Indian Creek
Watershed Management Authority

Flood Mitigation Goals: Input Form

If you were unable to attend the "Indian Creek Watershed Plan - Flood Mitigation Goals: Lunch, Learn & Input Session" on Wednesday, July 30th or would like to provide additional information, please fill out this form, save it and e-mail it to jennifer.fencl@ecicog.org.

Flood Mitigation / Hydrology Chapter of the Indian Creek Watershed Management Plan

Goal: Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed.

Objective 1: Communicate accurate information about flood risk to watershed residents and stakeholders.
- Raise awareness about watershed connections
- Provide information about specific actions
- Forum to convey flood prone areas & to receive flood impact reports
- Training opportunities for public sector staff & agricultural producers

Please provide your reaction, thoughts, ideas, suggested action steps, related stories, or questions below.

Flood Mitigation / Hydrology Chapter of the Indian Creek Watershed Management Plan

Goal: Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed.

Objective 2: Develop or update policies to better manage stormwater and floodplain areas.
- Encourage participation in the Community Rating System (CRS)
- Coordinate with Linn County Multi-jurisdictional Hazard Mitigation Planning process to align mitigation strategies
- Promote protection of a greenbelt along stream corridor

Please provide your reaction, thoughts, ideas, suggested action steps, related stories, or questions below.

Flood Mitigation / Hydrology Chapter of the Indian Creek Watershed Management Plan

Goal: Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed.

Objective 3: Implement practices to decrease runoff from urban and rural areas.
- Reduce then maintain stream discharge to targeted levels
- Treat runoff from the initial 1.25" rainfall event in urban areas
- Promote conservation easements as a mitigation tool
- Encourage all landowners to adopt two conservation practices
- Retrofit infrastructure to increase detention & infiltration

Please provide your reaction, thoughts, ideas, suggested action steps, related stories, or questions below.

Flood Mitigation / Hydrology Chapter of the Indian Creek Watershed Management Plan

Goal: Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed.

Objective 4: Develop a process and procedures to monitor and measure progress toward the objectives stated in the plan and to update the plan every 5 years.
- Update inundation models every 5 years
- Long-term flow and water quality monitoring
- Track implementation of BMPs
- Track public sector costs responding to / recovering from flood events

Please provide your reaction, thoughts, ideas, suggested action steps, related stories, or questions below.

Flood Mitigation / Hydrology Chapter of the Indian Creek Watershed Management Plan

Please provide your input to the overall goal or the hydrology section of the plan.

If you would like to provide additional information or receive future e-mails from the Indian Creek Watershed Management Authority, please fill out the information below.

First Name (optional)

Last Name (optional)

E-mail (optional)

Indian Creek

Watershed Management Authority

COOPERATION • FLOOD MANAGEMENT • CLEAN WATER

Hydrology Lunch, Learn & Input Session

July 30, 2014

Purpose

- Understand basic hydrology of the Indian Creek Watershed
- Overview of the modeling work
- Presentation of draft goals related to flooding
- Gather input about goals & action steps

ICWMA Members

- Linn County
- City of Marion
- City of Cedar Rapids
- City of Hiawatha
- City of Robins
- Linn SWCD

Draft Goal & Objectives

- Technical Team input
- Draw from other plans
- Goal and objectives are not final
- Objectives listed are examples
- Goal exercise designed to capture broad input

Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed

1. Communicate accurate flood risk information
2. Develop or update policies to better manage stormwater and floodplain areas
3. Implement practices to decrease runoff from urban and rural areas
4. Develop a process to monitor and measure progress toward the objectives

Obj. 1: Communicate

- Raise awareness about watershed connections
  - County Conservation Board PSAs
  - Host WFAN Women Caring for the Land event
- Provide information about specific actions
  - Workshops about infiltration practices
- Forum to convey flood prone areas & to receive flood impact reports
- Training opportunities for public sector staff & agricultural producers

Obj. 2: Policies

- Encourage participation in the Community Rating System (CRS)
- Coordinate with Linn County Multi-jurisdictional Hazard Mitigation Planning process to align mitigation strategies
- Promote protection of a greenbelt along stream corridor

Obj. 3: Practices

- Reduce then maintain stream discharge to targeted levels
- Treat runoff from the initial 1.25" rainfall event in urban areas
- Promote conservation easements as a mitigation tool
- Encourage all landowners to adopt two conservation practices

Obj. 4: Monitor & Measure

- Update inundation models every 5 years
- Long-term flow and water quality monitoring
- Track implementation of BMPs
- Track public sector costs responding to / recovering from flood events

Next Steps

- Goal setting process (July – Sept.)
  - August 13th – water quality
  - September 10th – social assessment
  - Sept. 24th or Oct. 1st – landcover & urban assessment
- Develop Implementation sections (Aug. – Oct.)
- Public comment on the draft plan (Nov.)
- Final plan to policy makers for adoption (Dec. 2014)

Questions or comments?

Jennifer Fencl

East Central Iowa Council of Governments

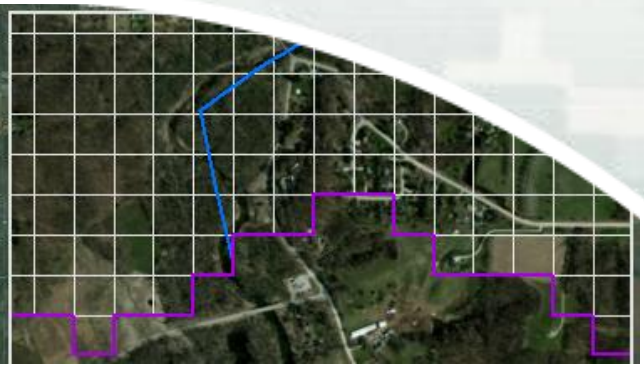
319-365-9941 ext. 131

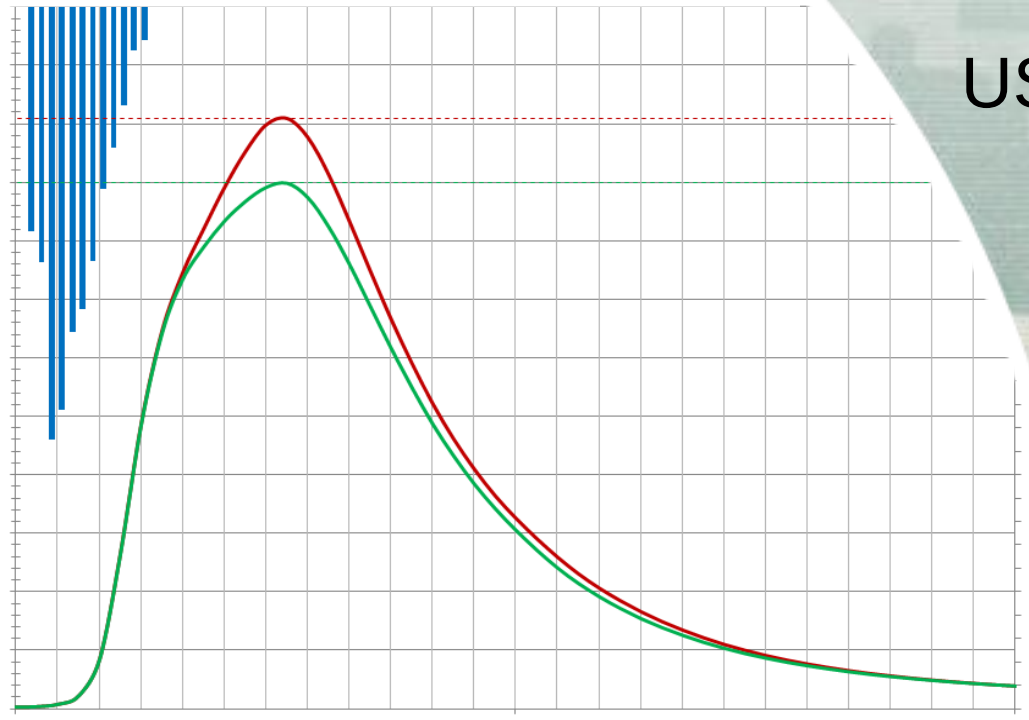
jennifer.fencl@ecicog.org

ICWMA Website

www.indiancreekwatershed.weebly.com

Watersheds, Hydrology and Flooding





Greg Karlovits, *P.E., CFM*
Hydrologist
US Army Corps of Engineers
Rock Island District

US Army Corps of Engineers
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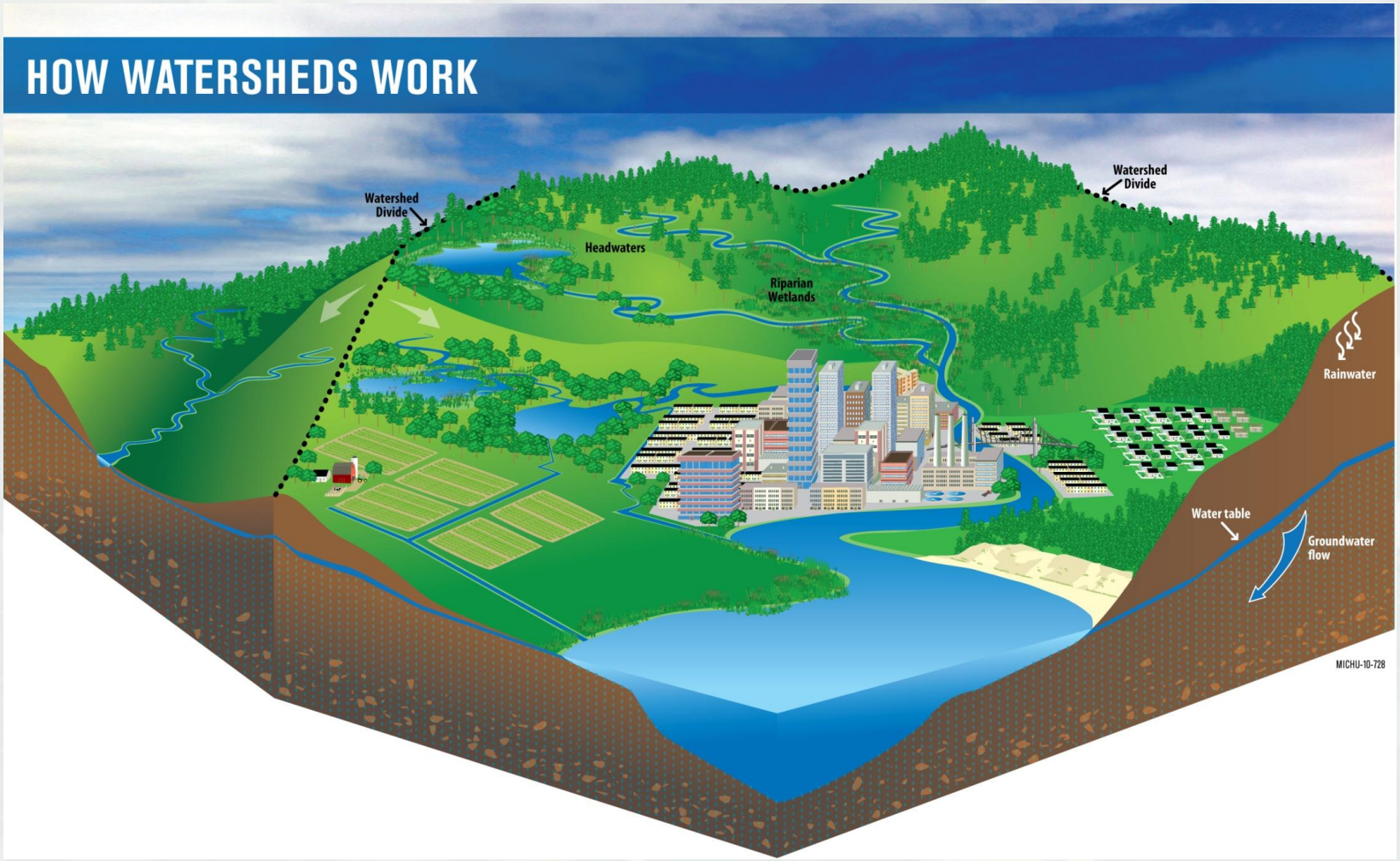
Outline of Topics

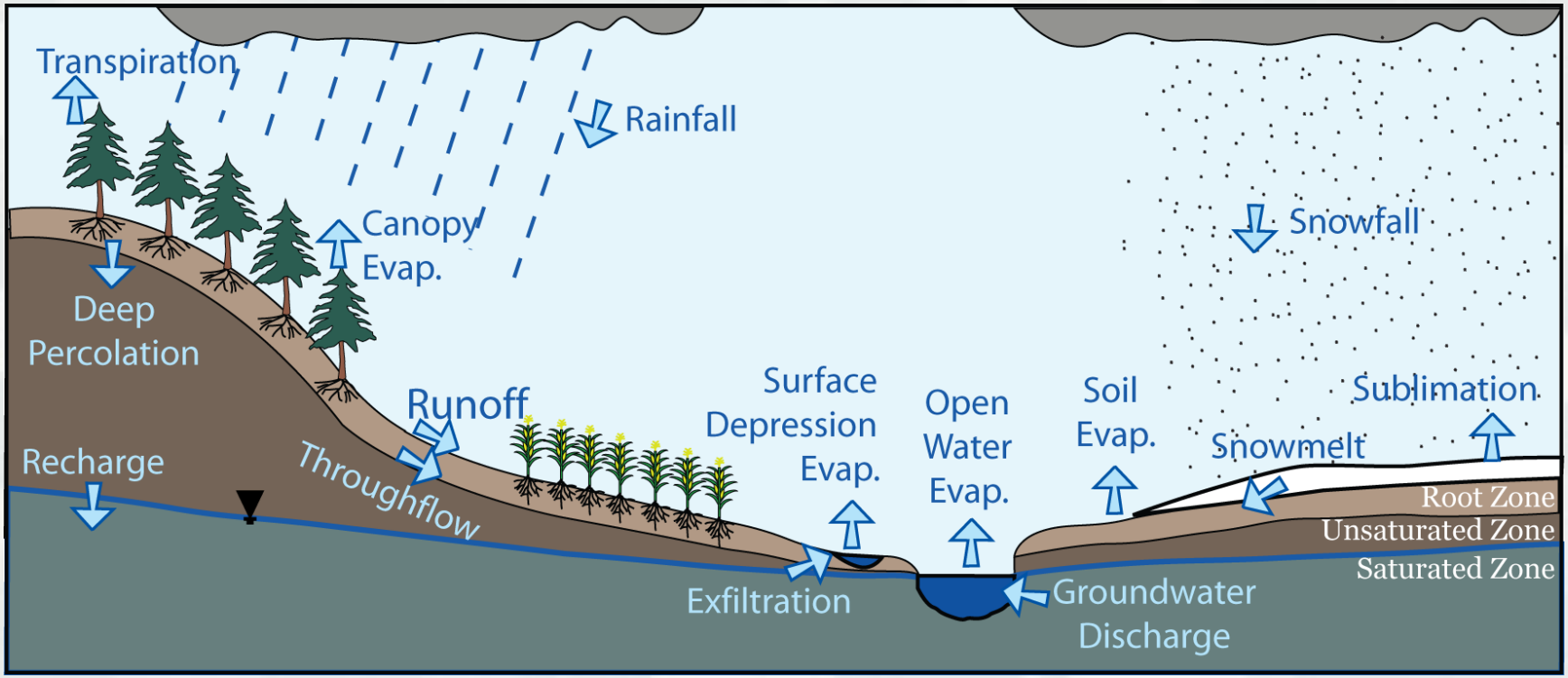
- ►Before lunch:
- Watersheds and basics of hydrology
- Floodplains
- ►During/after lunch:
- USACE work in Indian Creek/Cedar River
- Lessons learned/recommendations

What is a watershed?



