

# CBP Watershed Modeling Products

	Existing	Long term
TMDL	<div>CAST6-2017 CAST6-2019... CAST6-2025</div>	<div>CAST7-2025</div>
Eco-flows, Water supply P7 Development		<div>2023 Prototype</div>
Calibration, Estuarine loading	<div>P6 DM</div>	<div>P7 DM</div>

2023  
Prototype

Opportunity

...  
Geomorphometry

Land Use

Computing  
Power

New  
Science

Fine-scale  
tools  
(field doc)

2023  
Prototype

Partnership Need

...  
Factors Affecting  
Trends

WQGIT  
needs

STAC recs

Other GIT  
needs

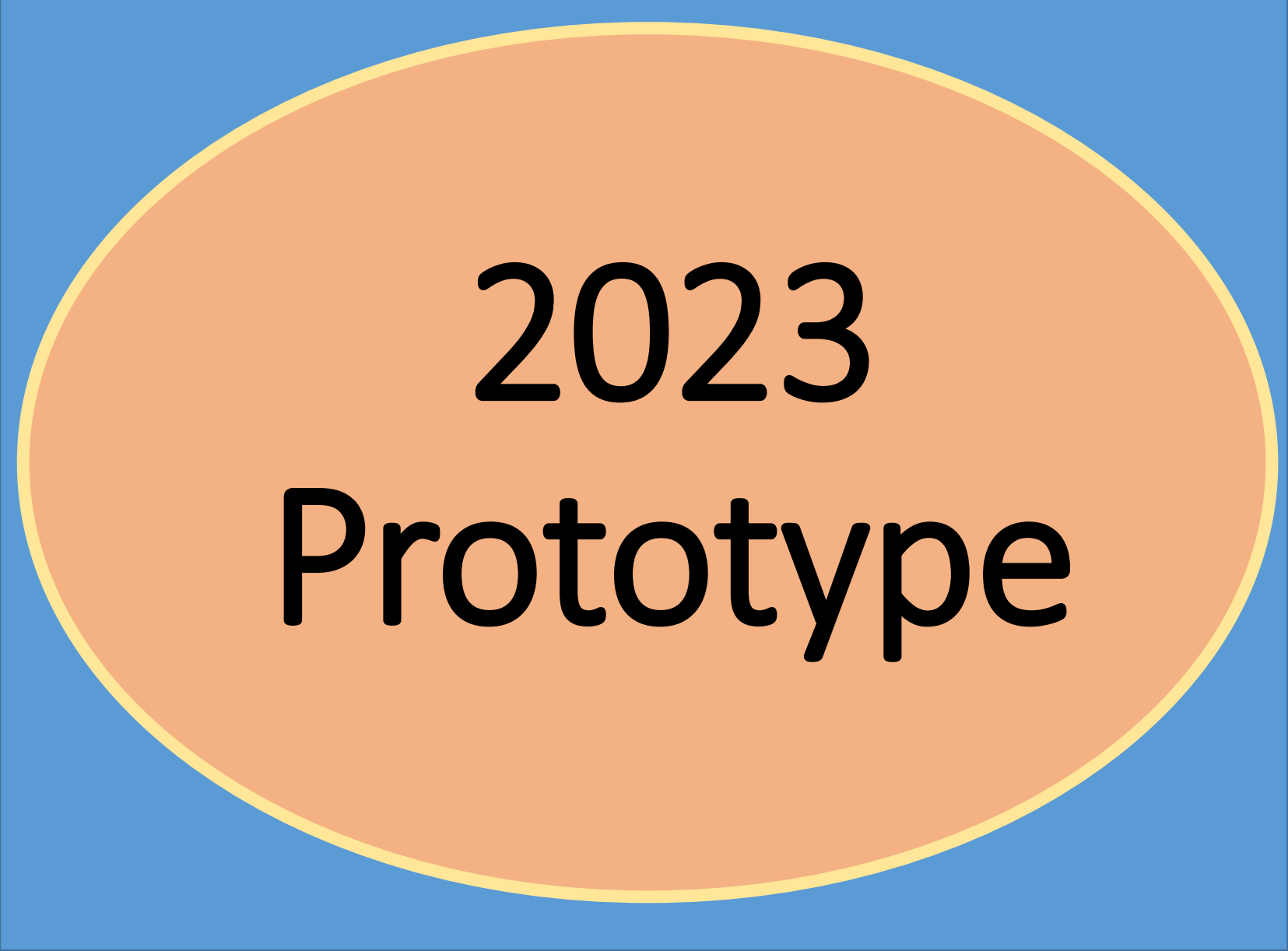
Water  
supply  
partners

Model  
Data Set  
Endpoint  
Project/Decision

Complete  
In Process  
Not Started

Top ...  
Up





# Partnership Need

Water supply partners

NHD100k hourly flow & temperature  
Low flow extremes  
Reservoirs

Other GIT needs

CAST inputs and outputs at NHD100k or NHD24k  
Time-averaged N, P, S, flow, temp characteristics

