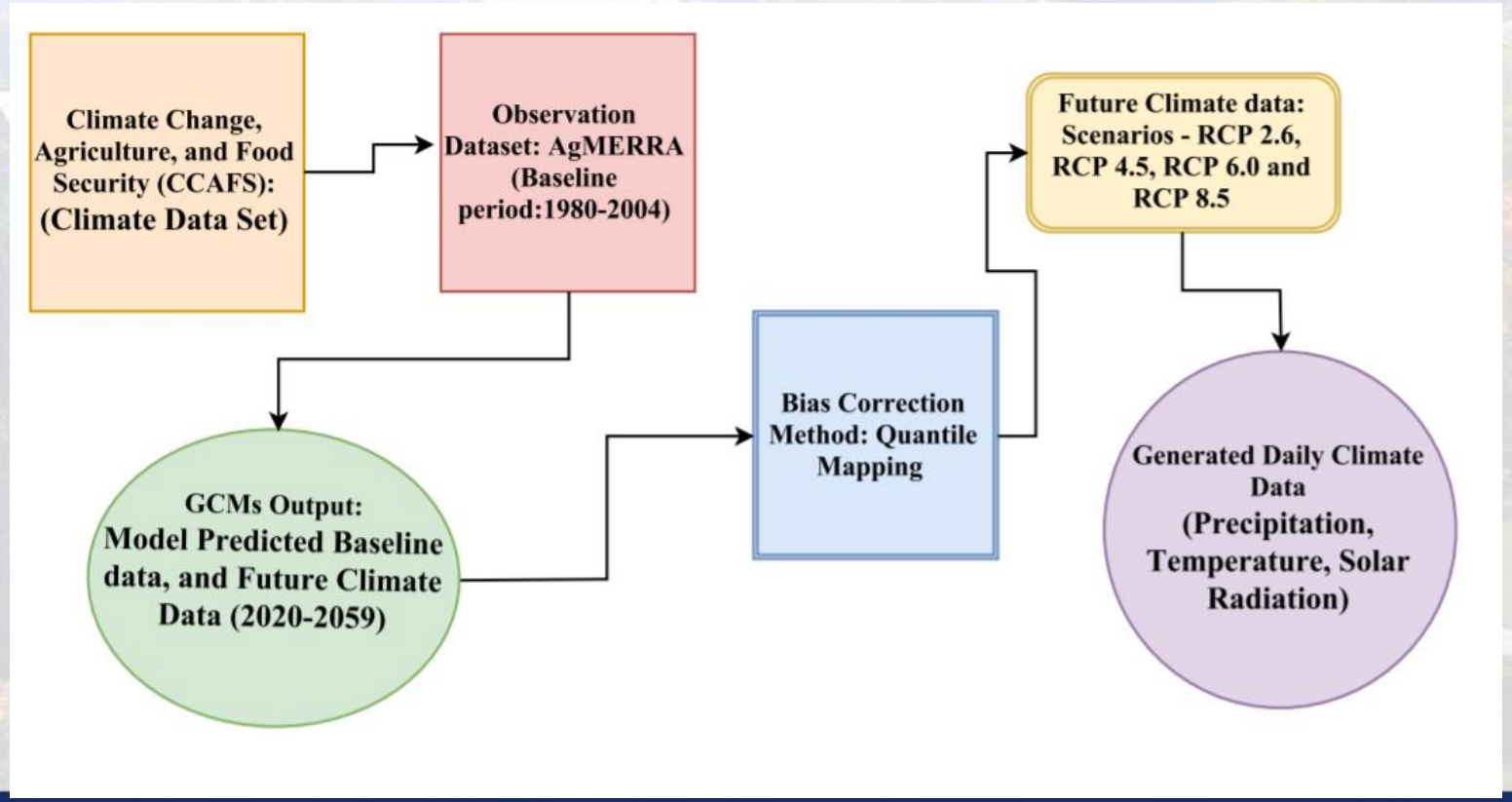
   - Prevent Flooding & Increase Food Production