A “neighborhood” where all the water gathers at one point

Hydrology 101



DNR-ISU Video

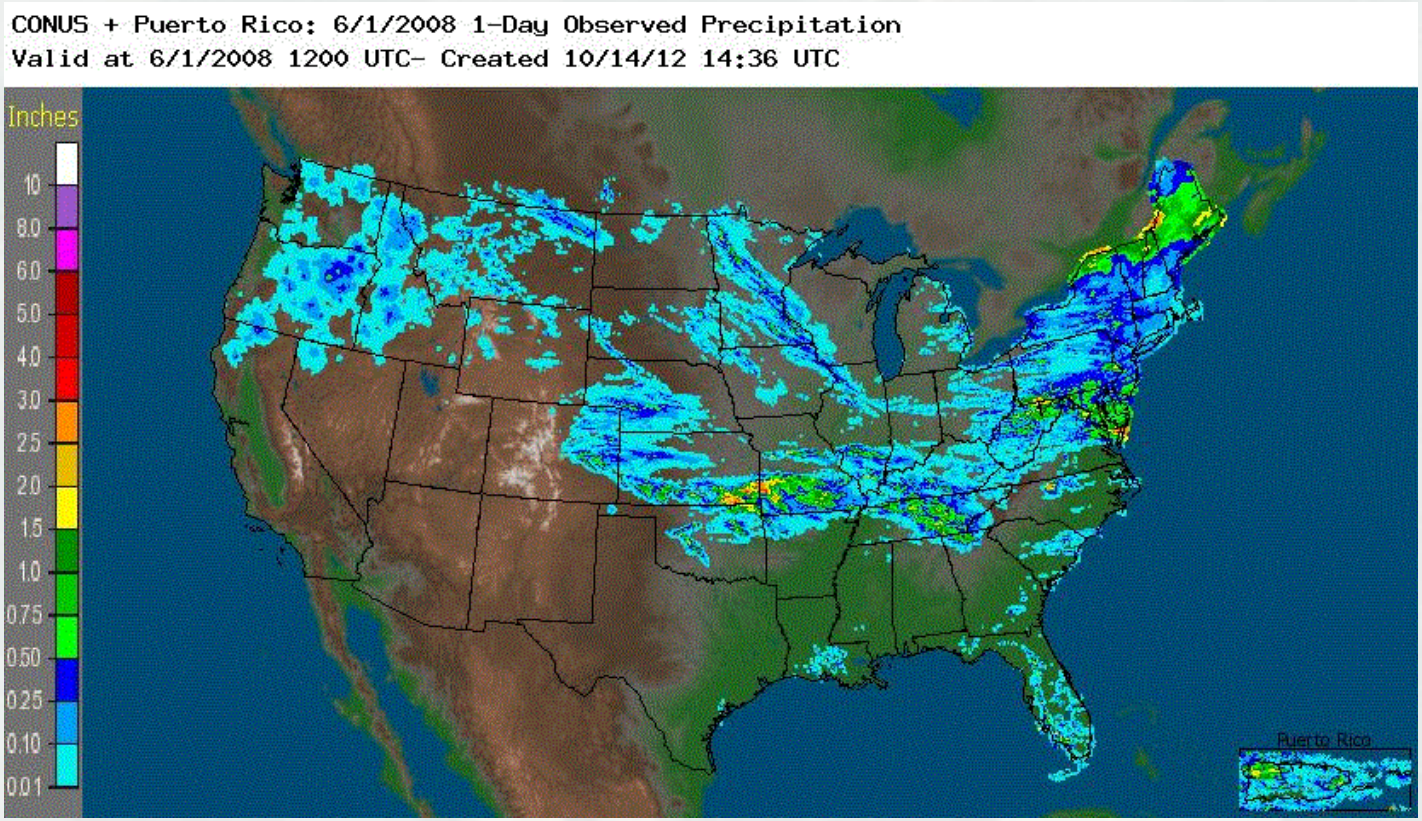
IOWA STATE UNIVERSITY
Extension and Outreach

http://www.extension.iastate.edu/floodinginiowa

Video 7: Factors Affecting Flooding (0:48-2:40)

Precipitation

Intensity-Duration-Frequency-Extent



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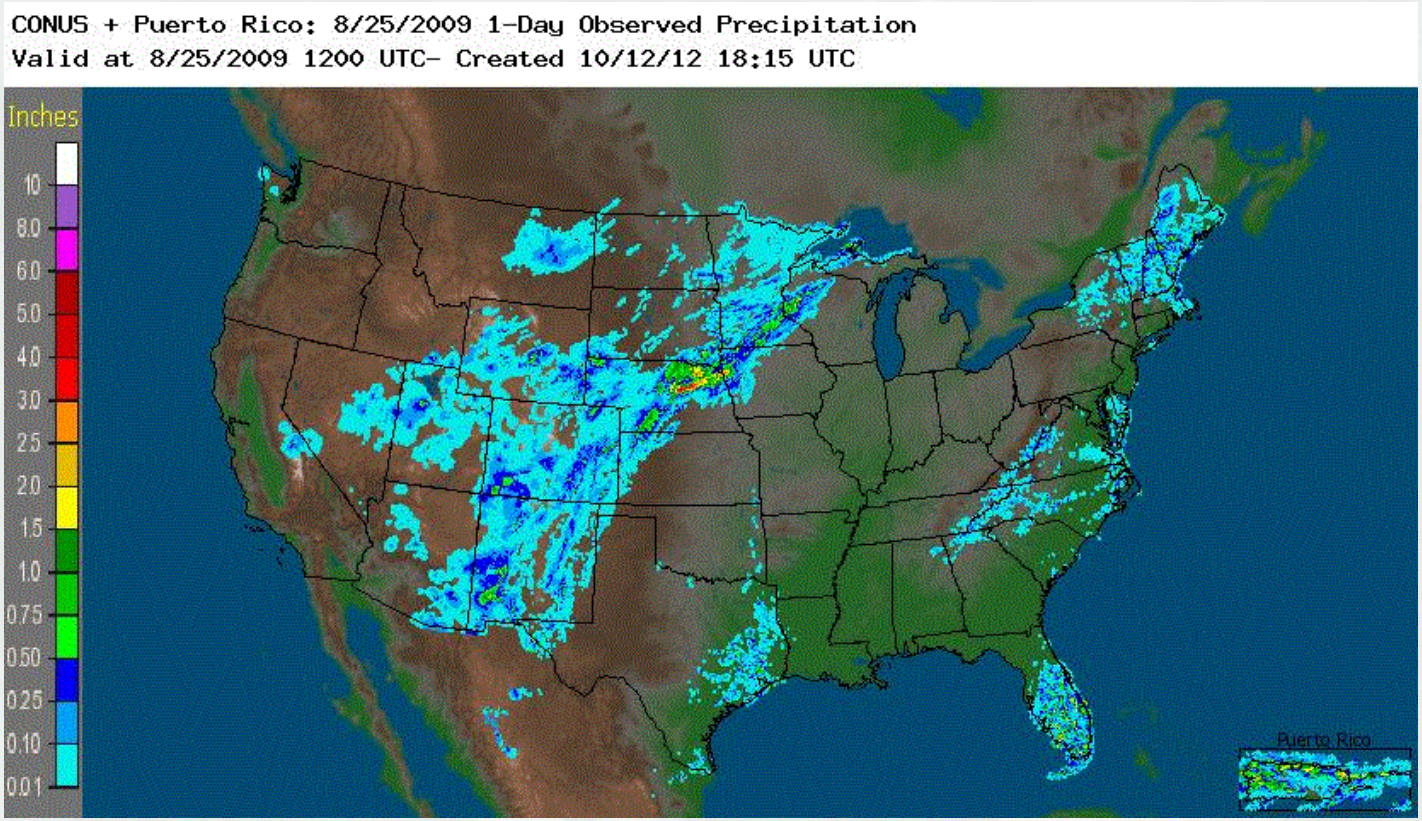
Precipitation

Intensity-Duration-Frequency-Extent



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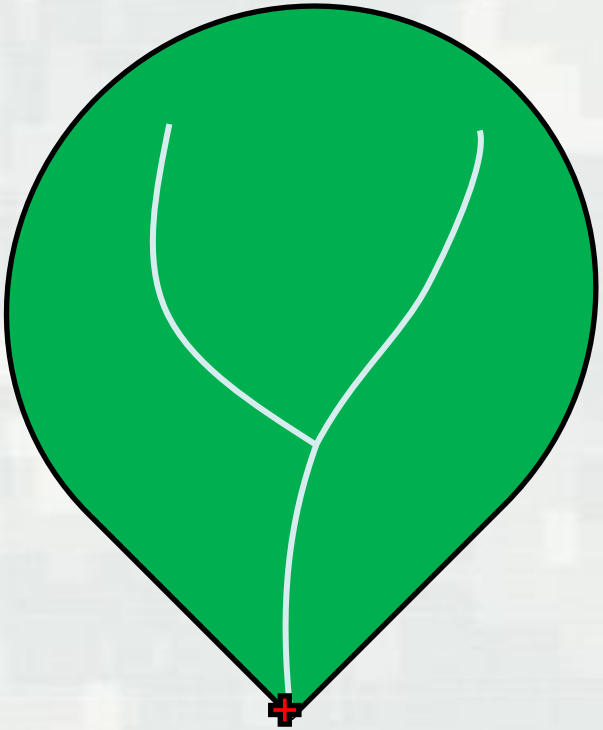
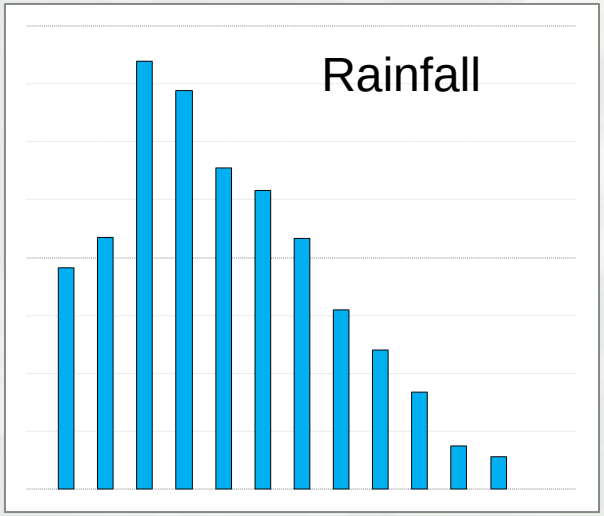
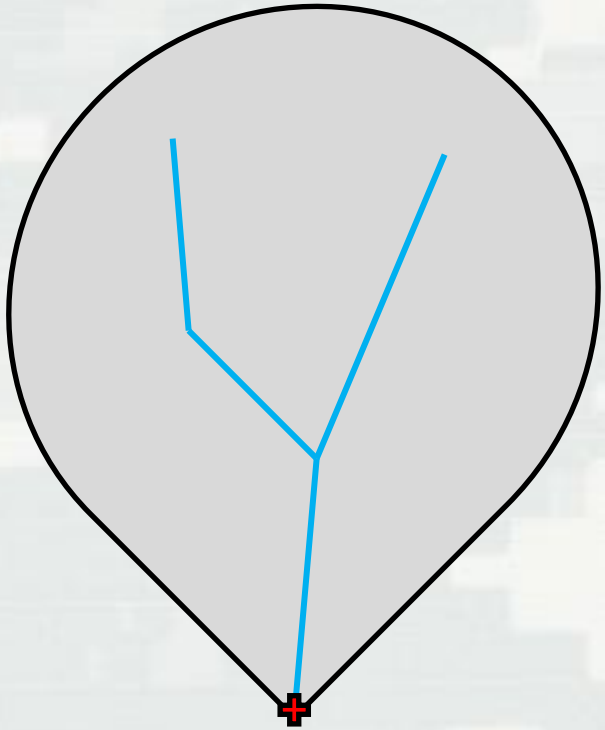
Runoff

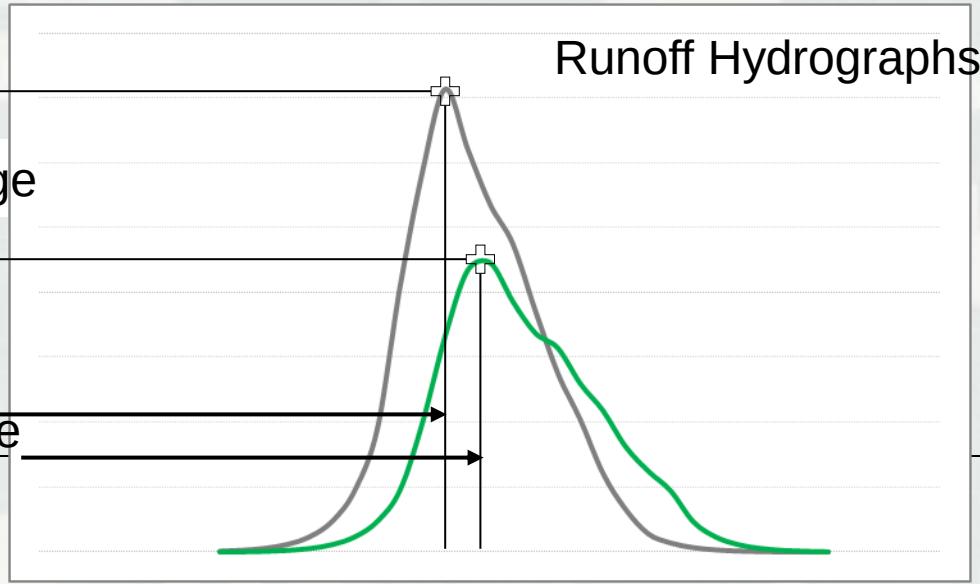


Natural Watershed





Urbanized Watershed



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DNR-ISU Video

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Extension and Outreach

http://www.extension.iastate.edu/floodinginiowa

Video 7: Factors Affecting Flooding (2:41-8:00)

Floodplains

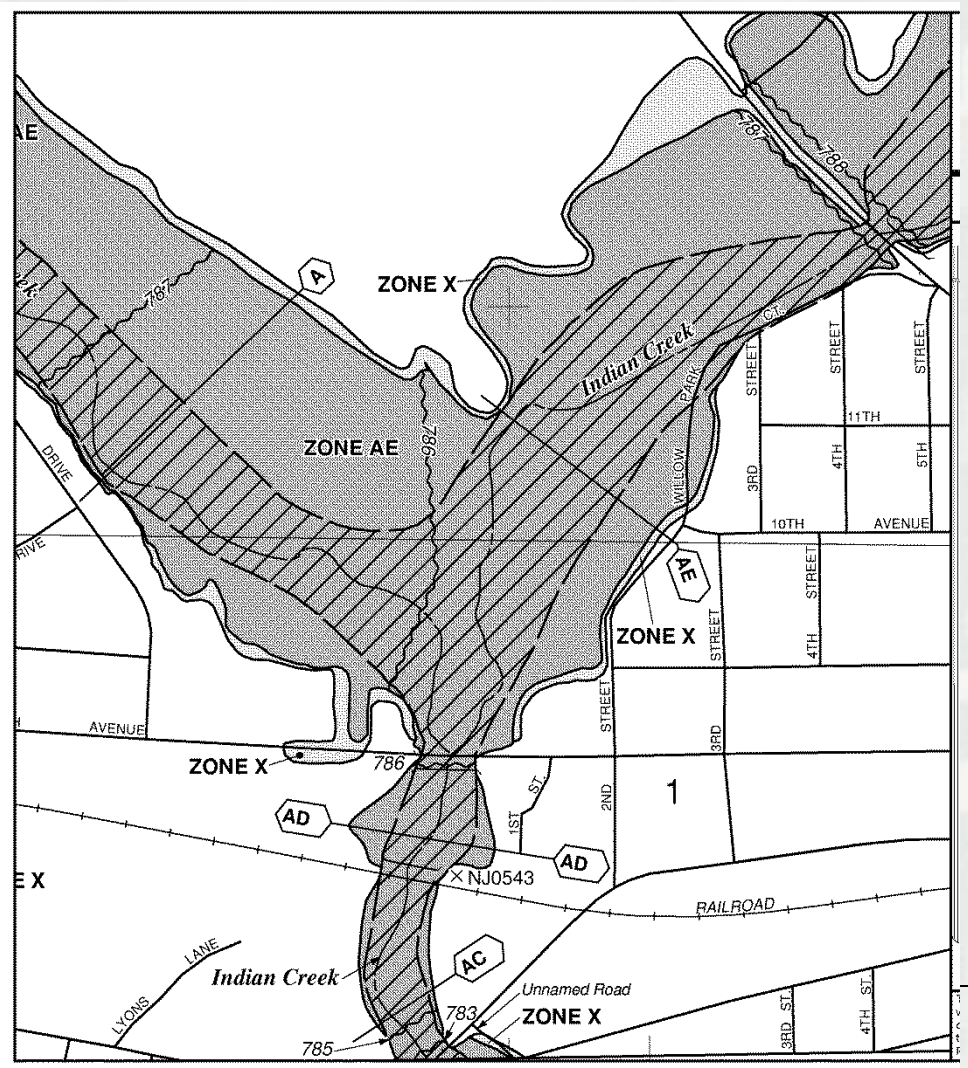
DNR-ISU Video

IOWA STATE UNIVERSITY
Extension and Outreach

http://www.extension.iastate.edu/floodinginiowa

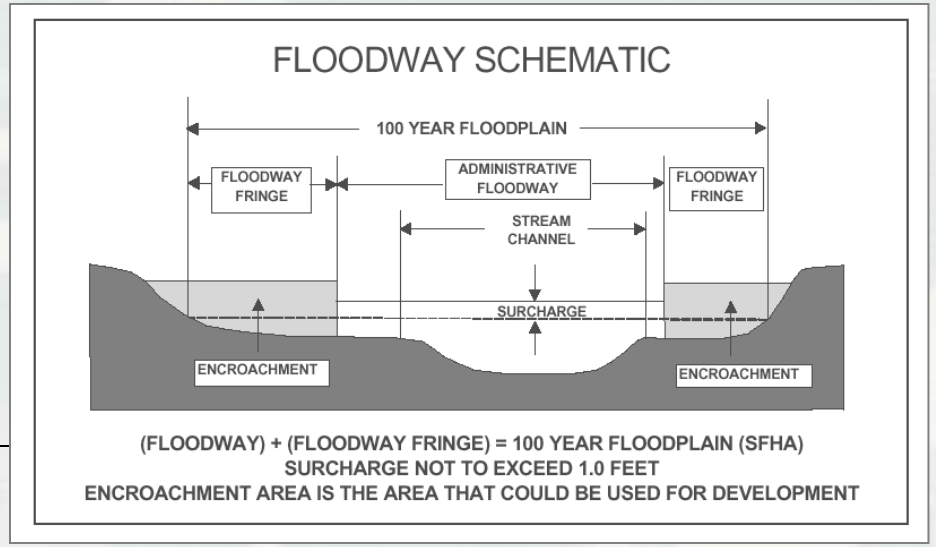
Video 5: Watersheds, Rivers and Floodplains (5:00-8:00)