STAC recs

**From Review**  
More models in ensemble  
Uncertainty Quantification (including BMPs)  
Finer scale  
Formalized optimization of CAST calibration  
Improved processes (sediment)

**MB 2025 workshop**  
Ensemble of dynamic models  
Uncertainty Quantification  
Local scale using high-resolution data  
Better characterize sources and sinks  
Legacy P effects on land uses  
Critical source areas  
Start a sediment workgroup

WQGIT needs

**Plans:** 2025 climate reassessment  
**SRS:** Finer scale (related to urban P)  
Climate BMP effects

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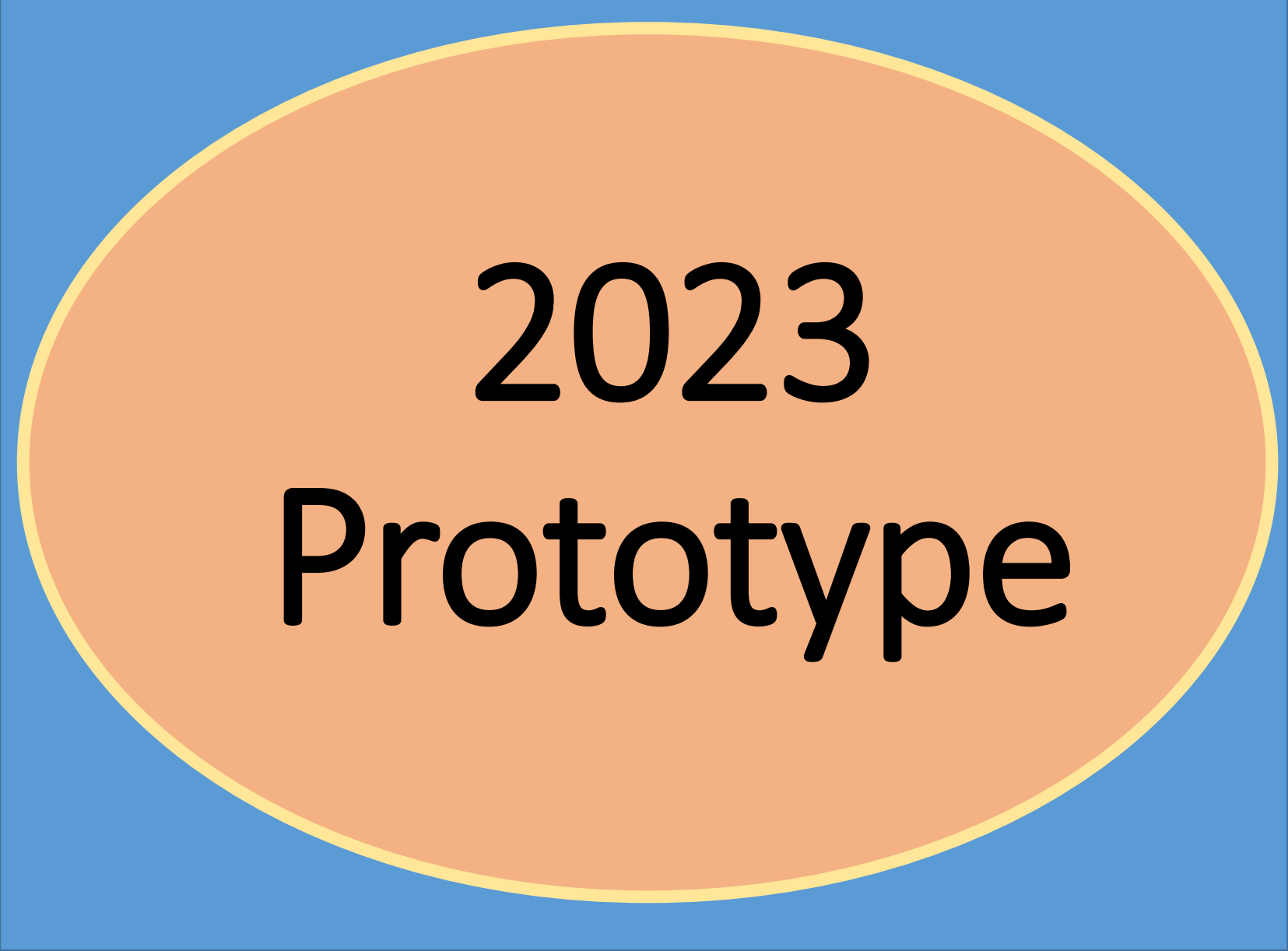
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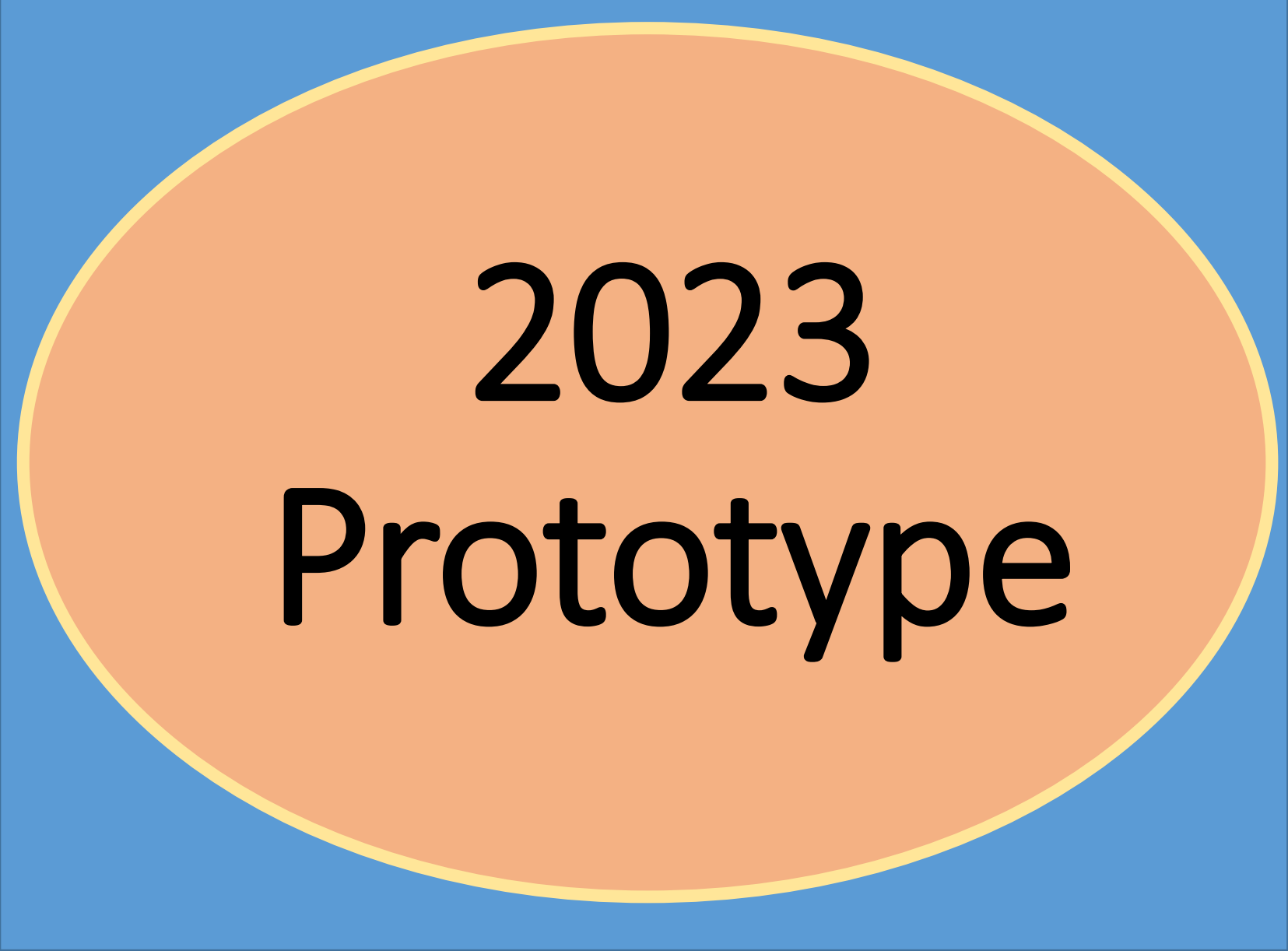
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Top ...