3. Nonpoint source Pollution control

   – Enhance Water Quality & Ecosystem Health

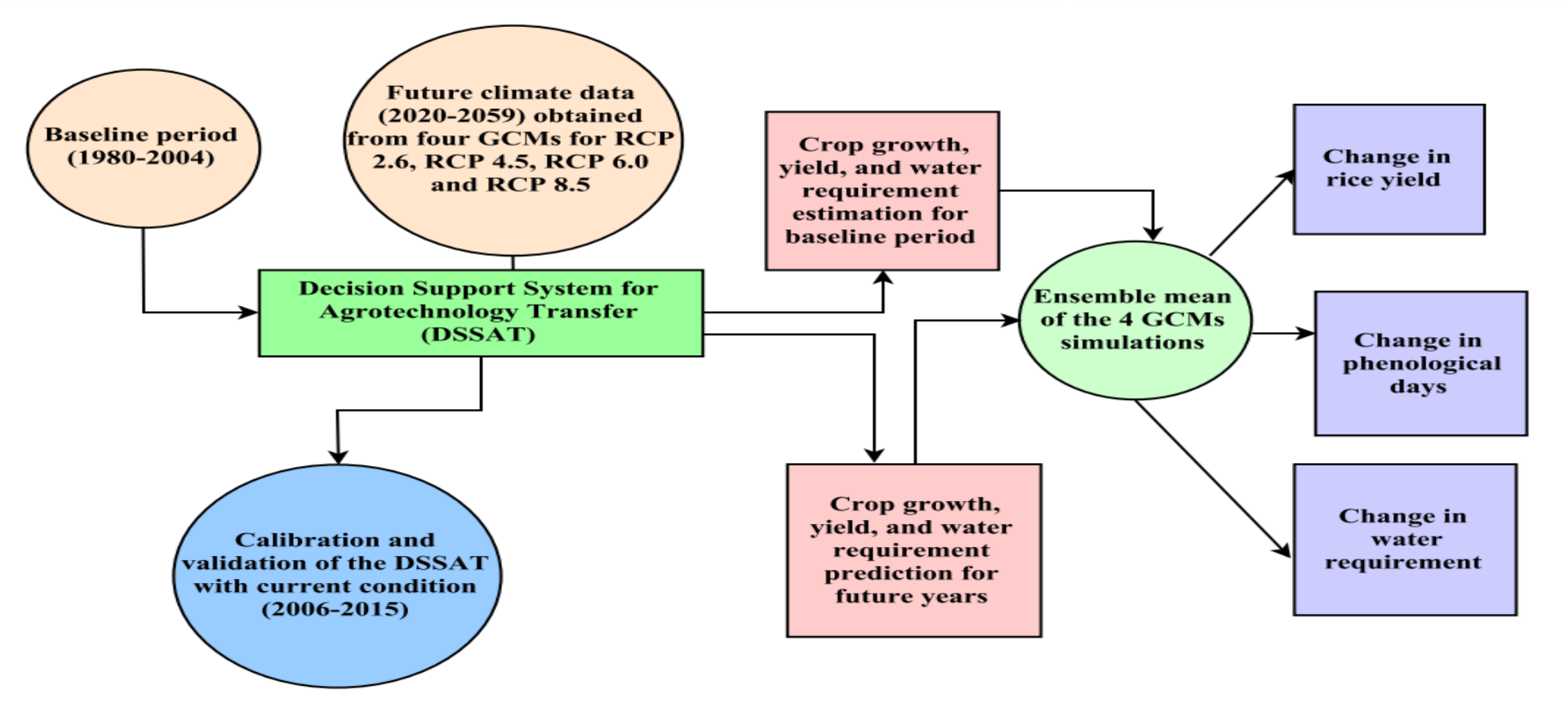
Reducing Irrigation & Increasing Food Production-
2015-2023 Data intensive study – climate, hydrology, soils, crop modeling