Regulatory Floodplains



Flood Insurance Rate Map (*FIRM*)

- Special flood hazard areas (SFHA)
- Base flood elevation (BFE)
- Cross-section locations
- Floodway delineation



Probability of Flooding

Less than 1/500 in <u>any</u> year

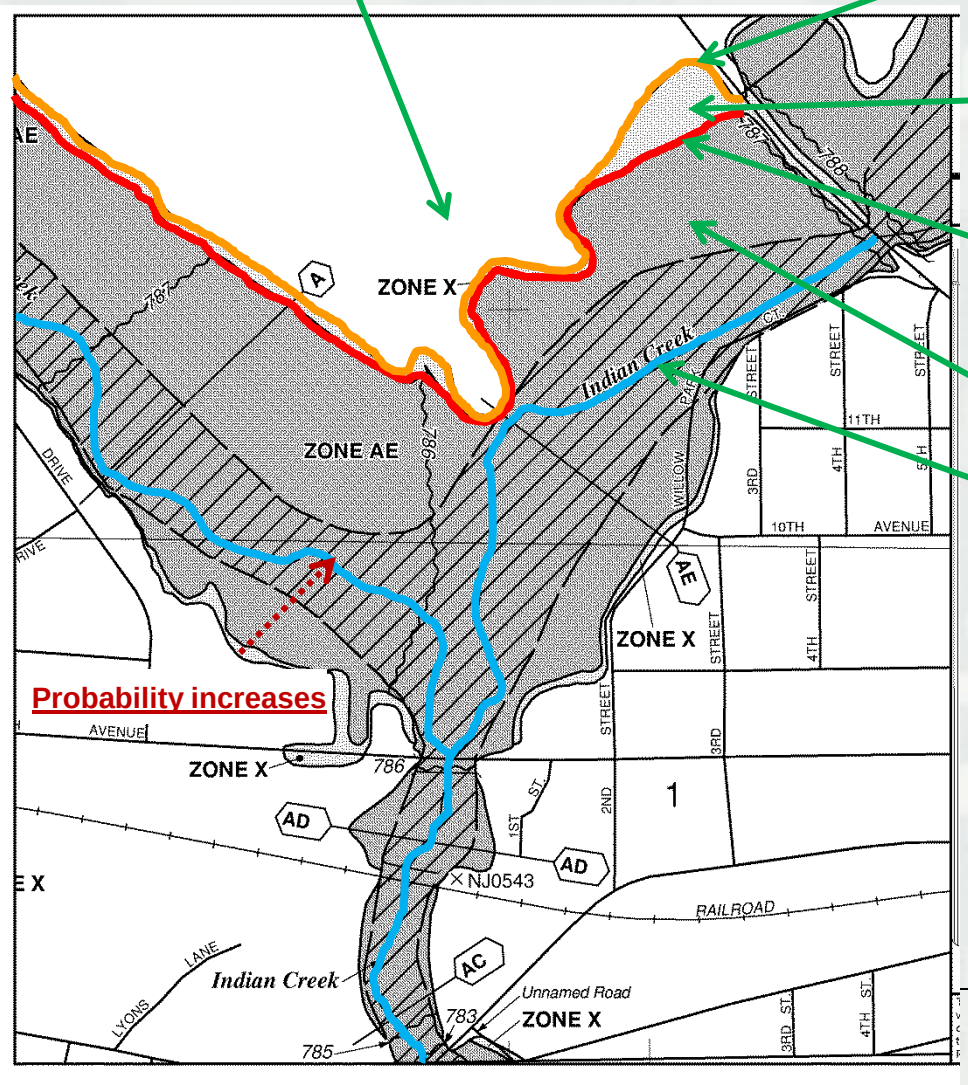
1/500 in <u>any</u> year

Between 1/100 and 1/500 in <u>any</u> year

1/100 in <u>any</u> year

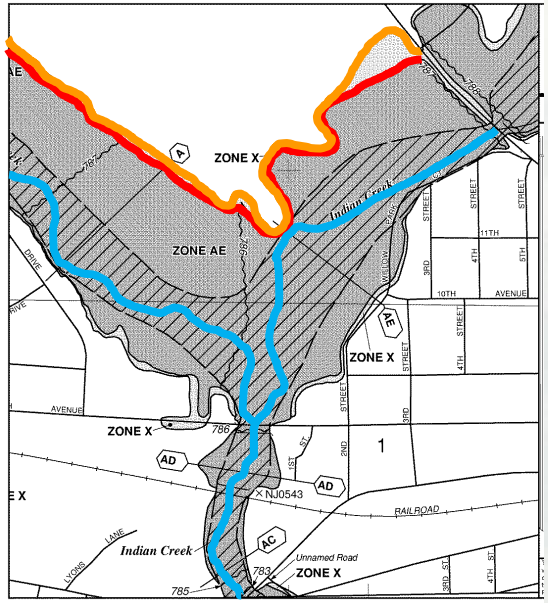
Higher than 1/100 in <u>any</u> year

(Source of flooding)



1/500	0.2%
1/100	1%
1/50	2%
1/25	4%
1/10	10%
1/2	50%

30 Year Mortgage in the 100-Year Floodplain

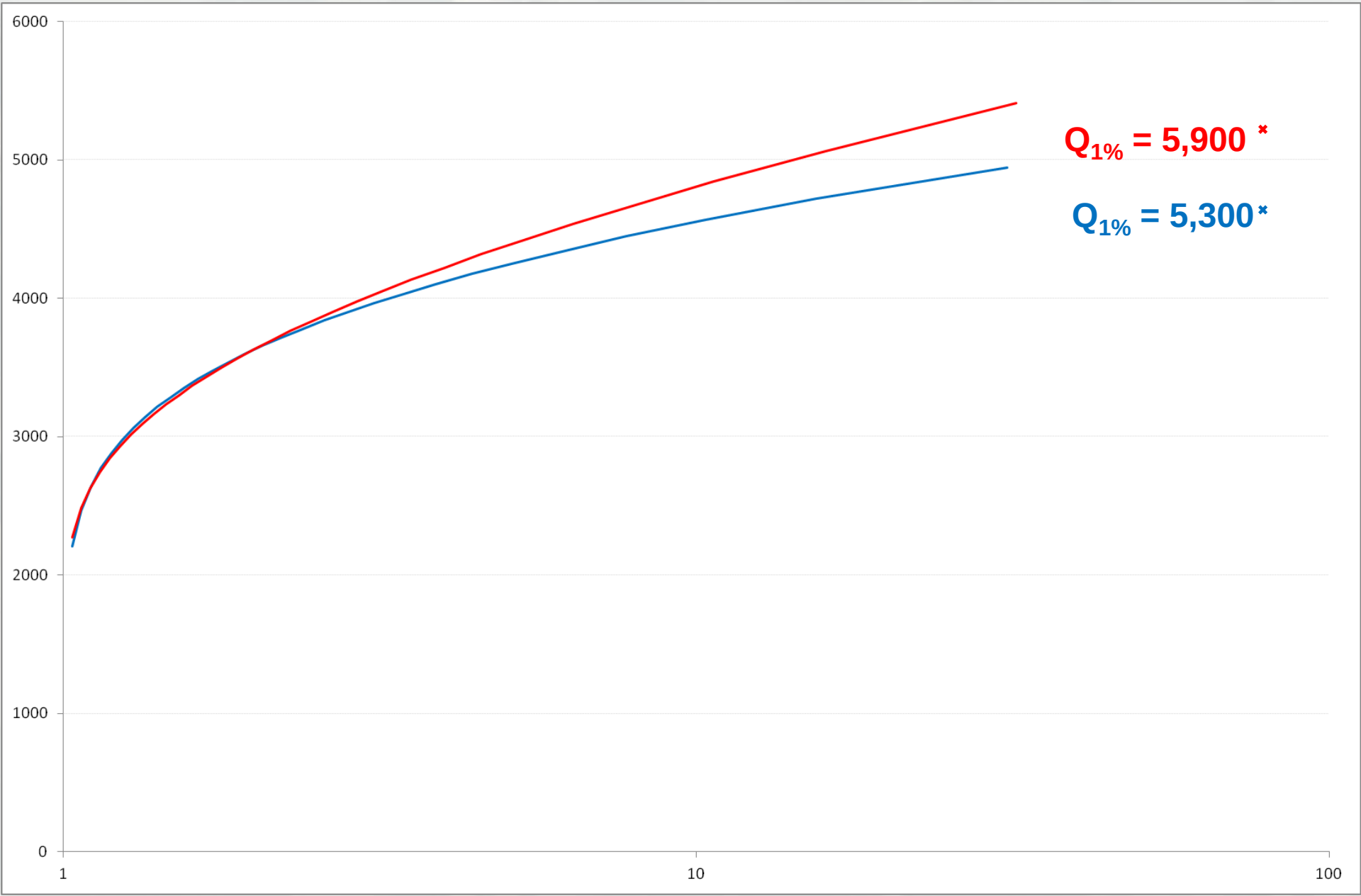


Flood Average Return Interval	Annual Probability of Exceeding	Probability of Exceeding At Least Once in 30 Years
500 years	0.2 %	5.8 %
100 years	**1 %**	**26 %**
50 years	2 %	45 %
25 years	4 %	71 %
10 years	10 %	96 %
2 years	50 %	100 %

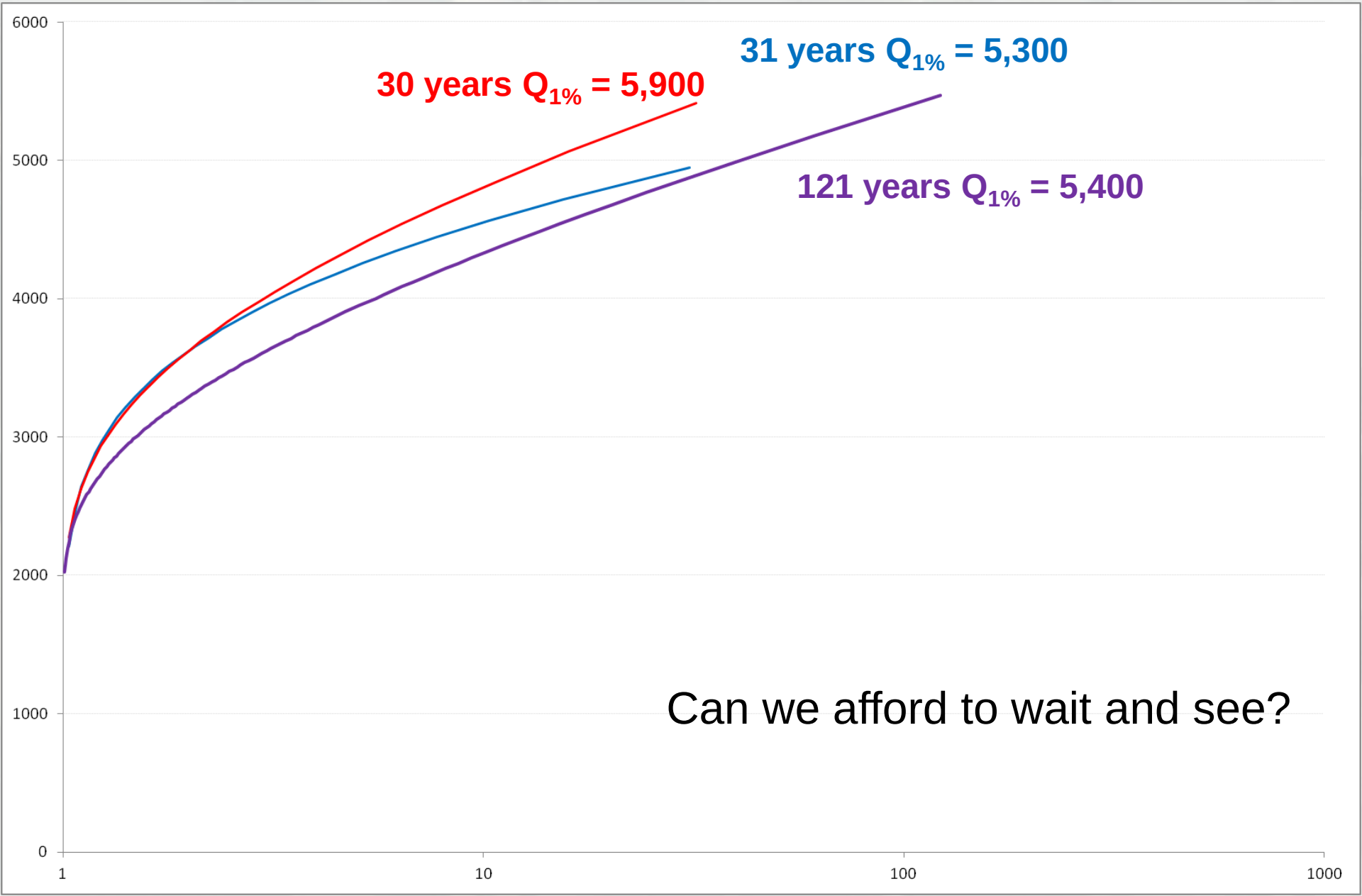
Flood Hazard Mapping

1. 1% (100-year) flow is estimated
    1. Flow frequency analysis of systematic record
    2. Rainfall-runoff modeling
    3. Regression equations
2. $Q_{1\%}$ modeled with hydraulic model for system
3. Area inundated by $Q_{1\%}$ is the 100-year floodplain

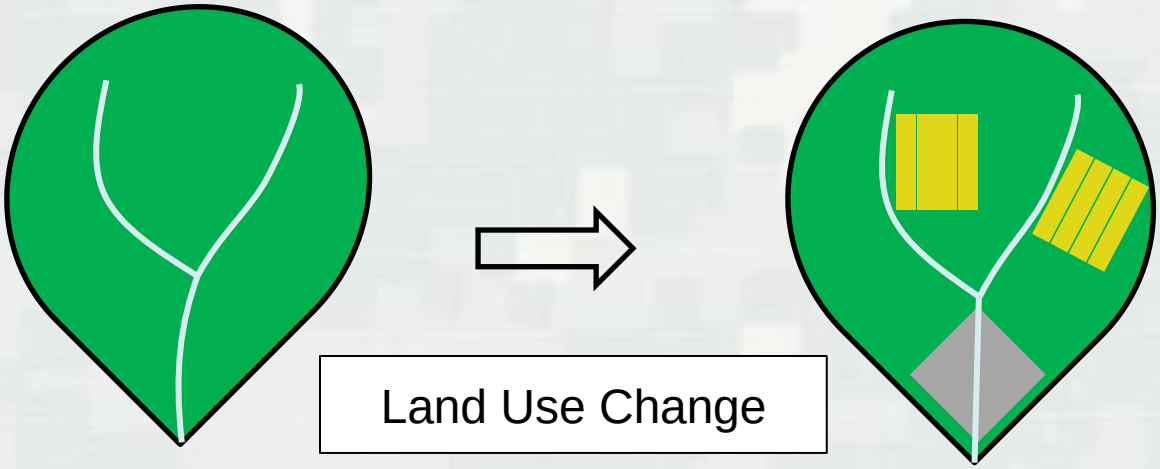
One More Year of Data



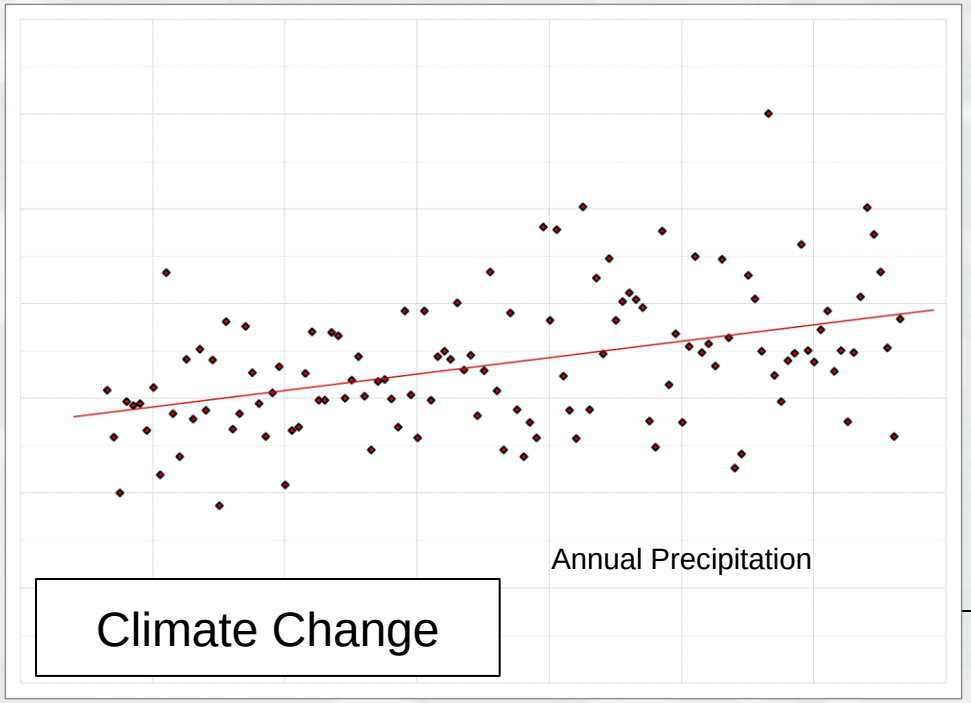
An Imperfect View of Reality



Changing Hydrology



Land Use Change



Climate Change

Defining Risk

Likelihood the event happens

Consequence of the event happening

Risk = probability x consequence x uncertainty

Unknowns about probability or consequence of event

Managing Risk

- Reduce probability of the event
- Reduce consequence of the event
- Reduce uncertainty

  - What is in your control?
  - What is cost-effective?
  - What do you give up?