- **Steps in collection and correction of climate data**

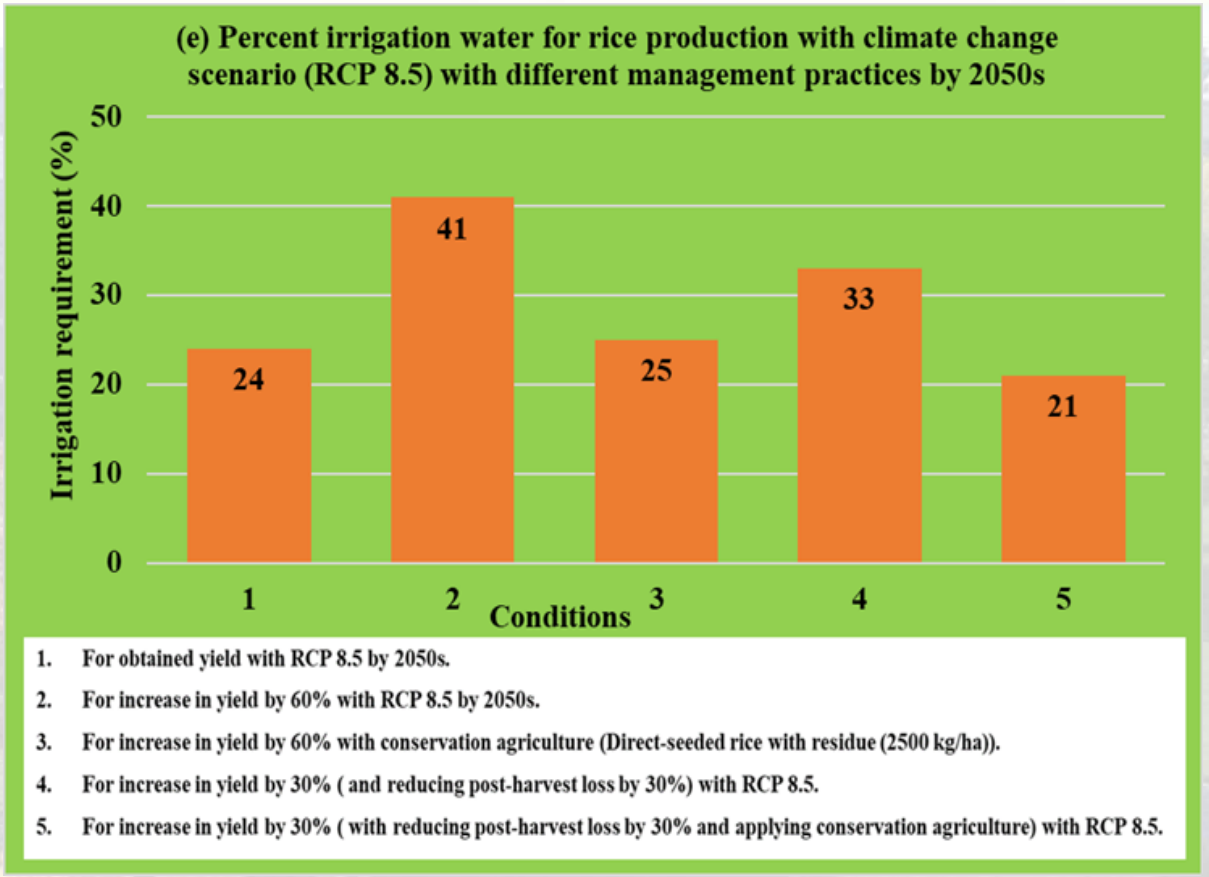


- **GCMs: 4 General circulation models GCMs**
- **Observation dataset** - "AgMERRA" has resolution of 0.25 degrees approx 25km.
- **Future Prediction:** 2020-2059 (40 years)

Estimation of climate change impact on rice production, phenological days, and water demand



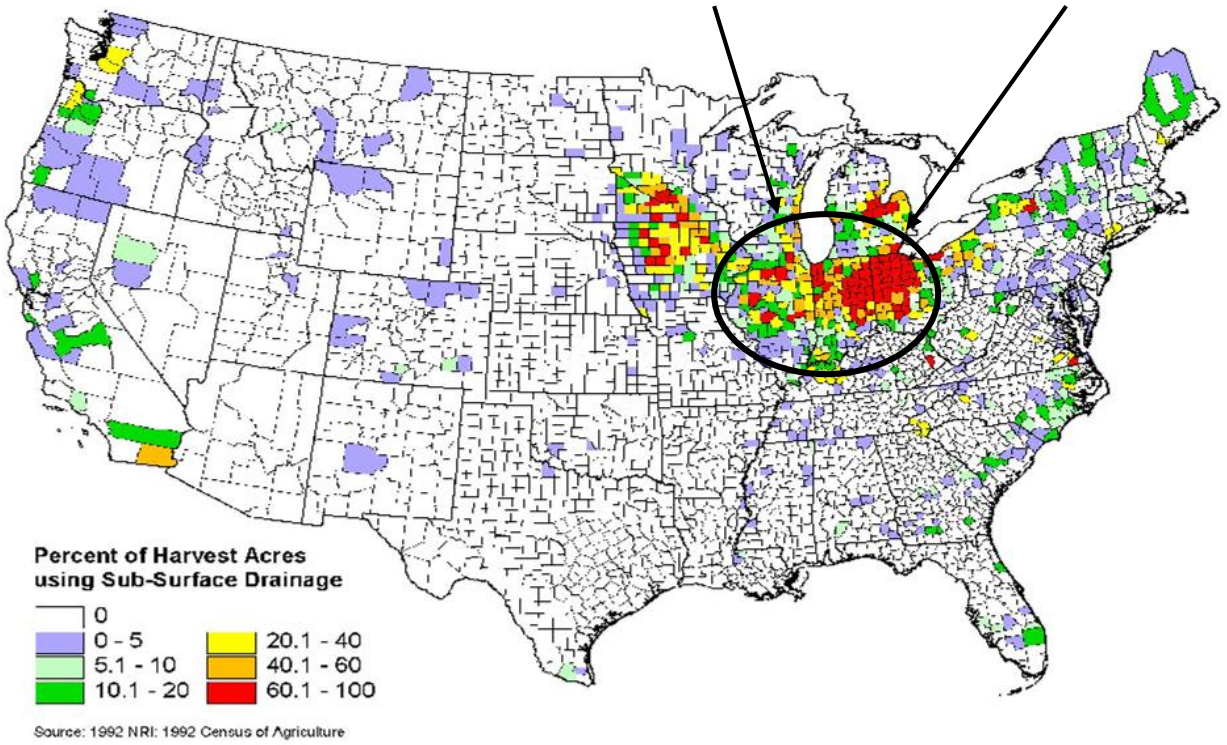
Predicted Irrigation requirement by 2050s