Questions

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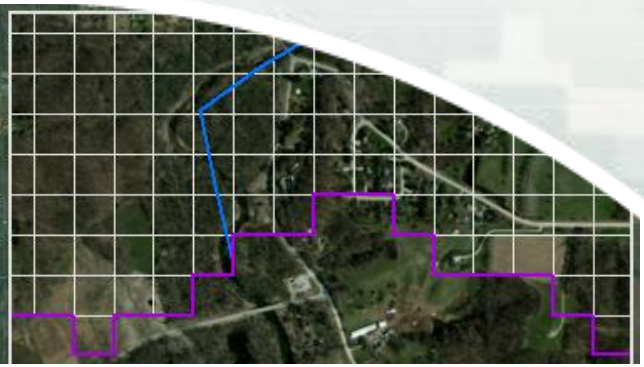
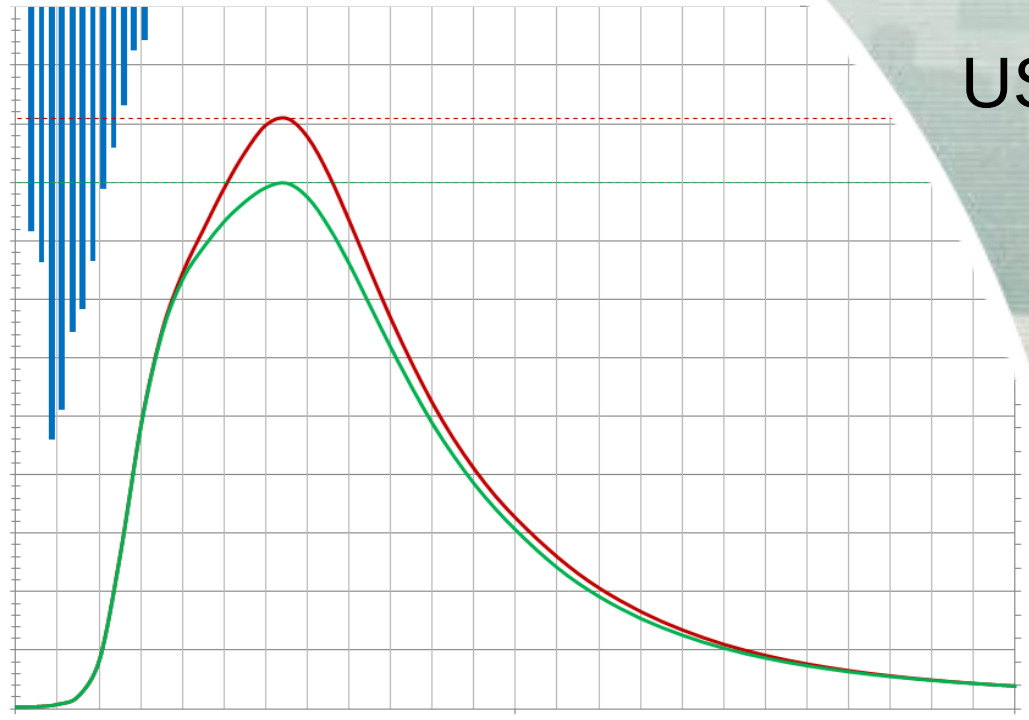
Indian Creek Hydrology





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Rock Island District

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Indian Creek Hydrology – In a Nutshell

Probability

- Increased agricultural intensity
- Increasing urbanization
- More rainfall

Consequence

- Urban floodplain encroachments
- Agricultural floodplain encroachments

Uncertainty

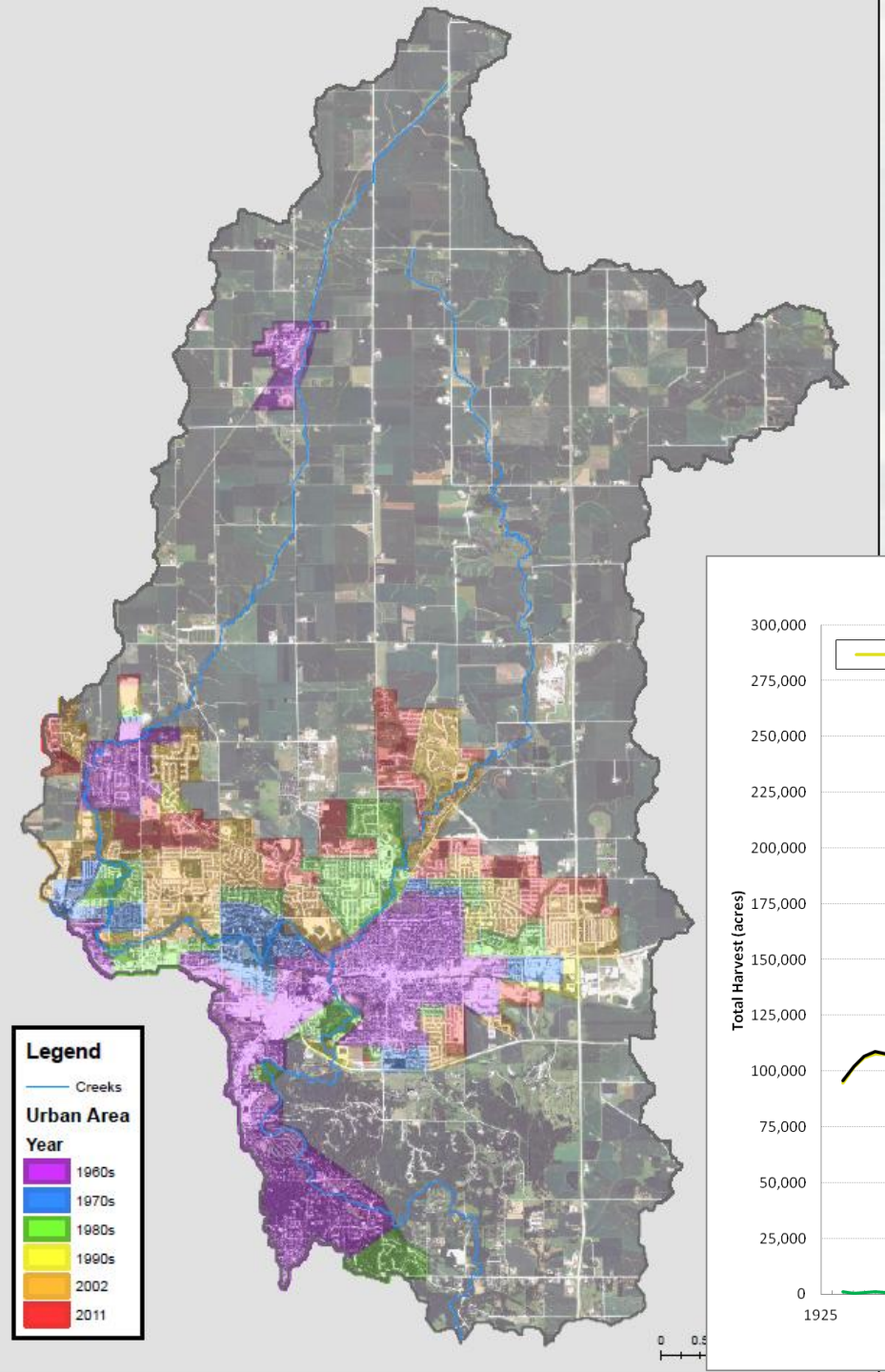
- Longer records
- More variability

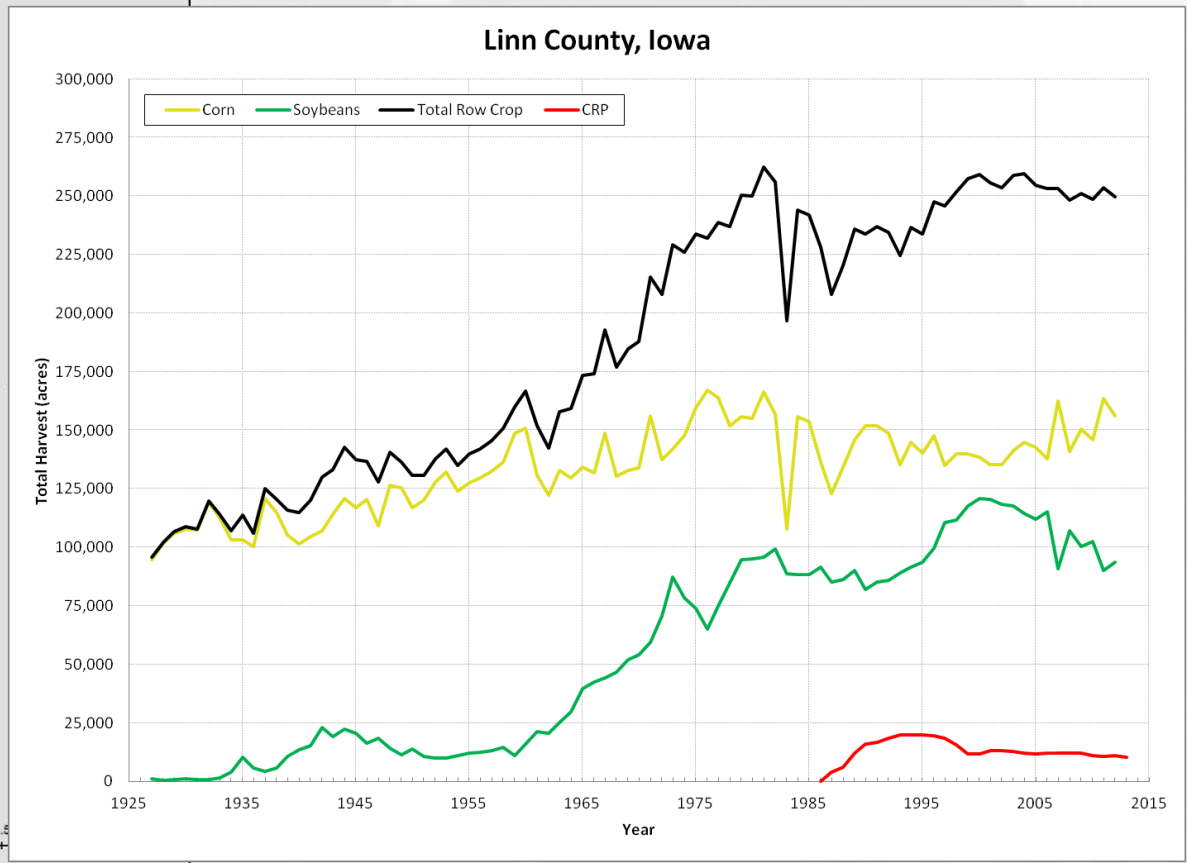
Afternoon Outline

- USACE study lessons learned
  - Land use and hydrology
  - Climate and hydrology
  - Floodplain mapping
- Using what we learned

Land Use

Land Use – Indian Creek and Linn County

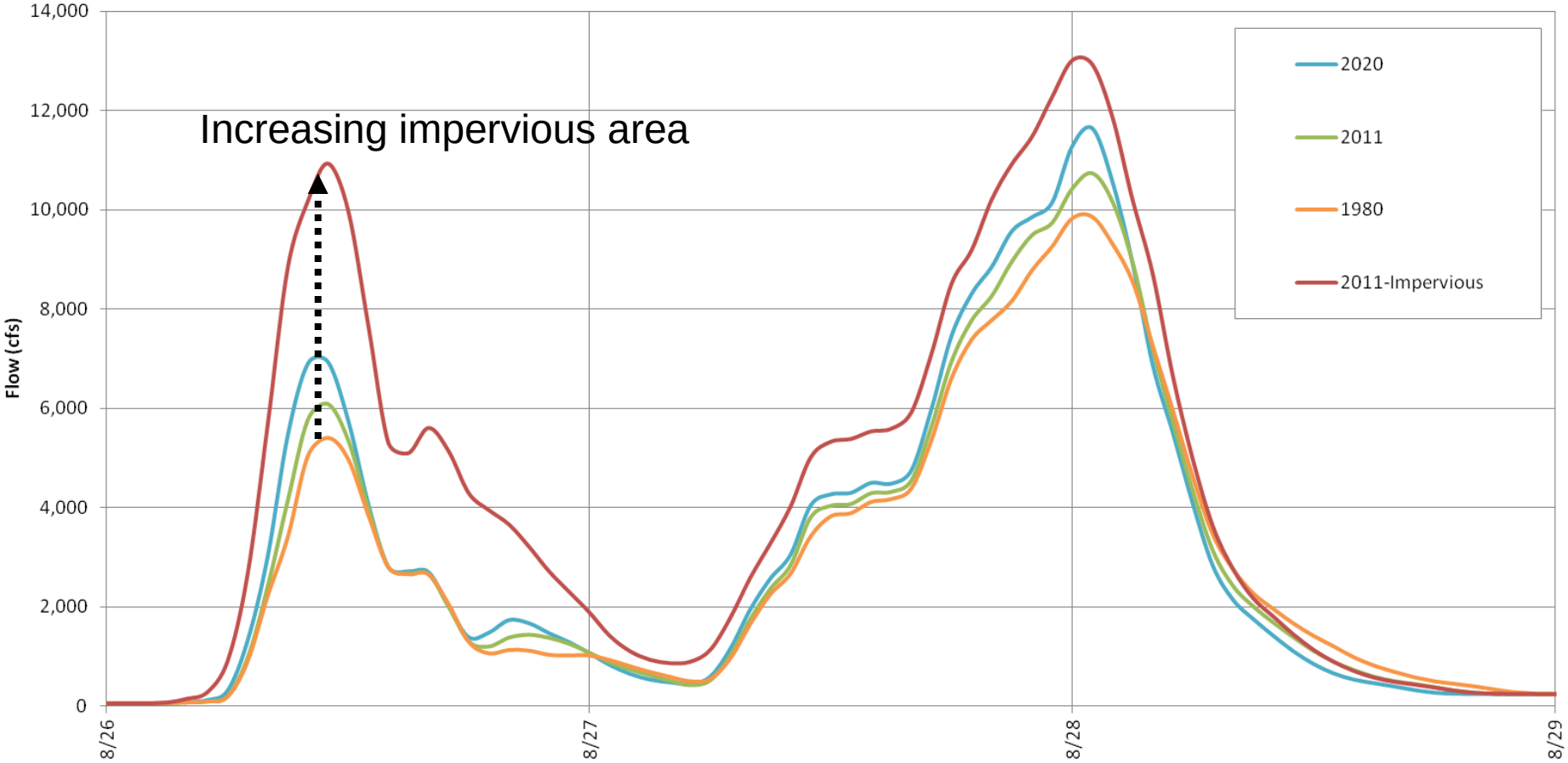




Land Use Matters

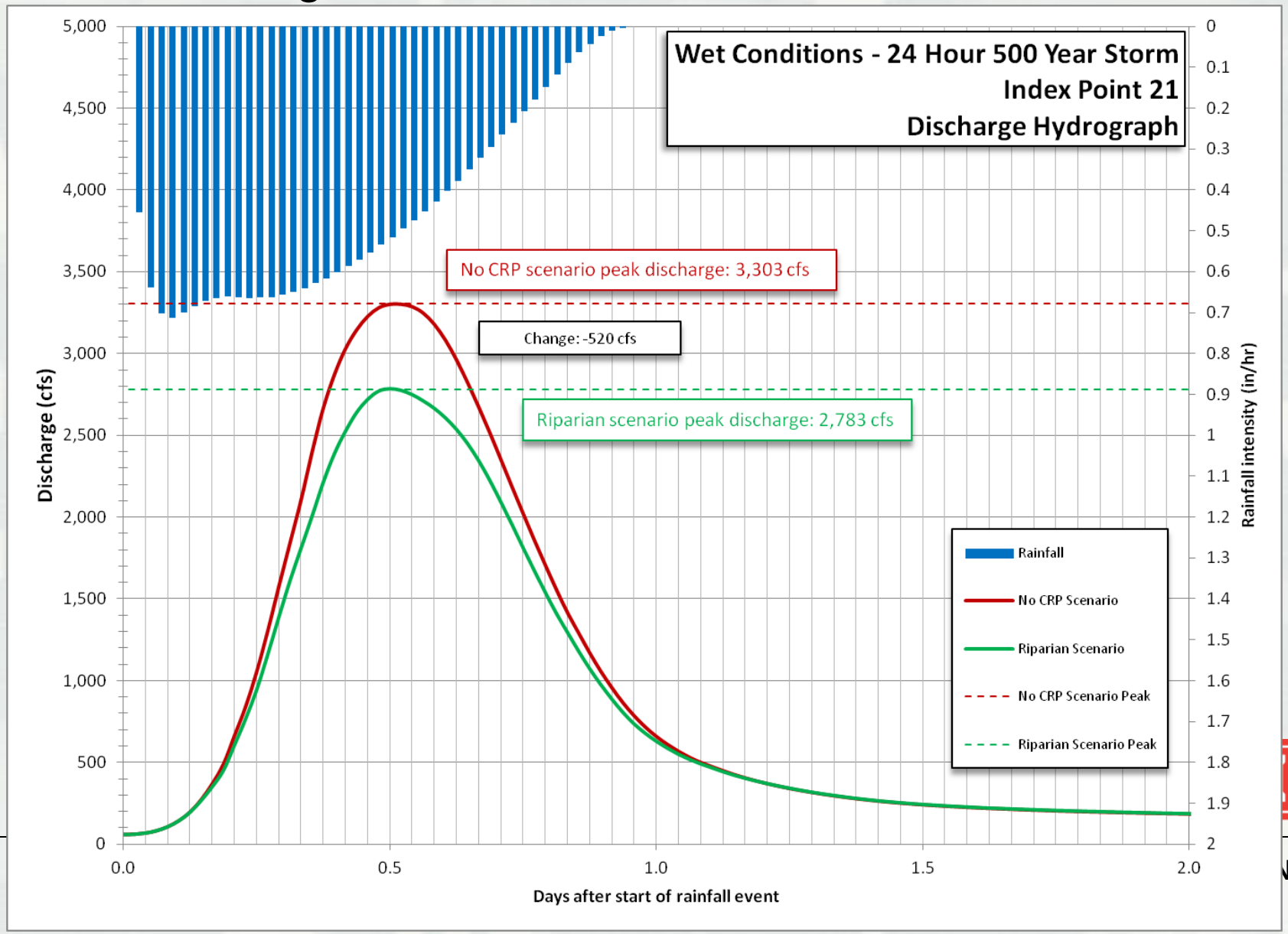
Urbanization

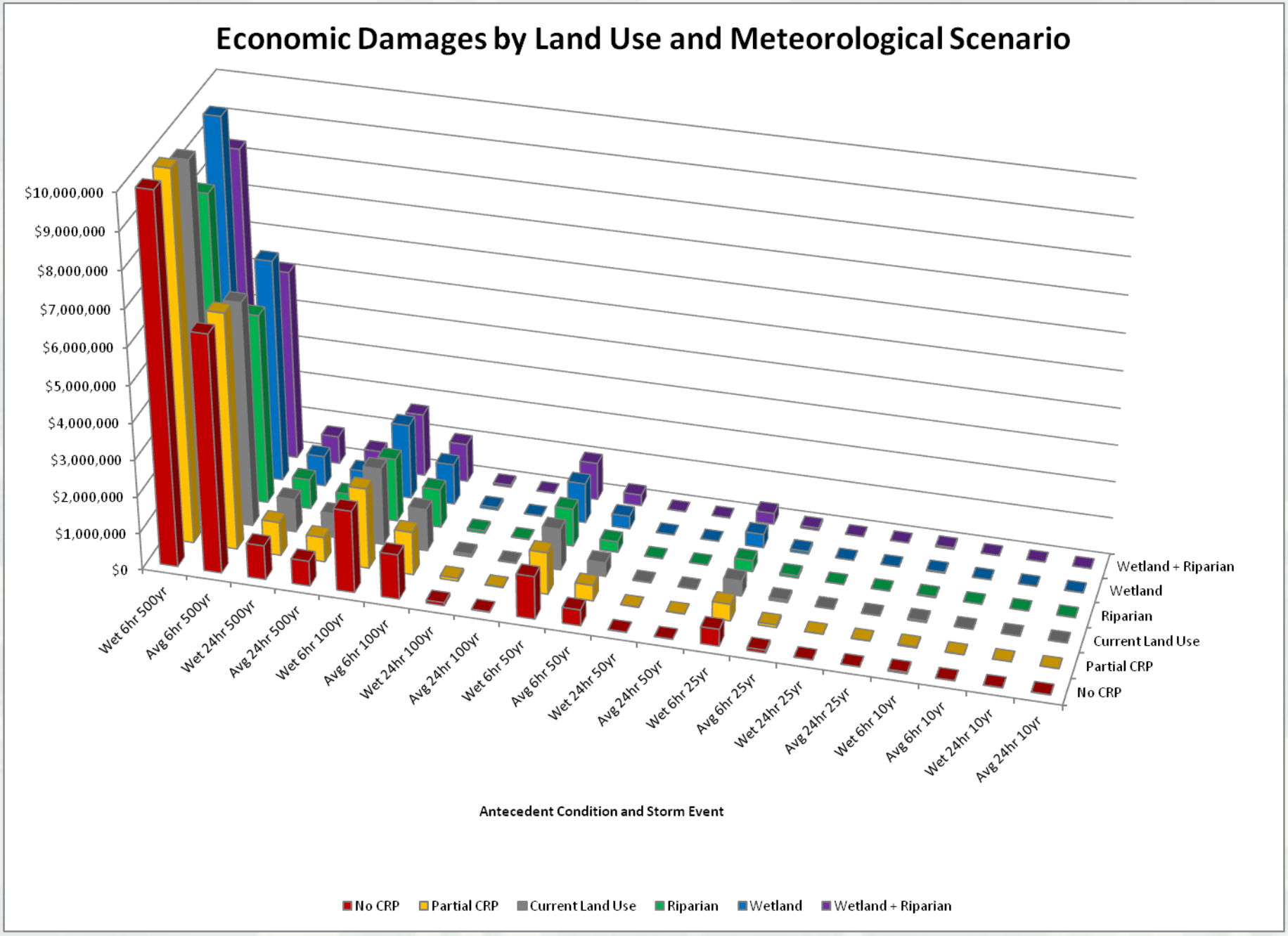
August 2009 flood event in Indian Creek, with different land use scenarios

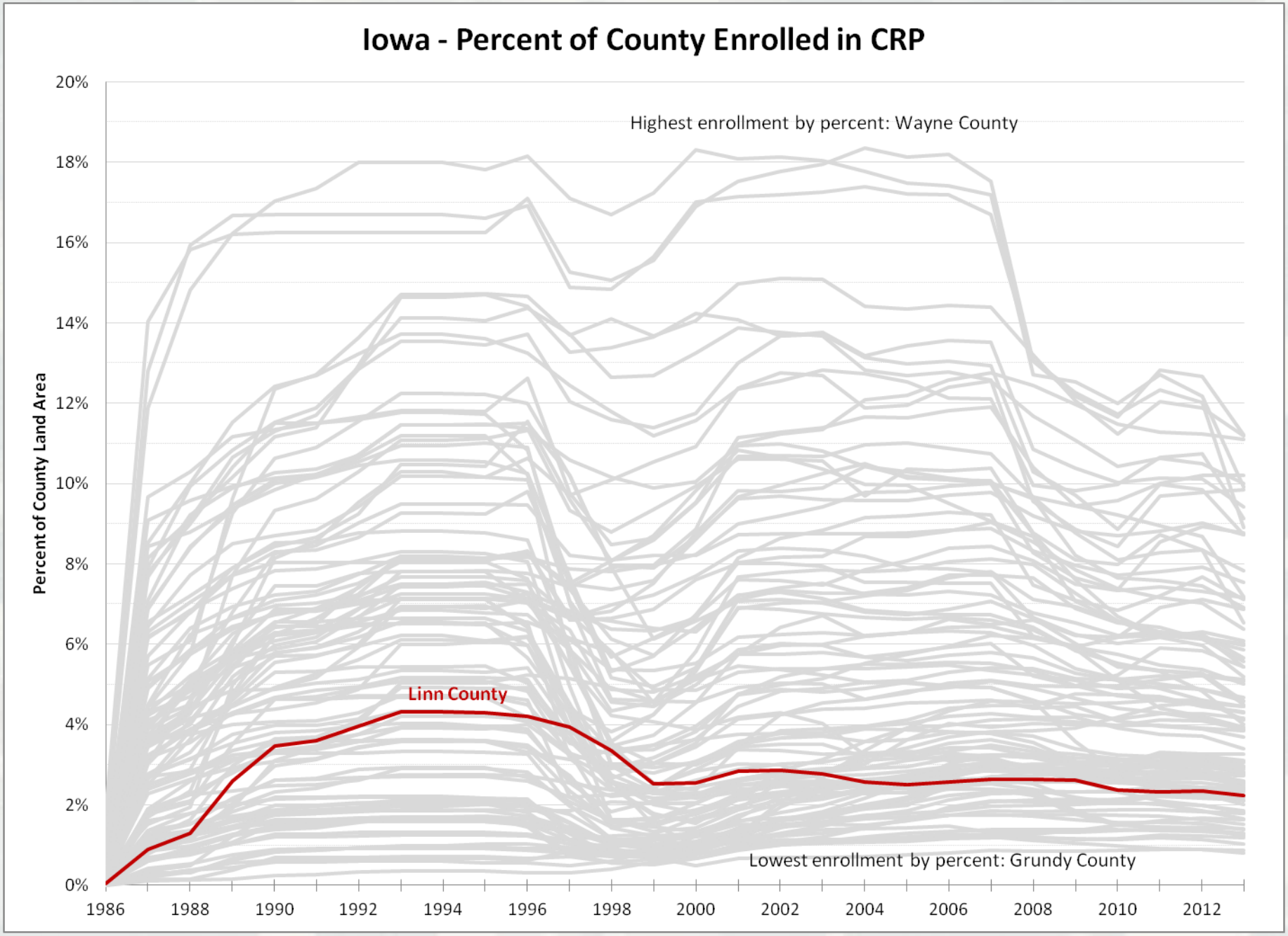


Land Use Matters

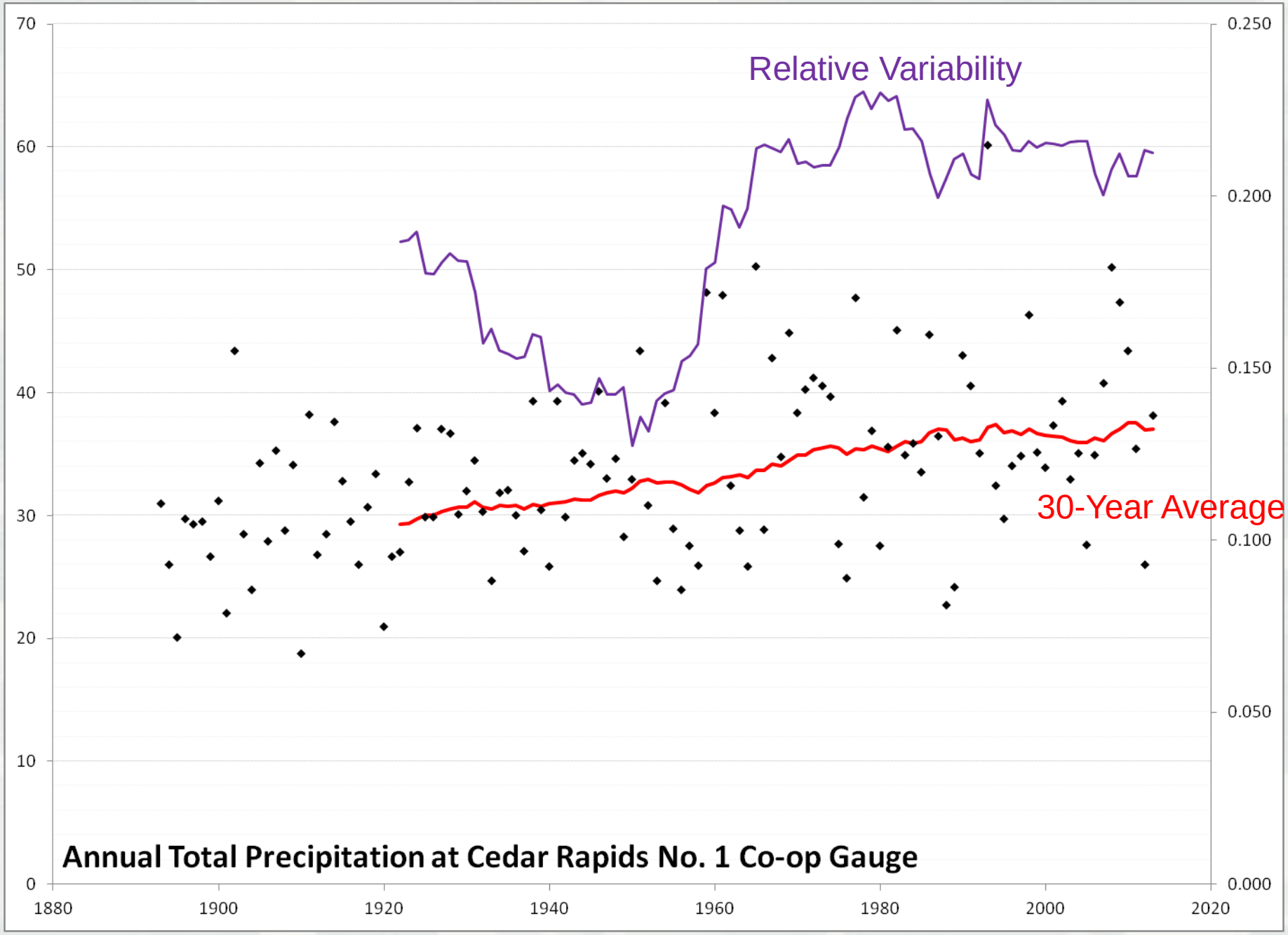
Agricultural Conservation Practices

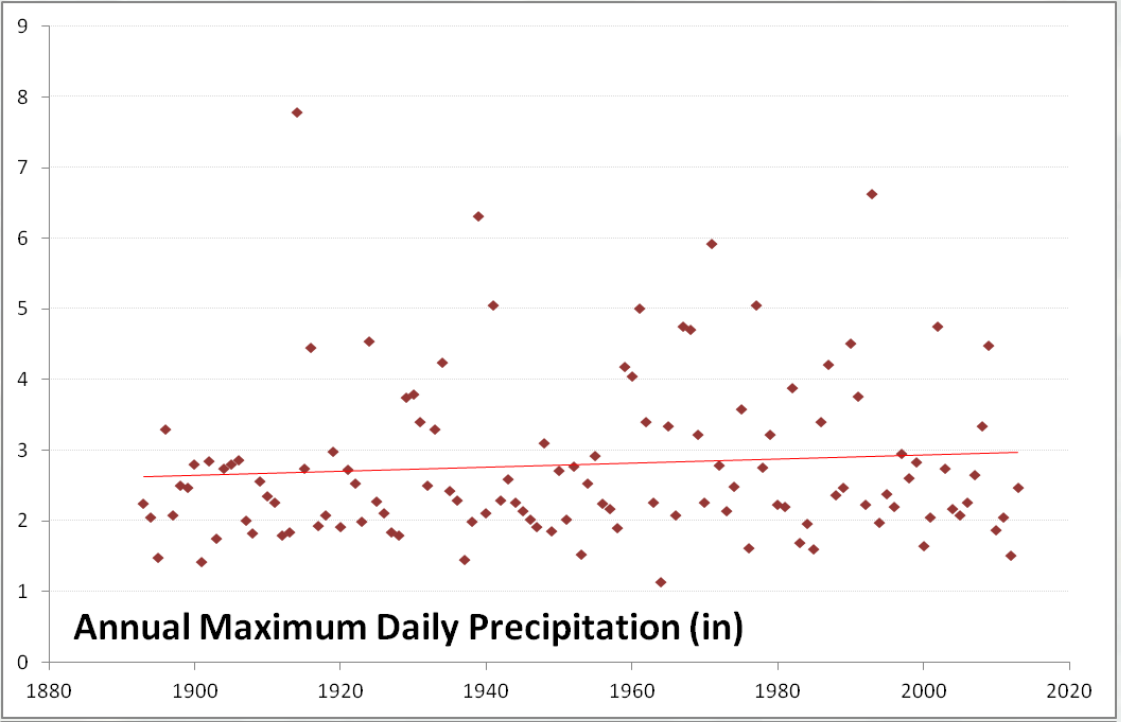



Economic Damages by Land Use and Meteorological Scenario
$10,000,000
$9,000,000
$8,000,000
$7,000,000
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
Wet 6hr 500yr
Avg 6hr 500yr
Wet 24hr 500yr
Avg 24hr 500yr
Wet 6hr 100yr
Avg 6hr 100yr
Wet 24hr 100yr
Avg 24hr 100yr
Wet 6hr 50yr
Avg 6hr 50yr
Wet 24hr 50yr
Avg 24hr 50yr
Wet 6hr 25yr
Avg 6hr 25yr
Wet 24hr 25yr
Avg 24hr 25yr
Wet 6hr 10yr
Avg 6hr 10yr
Wet 24hr 10yr
Avg 24hr 10yr
Wetland + Riparian
Wetland
Riparian
Current Land Use
Partial CRP
No CRP
Antecedent Condition and Storm Event
No CRP
Partial CRP
Current Land Use
Riparian
Wetland
Wetland + Riparian