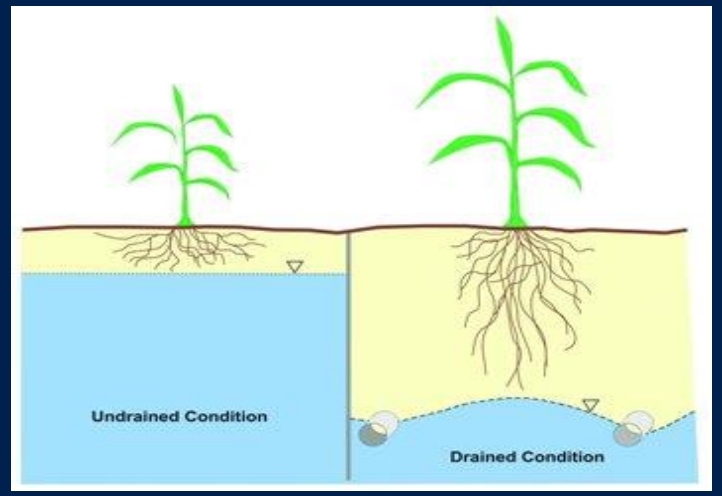
Subsurface Drainage – Flood Control, Stormwater Management, and Food Production

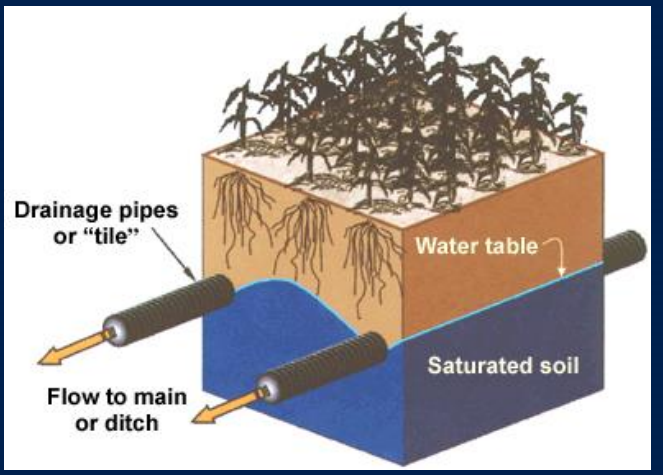
Extent of Subsurface Drainage ('92)