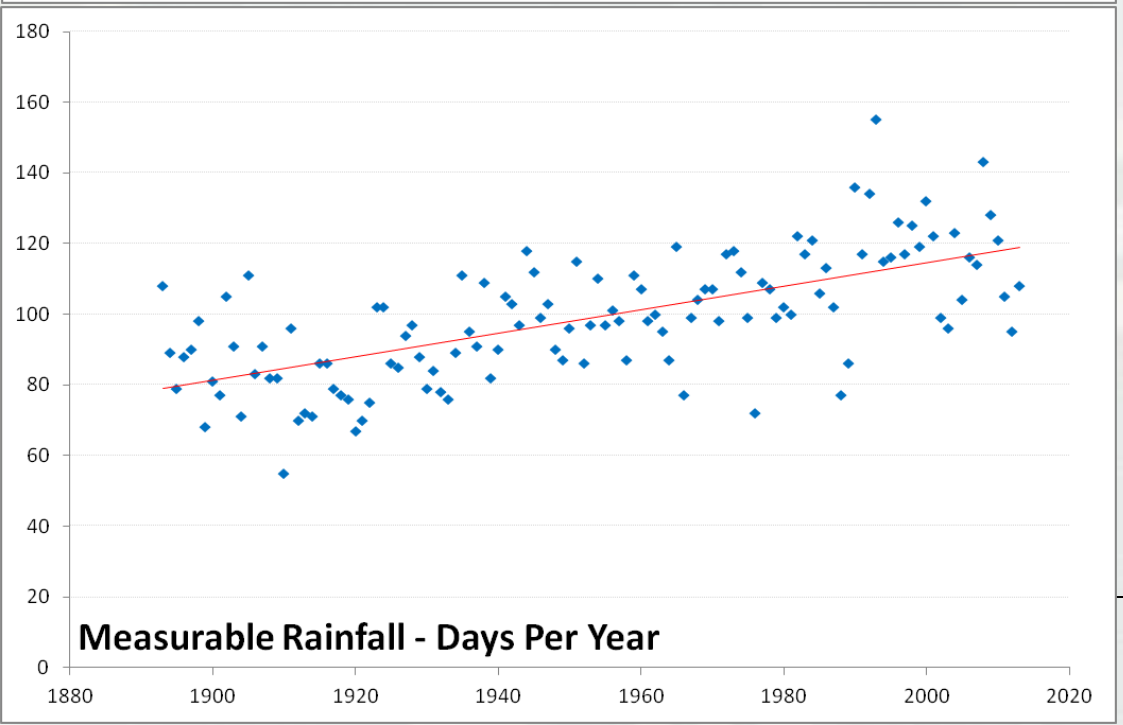

Iowa - Percent of County Enrolled in CRP
Percent of County Land Area
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Highest enrollment by percent: Wayne County
Linn County
Lowest enrollment by percent: Grundy County

Climate


Relative Variability
30-Year Average
Annual Total Precipitation at Cedar Rapids No. 1 Co-op Gauge
70
60
50
40
30
20
10
0
0.250
0.200
0.150
0.100
0.050
0.000
1880
1900
1920
1940
1960
1980
2000
2020

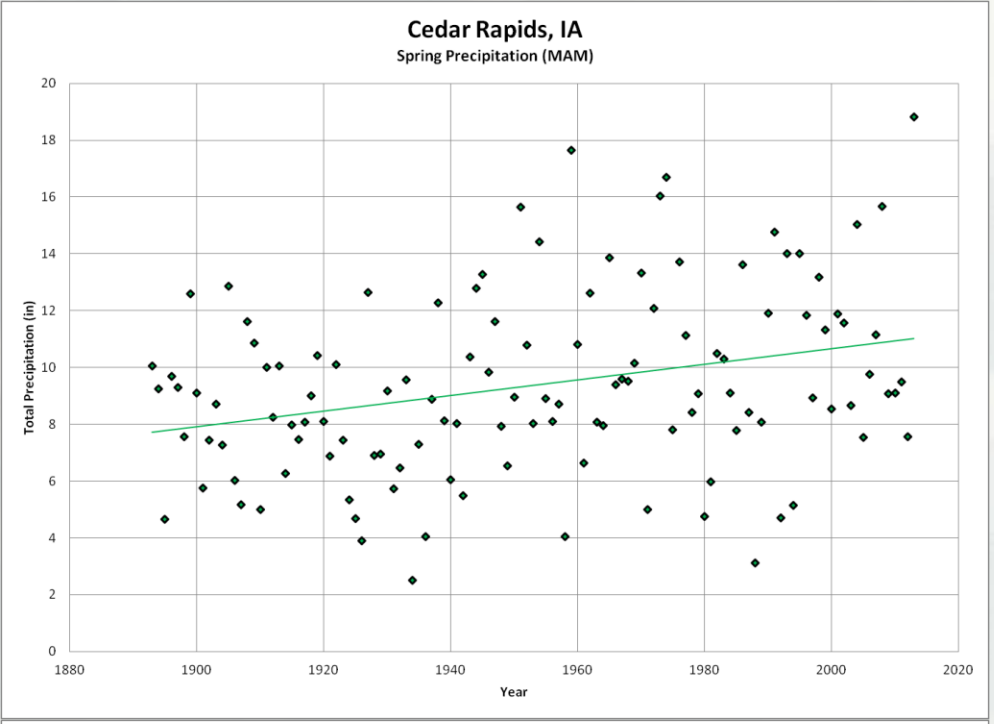


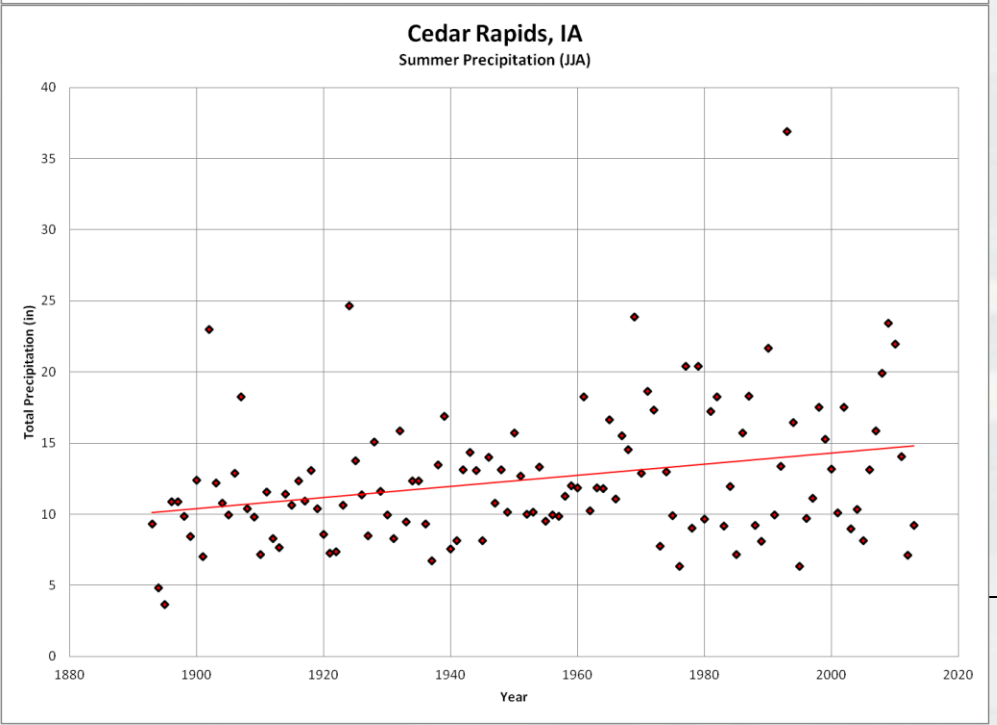
1-day events are only slightly increasing in intensity



There are more rainfall events during the year

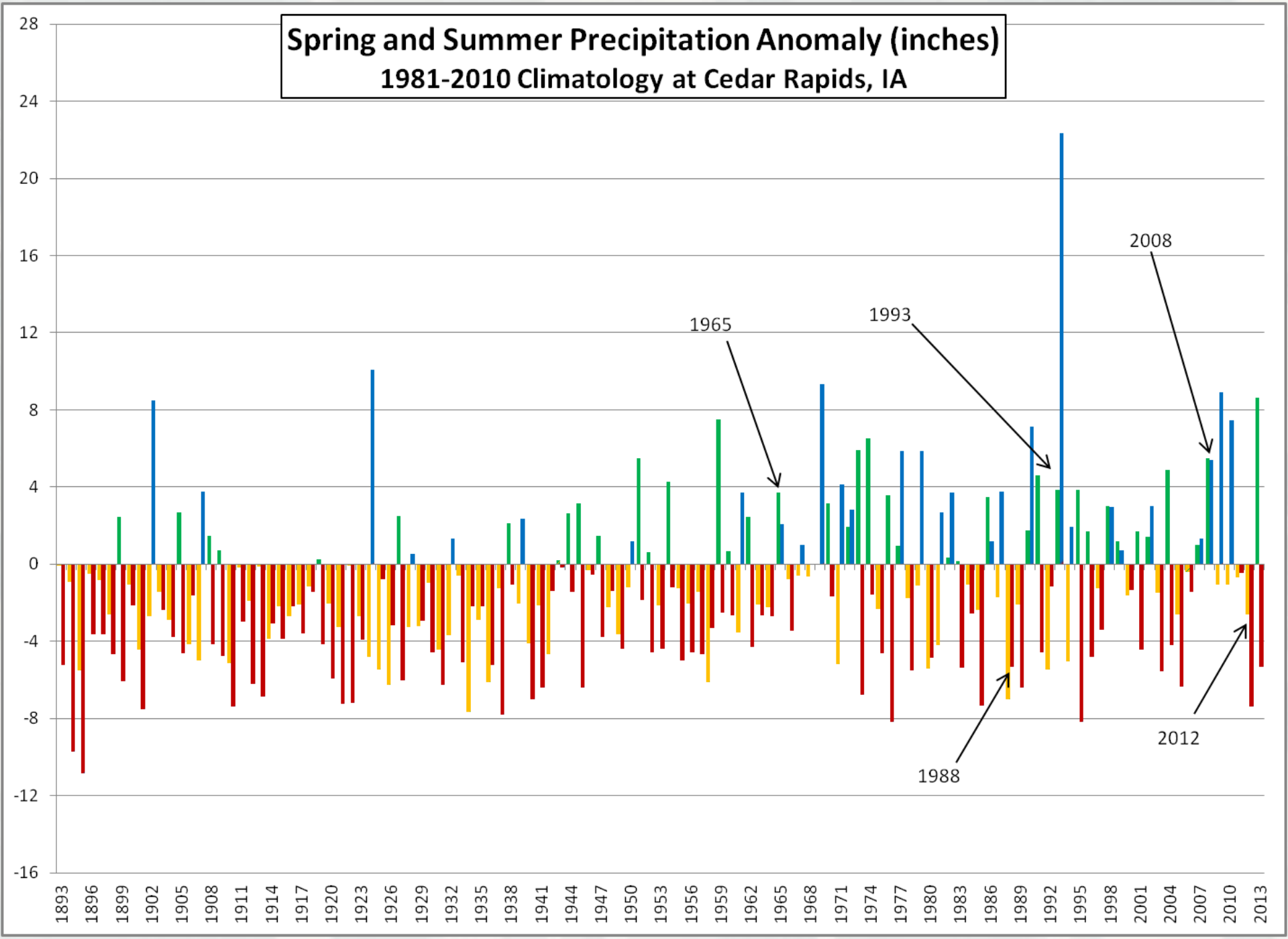
Dry spells are on average shorter





Spring and summer generally make up more than 60% of annual rainfall at CR (historical range 41-85%)

Heaviest rainfall events occur in these seasons


Spring and Summer Precipitation Anomaly (inches)
1981-2010 Climatology at Cedar Rapids, IA
28
24
20
16
12
8
4
0
-4
-8
-12
-16
1965
1988
1993
2008
2012
1893
1896
1899
1902
1905
1908
1911
1914
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
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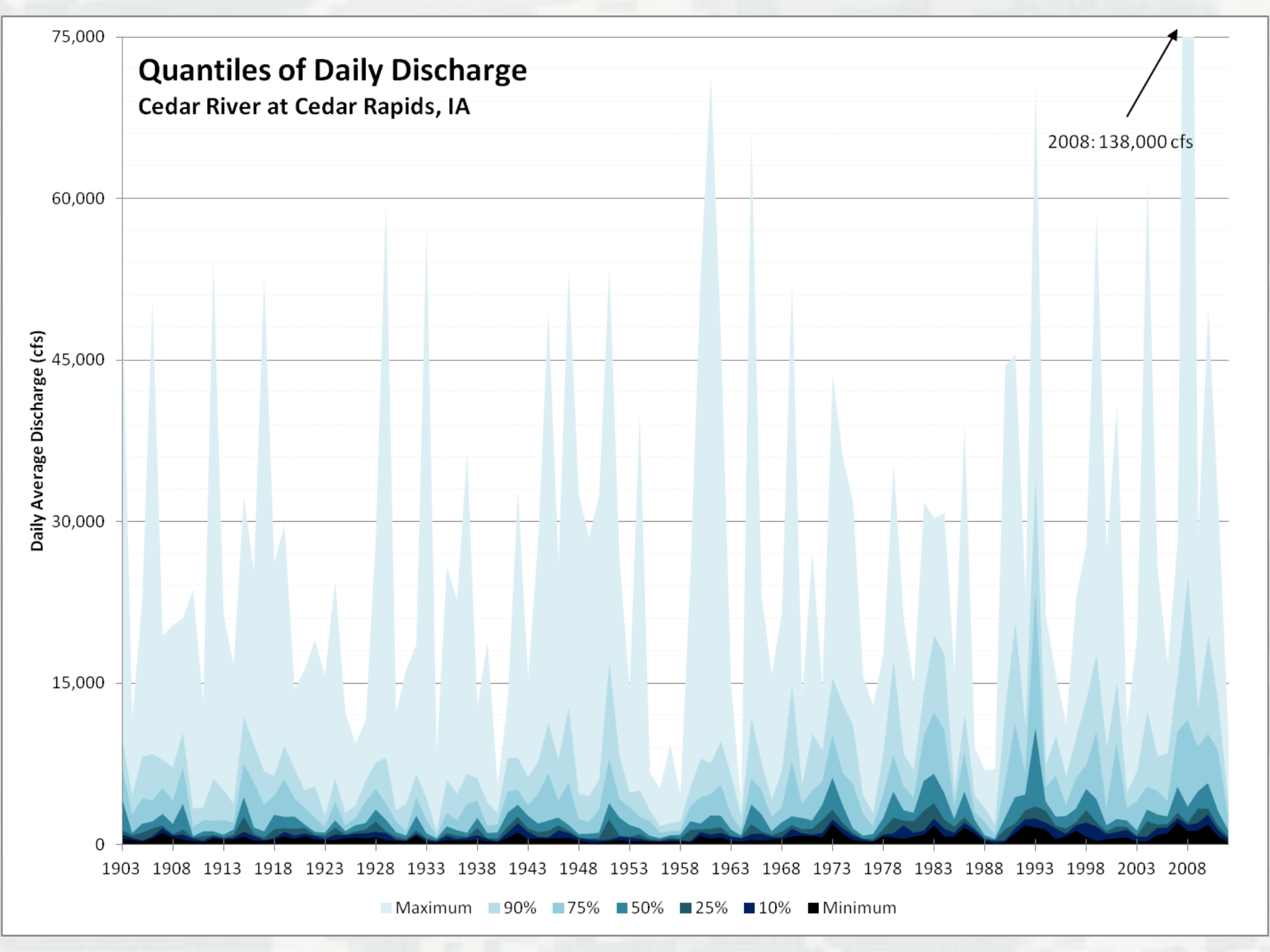
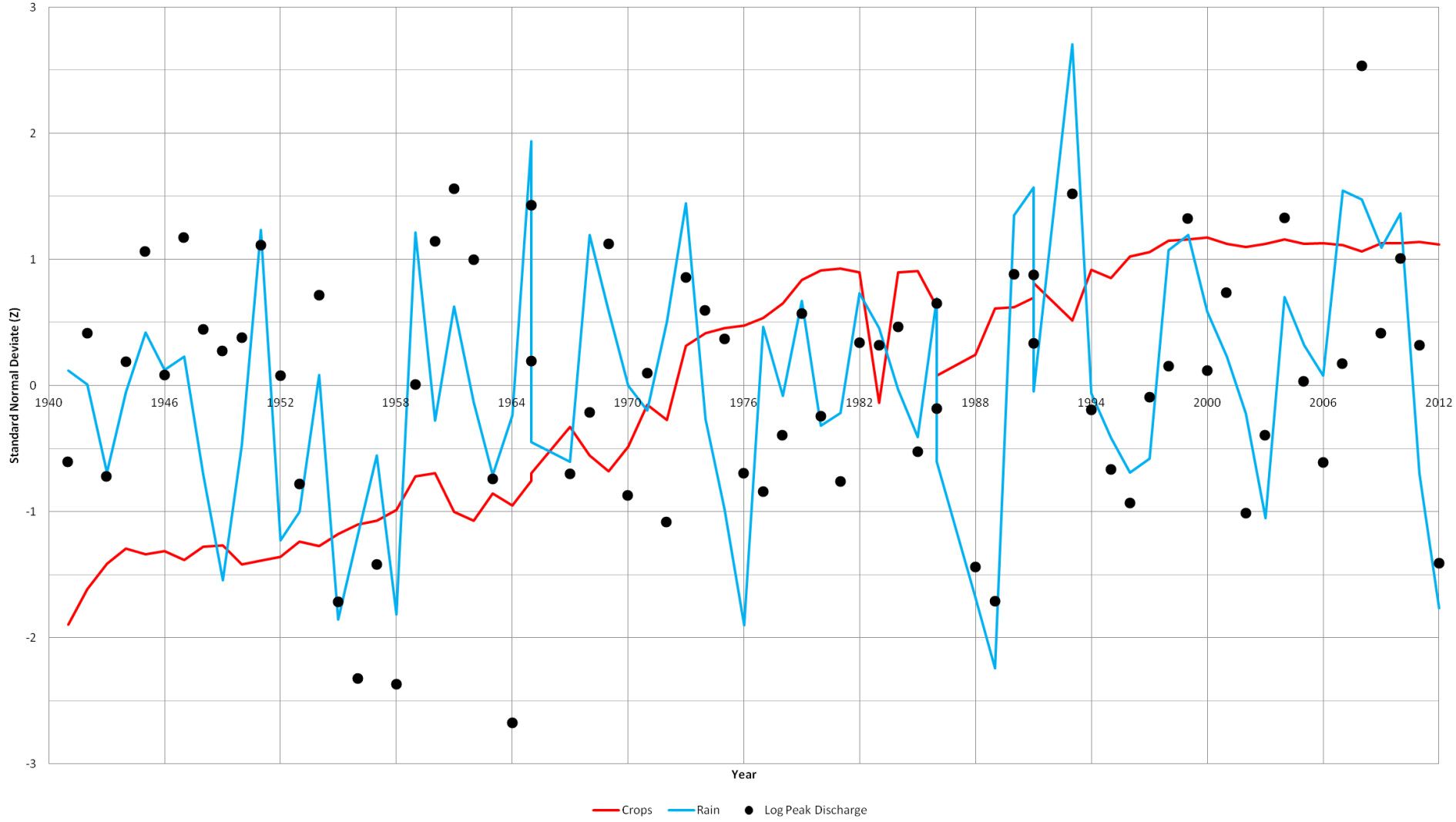
2001
2004
2007
2010
2013


Quantiles of Daily Discharge
Cedar River at Cedar Rapids, IA
2008: 138,000 cfs
Daily Average Discharge (cfs)
75,000
60,000
45,000
30,000
15,000
0
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003
2008
Maximum
90%
75%
50%
25%
10%
Minimum

Normalized Annual Total Precipitation, Row Crop Acreage and Peak Daily Discharge

Cedar River at Cedar Rapids + Cedar Rapids No 1. Coop Gauge



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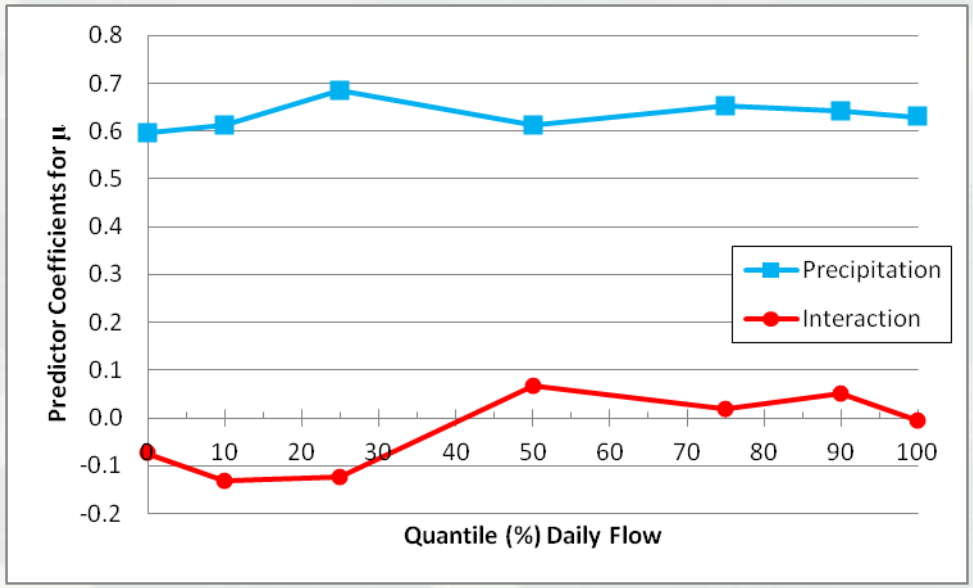
Which has a stronger effect, land use change or climate change?



- Changing flow most strongly driven by changing precipitation
- Changing land use has an amplifying effect
  - At lowest/low flow, more intense agriculture reduces flows
  - At high flows, more intense agriculture increases flows
  - At highest flow, land use effect is washed out by precipitation

USACE Floodplain Mapping

1% floodplain mapping products – July 2013 version

Measures for Flood Risk Management

Managing Runoff

- Goal: Reduce runoff to reduce flood damages
- Tools:
  - Storage (detention, retention, on-line, off-line)
  - Stormwater best management practices (BMPs)
  - Low-impact development
  - Agricultural BMPs

Reducing Flood Consequences

- Goal: Reduce exposure to flood damages
- Tools:
  - Floodplain management
    - Zoning
    - Above-and-beyond NFIP requirements
  - Non-structural measures
    - Elevation
    - Floodproofing (wet and dry)
    - Buyouts
    - Flood warning/information

Flood Storage

- **Retention/detention basins, reservoirs, off-line storage, rain barrels, other distributed storage**
- Require significant real estate
- Offer limited flood peak reduction
- Effectiveness declines over time
- Water quality issues
- Operation/maintenance costs

Stormwater BMPs/LID

- **Infiltration practices (bioretention, infiltration trenches, pervious pavement, etc.)**
- **Flow-slowing practices (grade control/check dams, flow spreaders, etc.)**

- Small, incremental practices that require high level of participation
- Most effective for “first flush” of rainfall
- Water quality benefits
- Maintenance costs

Agricultural BMPs

- ► **Agricultural management: conservation practices, tillage practices**
- Require farmer participation
  - ► Takes land out of production
- Small, incremental practices that require high level of participation
- Water quality benefits
- Maintenance costs

Floodplain Management

- **Floodplain development ordinances, zoning, open spaces, Community Rating System, continuous update of flood extents, flood warning/information systems**
- Restriction of activities in floodplain
- Loss of revenue
- Overhead and enforcement costs
- Adapts to changing conditions

Nonstructural Measures

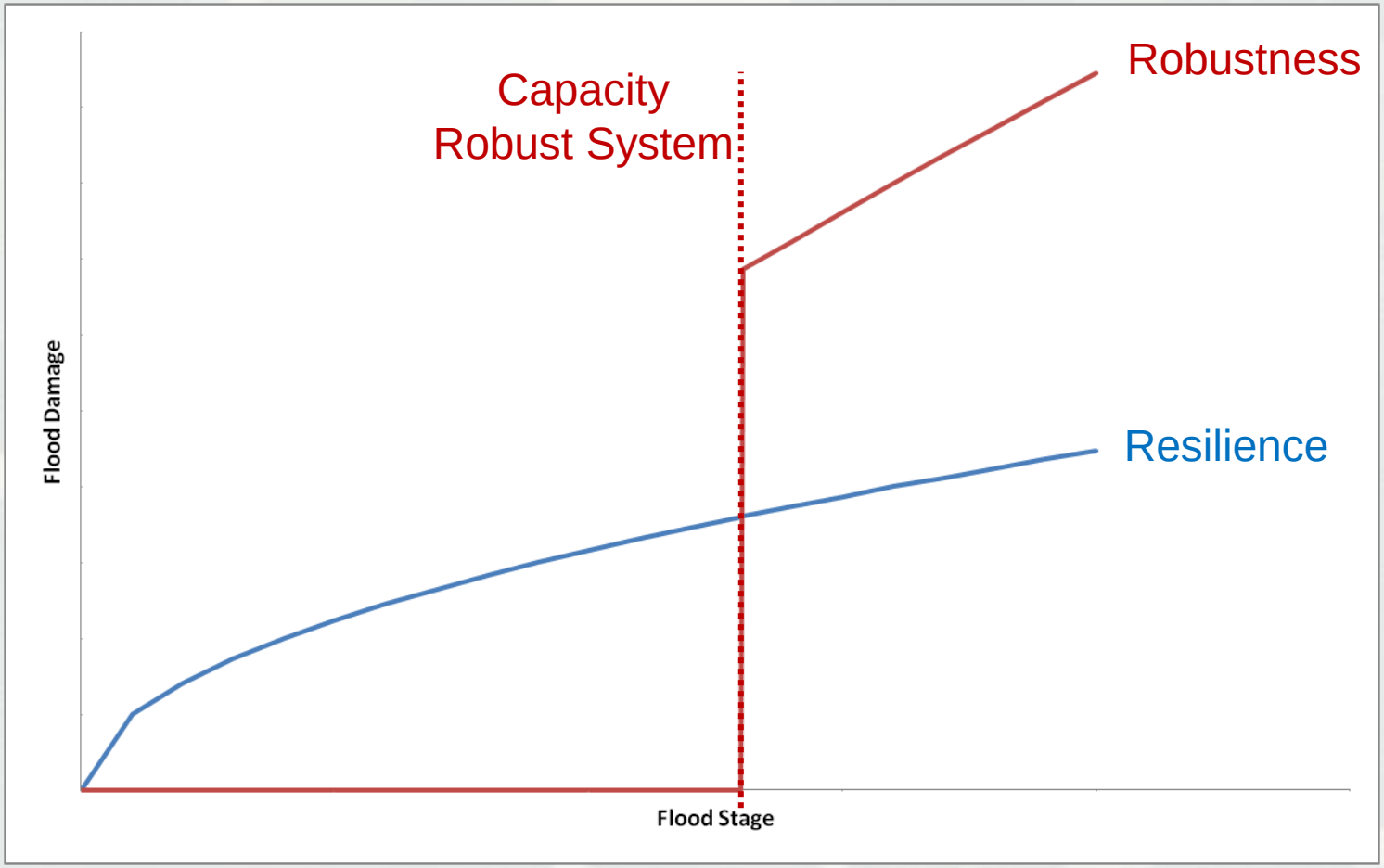
- **Elevation of structures, dry or wet floodproofing, structure buyouts**
- Cost to implement measures
- Generally affect one structure at a time
- Grants may be available to mitigate cost
- Resilient solution

Areas of Interest

- Specific locations depend on selected measures
  - Floodplain management would look at new inundation mapping, areas in the floodplain
  - Runoff reduction would consider areas in the upland with opportunity for infiltration practices

Robustness vs. Resilience

- Robustness: the system is designed to handle as many adverse events as possible
  - System capacity may be exceeded or an unanticipated adverse event can occur
  - Structural measures tend to be robust
- Resilience: the system is fault-tolerant and reduces the impact of all adverse events
  - There is no system capacity, but most adverse events can have a negative impact
  - Nonstructural measures tend to be resilient



The estimate of the frequency of capacity exceedance changes with more information and changing hydrology and hydraulics

Questions

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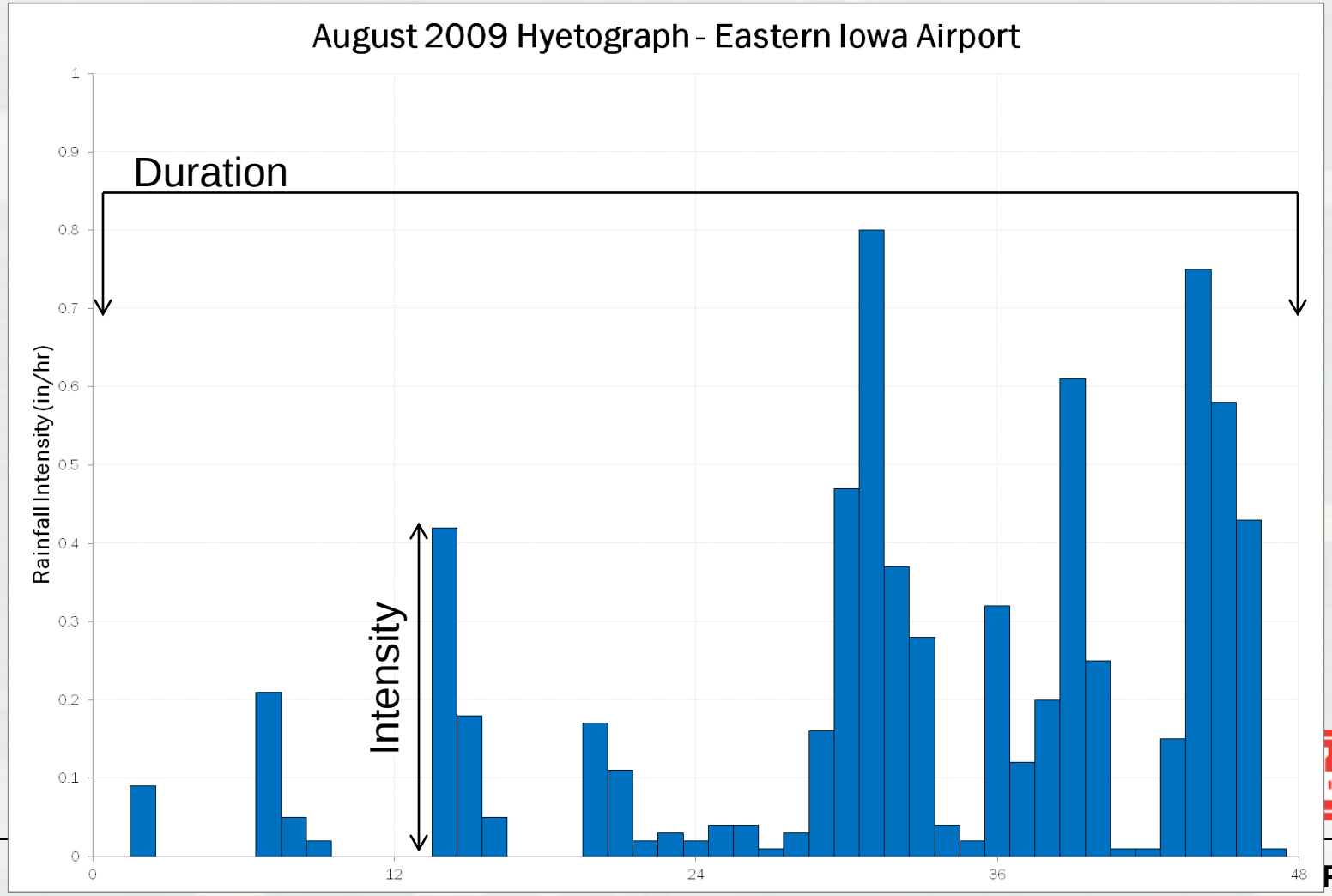
Describing Precipitation