51 million ac of corn-belt

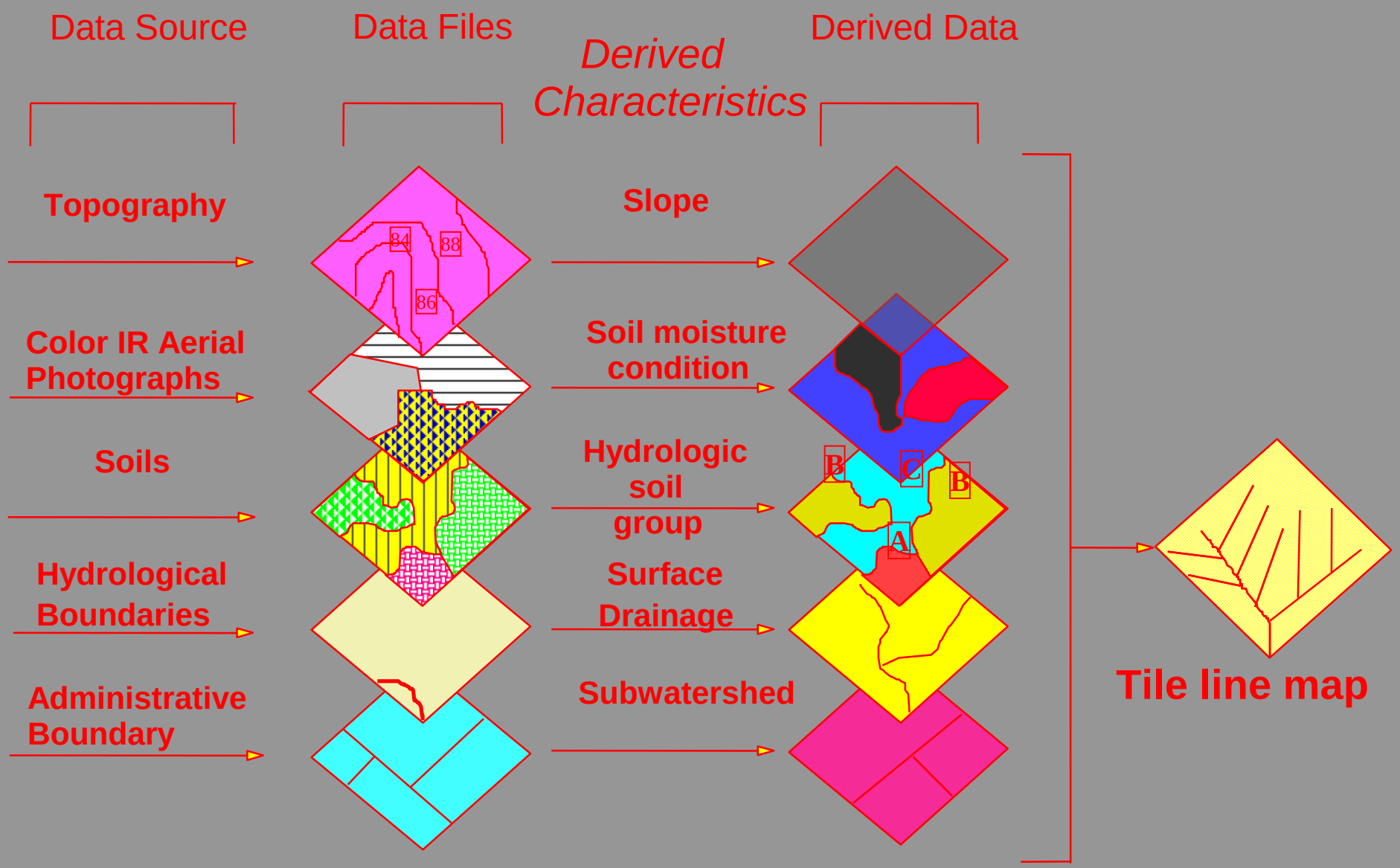


Benefits of Subsurface (Tile) Drainage – increasing food production, flood control, stormwater management