Intensity – Duration - Frequency



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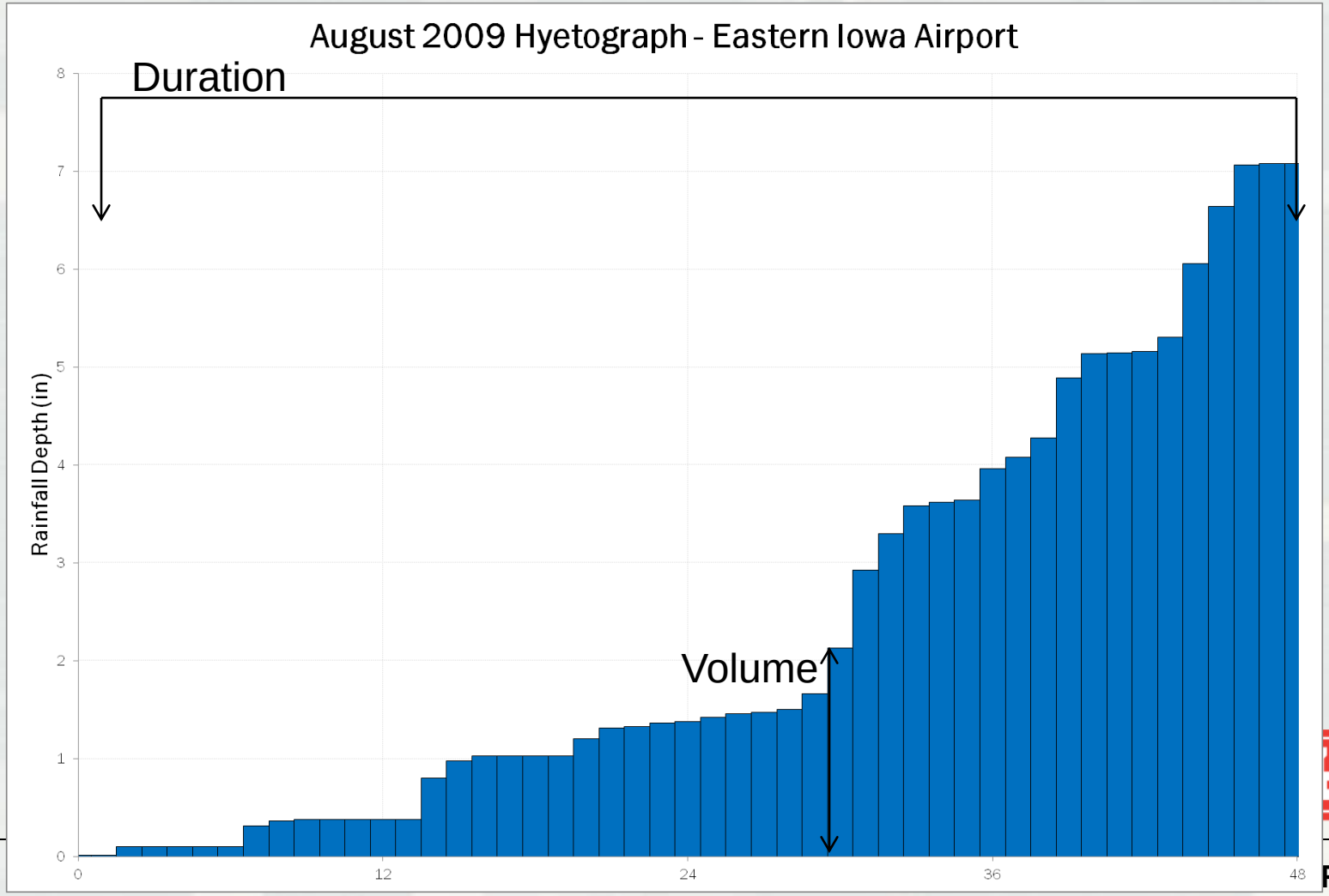
Describing Precipitation

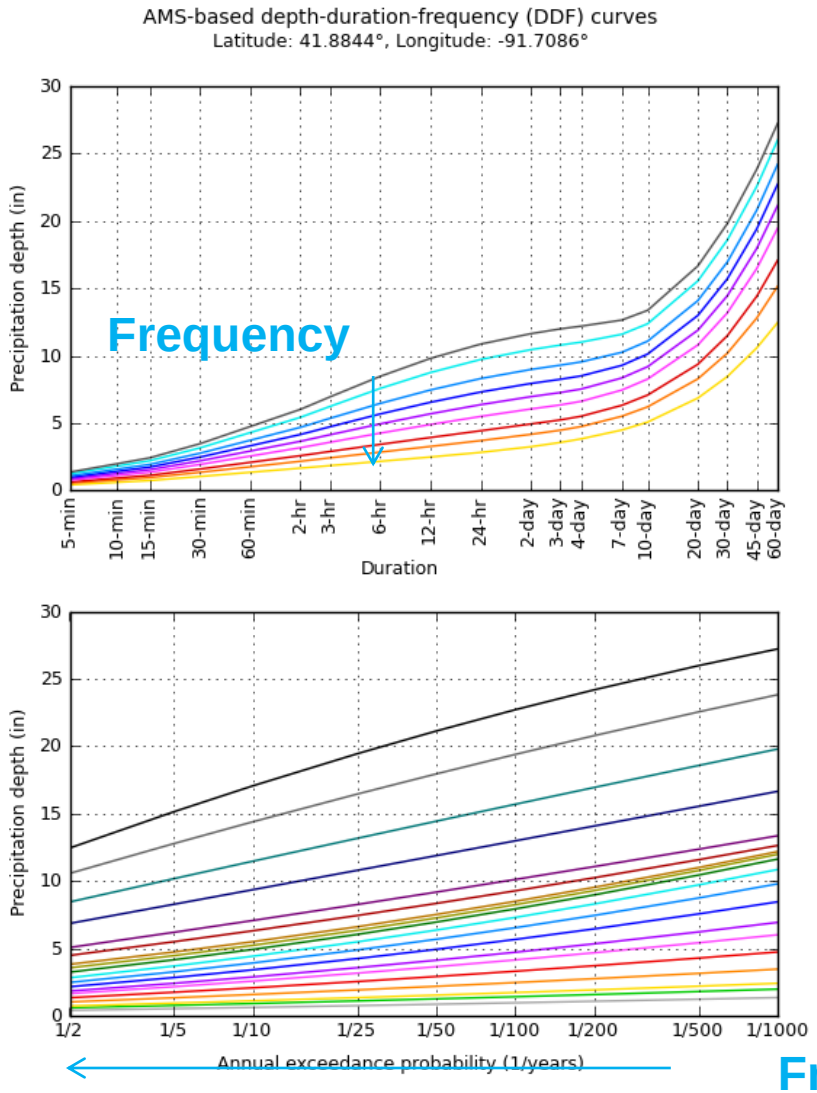
Intensity – Duration - Frequency



RONG®

Describing Precipitation

Intensity – Duration - Frequency



Annual exceedance probability (1/years)

- 2
- 5
- 10
- 25
- 50
- 100
- 200
- 500
- 1000

Duration

- 5-min
- 10-min
- 15-min
- 30-min
- 60-min
- 2-hr
- 3-hr
- 6-hr
- 12-hr
- 24-hr
- 2-day
- 3-day
- 4-day
- 7-day
- 10-day
- 20-day
- 30-day
- 45-day
- 60-day

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Flood Mitigation Focus Group
July 30, 2014

Summary of Responses & Input

Participants: A full list of attendees is included in this report. In general, the focus group participants represented city & county public works and planning staff; state level staff; agriculture interests; property owners; local college students; conservation interests; civic organizations; development interests; and elected officials.

Focus group participants were provided with worksheets and asked to provide their feedback for the draft goal and objectives presented. Feedback was requested on overall reactions, thoughts, ideas, suggested action steps, and questions relating to each of the objectives. The written responses from each participant were recorded as raw data into one document, and a summary of the major themes discussed is provided below.

Framework for goals and objectives:

- Education / Communication
- Policy
- Practices
- Measure / Monitor

Goal:
Protect human life, property, and surface water systems that could be damaged by flood events in the Indian Creek Watershed.

Objective 1: Communicate accurate information about flood risk to watershed residents and stakeholders.
Draft Action Steps:

- *Raise awareness about watershed connections*
- *Provide information about specific actions*
- *Forum to convey flood prone areas & to receive flood impact reports*
- *Training opportunities for public sector staff & agricultural producers*

Feedback from participants:

Target Audiences: There were many comments on the specific audiences that need to be reached by educational efforts.

- School-age children and their parents (4 responses)
- City Council / Board of Supervisors / policy makers in general (3 responses)
- Realtors (2 responses)
- Developers
- Non-farming landowners
- Elderly landowners
- Service groups
- Floodplain residents
- Homeowners
- Garden centers

Communication / education strategies:

- Events / information to communicate about flood-prone areas and risks (7 responses)
- Social media (5 responses)
- Marketing campaign – simple, standardized messages - such as for "You Pick Two" conservation practices or the economic effects of flood damage (4 responses)
- Website (eg post USACE information, FAQs) (4 responses)
- Recognizing farmers / homeowners / business owners who are doing the right thing / ambassadors (3 responses)
- CCB, city PSAs (3 responses)
- Field days to teach about practices, for homeowners, farmers, businesses, public sector employees (3 responses)
- "peer to peer" (2 responses)
- WFAN events (2 responses)
- Signage (now entering the watershed) (2 responses)
- Point of sale notices (2 responses)
- Newspaper articles (2 responses)
- Newsletters (2 responses)
- Watershed 101 for residents (2 responses)
- After Action Report to compare rainfall / runoff & damages
- City Council work sessions to educate about watershed issues
- One-on-one meetings with farmers to 'sell practices'
- Inserts in utility billings
- Regular opinion surveys of watershed residents, landowners
- Demonstration projects
- Recreation as an educational opportunity
- Education on runoff reduction
- River clean-ups as education / partner with local business
- Raise awareness about hazard mitigation

Floodplain Maps:

- Communities may consider using USACE revised flood frequency / mapping products (2 responses)
- More, better, updated maps (2 responses)
- Update FIRM maps

Objective 2: Develop or update policies to better manage stormwater and floodplain areas.
Draft Action Steps:

- Encourage participation in the Community Rating System (CRS)
- Coordinate with Linn County Multi-jurisdictional Hazard Mitigation Planning process to align mitigation strategies
- Promote protection of a greenbelt along stream corridor

Feedback from Participants:

Specific Policy / Regulations: Many comments were received with specific policy recommendations.

- Restrict development in floodplain (8 responses)
- Topsoil requirement for new development (4 responses)
- Restrict fill in floodplain (2 responses)
- Change to a 0.2% (500-year) regulatory floodplain (2 responses)
- Seek higher CRS designation (2 responses)
- Allow natural drainage in street right-of-way (2 responses)
- More retention / detention for development
- Post-construction stormwater ordinance
- Reduce road width
- Cap-and-trade system for run-off on a site-by-site basis
- Don't allow sawed tree trunks / limbs to be dumped in creek
- Preserve overbank flow paths in subdivisions / basins, such as through grading ordinance
- Restriction on farming to the edge of a waterway
- Do not allow connection of gutter downspout to storm sewer
- Promote infiltration / storage in the planning stages of development

Objective 3: Implement practices to decrease runoff from urban and rural areas.

Draft Action Steps

- *Reduce then maintain stream discharge to targeted levels*
- *Treat runoff from the initial 1.25" rainfall event in urban areas*
- *Promote conservation easements as a mitigation tool*
- *Encourage all landowners to adopt two conservation practices*
- *Retrofit infrastructure to increase detention & infiltration*

Feedback from Participants:

Specific Practices: Many ideas for specific practices were suggested.

- Greenbelt (8 responses)
- Native vegetation / conservation landscaping (4 responses)
- Rainwater harvesting / rain barrels (4 responses)
- Rain gardens (4 responses)
- Permeable paving (3 responses)
- Buffer strips (3 responses)
- Wetlands – in floodplains; for sediment trapping (3 responses)
- Bioswales (2 responses)
- Retention ponds (2 responses)
- Drain tile (2 responses)
- CRP (2 responses)
- Promote infiltration practices / retrofits (2 responses)
- Stream restoration
- Protect undeveloped floodplain areas
- Native landscaping

- Dam / reservoir above County Home Road
- Dam removal
- Buyouts
- Check dams
- Reintroduce beavers
- Increase organic content of soil
- Identify specific projects that could be candidates for Haz Mit Grant Program

Funding for Practice Implementation

- Cost-share / financial incentives for practices; sponsored by cities / county (6 responses)
- Tax incentive program – or water fund - to develop a mechanism to pool funds for investing in conservation (3 responses)
- Seed money to promote BMPs
- Need sustainable funding to support BMP implementation
- Fee structure for new development, to help fund conservation practices
- Stormwater fund
- Stormwater fee discounts for BMP adoption

Objective 4: Develop a process and procedures to monitor and measure progress toward the objectives stated in the plan and to update the plan every 5 years.

Draft Action Steps:

- *Update inundation models every 5 years*
- *Long-term flow and water quality monitoring*
- *Track implementation of BMPs*
- *Track public sector costs responding to / recovering from flood events*

Feedback from Participants:

Specific Monitoring / Measuring

- Survey areas of stream every 5 yrs to understand how it changes over time such as by erosion / RASCAL (3 responses)
- Update inundation models every 5 years (2 responses)
- Continue to use college students for monitoring (2 responses)
- Dense array of stream gages / sensors
- Coordinate IOWATER volunteers
- More money for water quality monitoring

Planning Objectives

- Track use of BMPs / wetlands, develop uniform reporting system (5 responses)
- Track public sector costs (5 responses)
- Develop goals & schedules & benchmarks / measurable milestones for implementation (3 responses)
- Retain and treat 1.25" (2 responses)
- Track damage costs to private property (2 responses)

- Track progress
- Reduce / maintain stream discharge
- Track environmental costs
- Develop a HUC-12 focused planning approach
- Set goals for each community for reporting BMP implementation
- Develop watershed-specific land use plans
- Develop regional land use plans
- Focus regional buyout planning
- Need to set habitat protection goals
- Need to set a goal of 'decrease flooding damages
- Include planning for transportation during flood events
- Monitor repetitive loss
- Provide opportunities to suggest new mitigation alternatives
- Coordinate hazard mitigation planning & watershed planning

Future Research / Analysis

- Evaluate risks of future consequences on today's policies
- Current FIRM maps are based on old data that needs to be updated
- Put a value on development of greenbelt
- Learn / study which practices work and which don't
- Water quality concerns associated with flood waters
- Measure the ratio of rainfall to rain runoff to see how it has changed
- Damage costs may increase even after preventative measures are taken; need to show what impacts could have been without those preventative measures

Additional Feedback From Participants

Overall Challenges

- Retrofit of urban areas is a challenge
- Tracking BMP adoption seems like a difficult task
- People are not fully informed about risk
- Need more involvement from more stakeholders
- Greenbelt is a good idea but it can split up a community
- Difficult to make a significant impact to the large events, so focus on smaller events
- Will be difficult to set targets for stream discharge, especially in rural areas

General

- Need better flood warning systems and communications / flood status – risk metric (4 responses)
- Hire a dedicated watershed project coordinator
- New department in city to oversee the watershed plan
- Nutrient reduction strategy should be mandatory not voluntary
- Who specifically will be in charge of continuing the plan – ECICOG?
- Just do it now!
- Elect people to local office who favor storm water management practices
- Make it stop raining so much