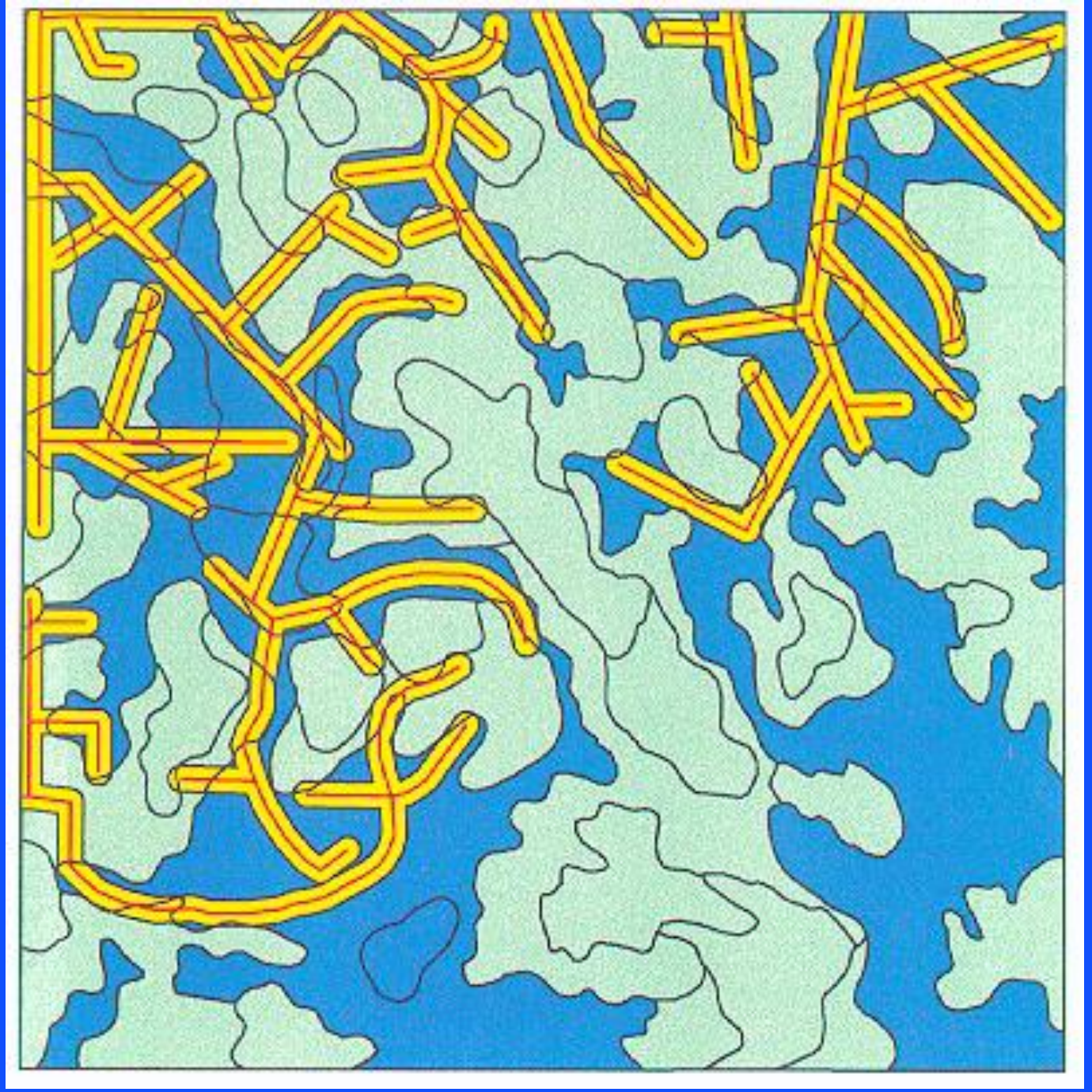




Data Intensive research- Delineation of Drainage Network

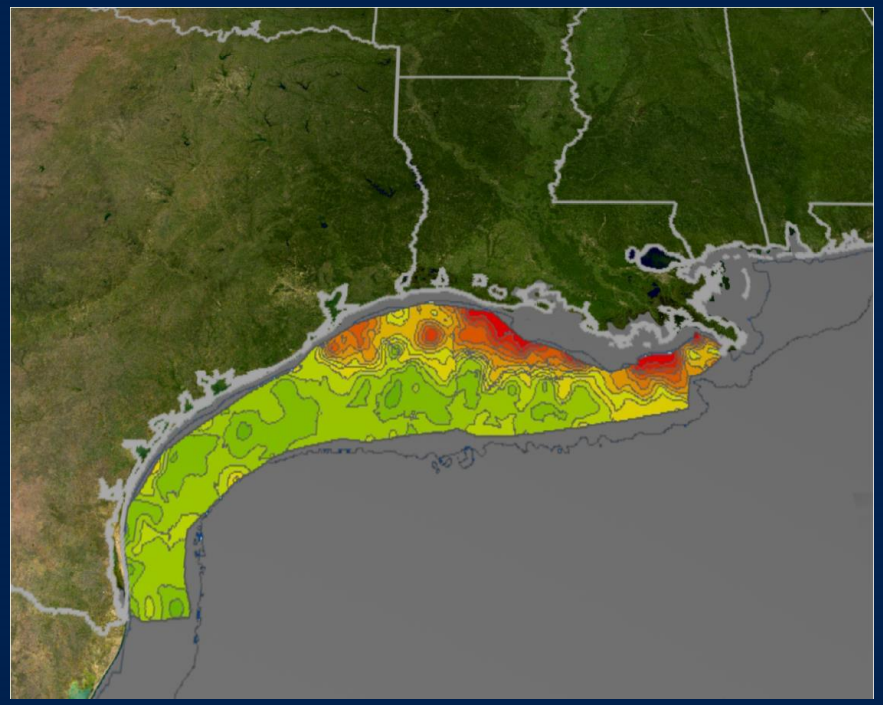


Subsurface drainage map

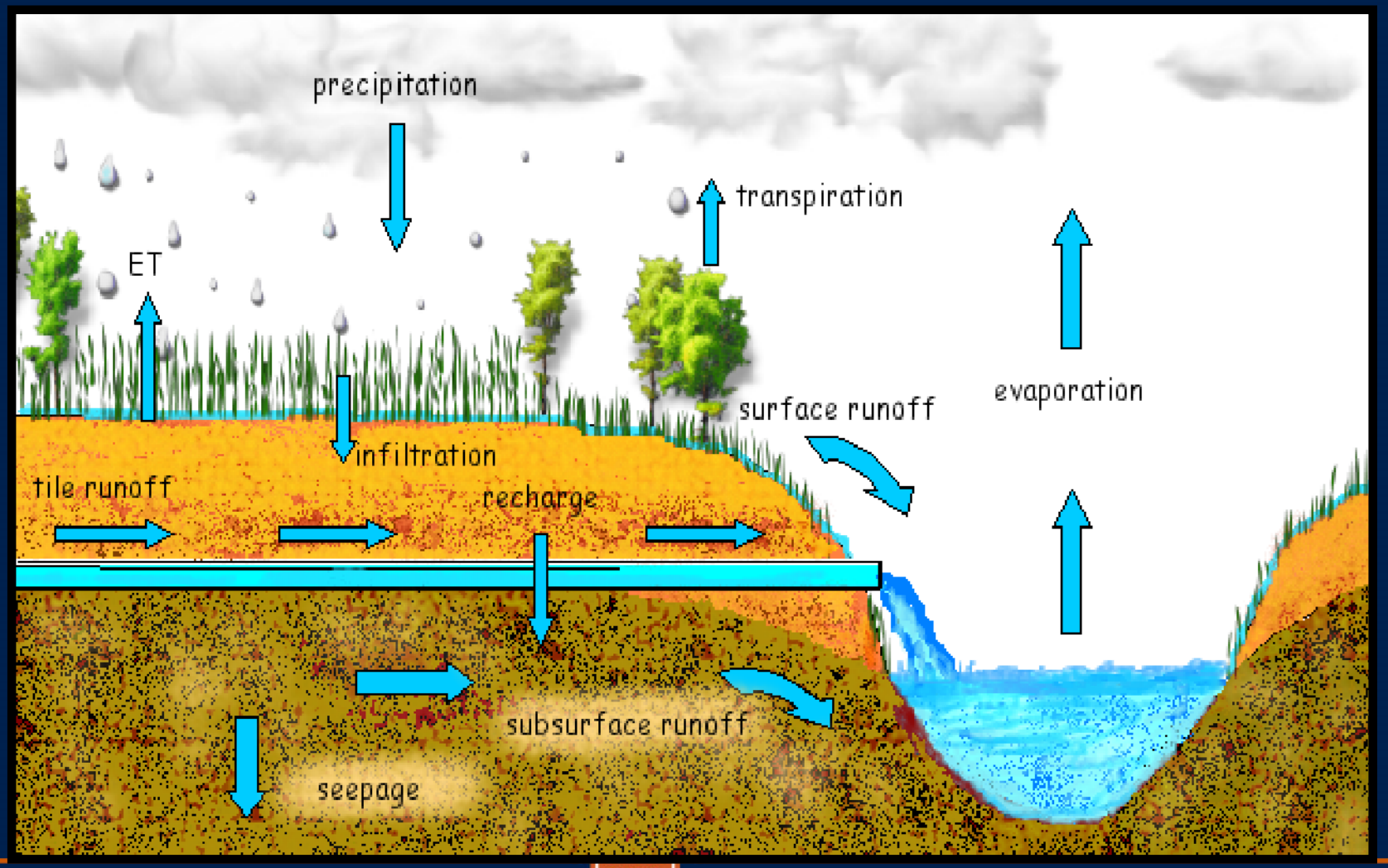


Water Quality Problems Associated With Nonpoint Source Pollution-

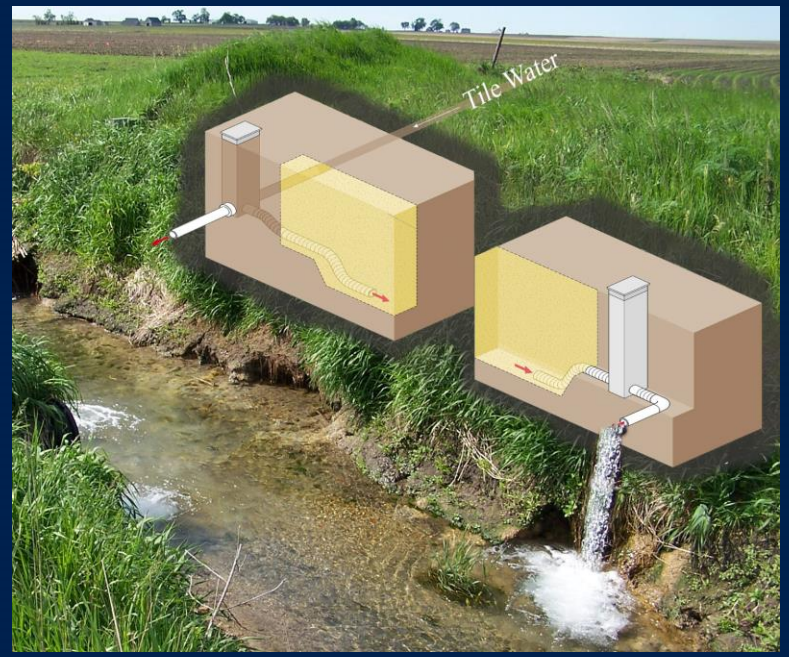
Nitrate-N, Phosphorus, Sediment



Water Quality Challenges – innovative solutions

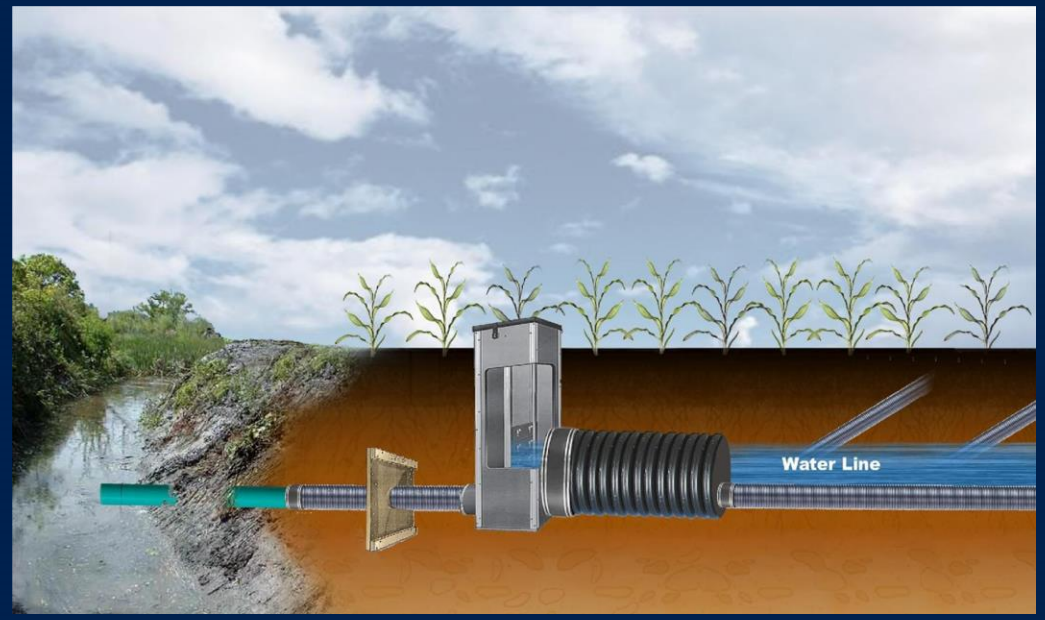


Biofiltration System



Edge-of-field biofilter

Biofiltration with controlled drainage



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State-of –the-art:

1. Technological advances: Improved irrigation methods, water measuring and water metering, improved sensors/technology, digitization and remote sensing tools
2. Prediction technology and advances in modeling
3. Incorporation of AI, IOT
4. Data analytics and handling (weather, soils, water, hydrology, crops, human)
5. Improved understanding/knowledge of the complex water- food-energy nexus
6. Virtual tools for seamless education, knowledge transfer, capacity building

“Water, thou hast no taste, no color, no odor; canst not be defined, art relished while ever mysterious. Not necessary to life, but rather life itself, thou fillest us with a gratification that exceeds the delight of the senses.” » ***Antoine de Saint-Exupery***

THANK YOU