Up



Partnership Need

# SCALE

Water supply partners

Other GIT needs

STAC recs

WQGIT needs

NHD100k

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# Structure

Uncertainty Quantification  
Formalized optimization of CAST calibration

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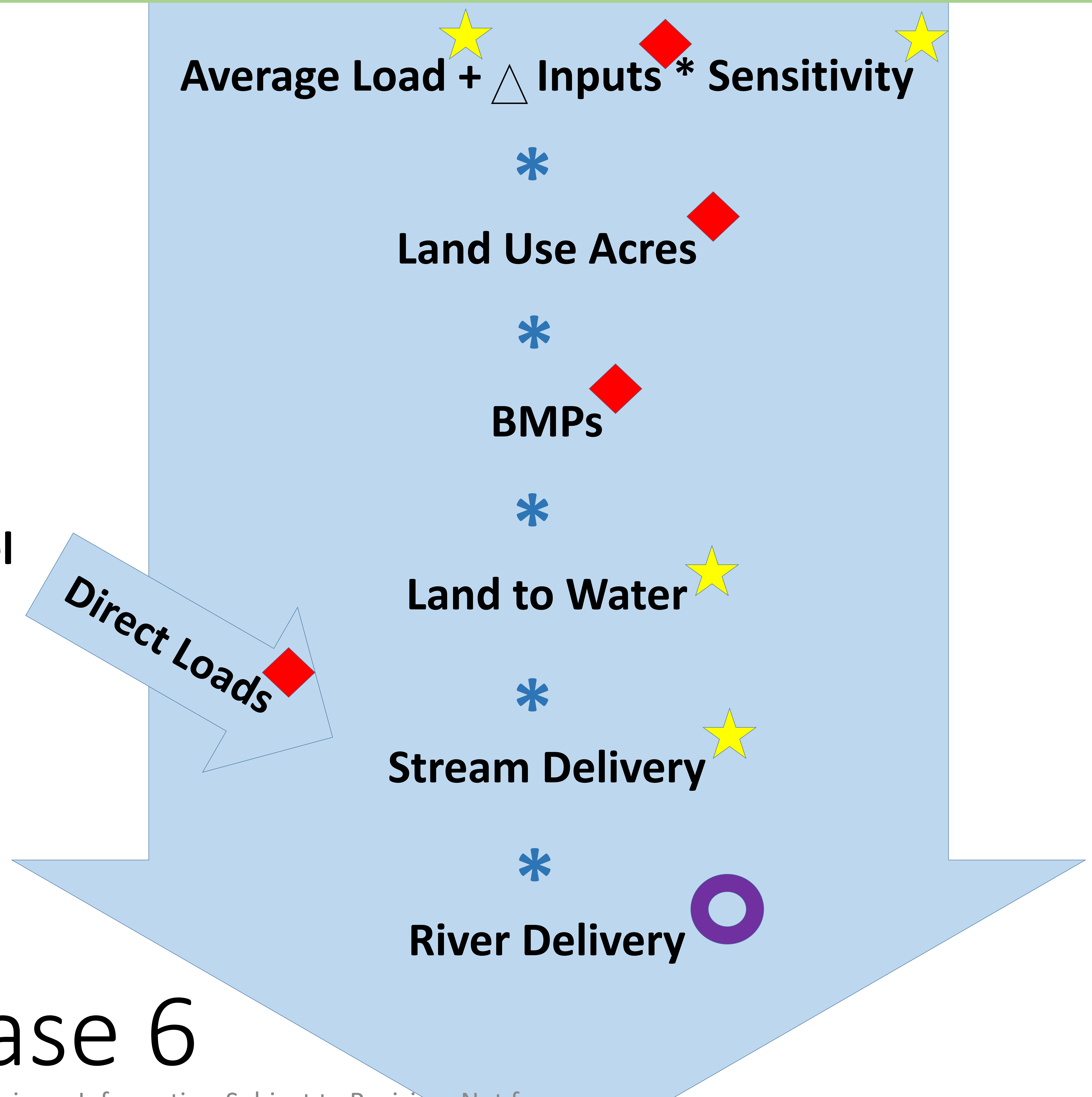
# Phase 6 Model Structure

## Structure

◆ Specified by WQGIT

★ Estimated by MWG

○ Calibrated in dynamic model



## Phase 6

Preliminary Information-Subject to Revision. Not for

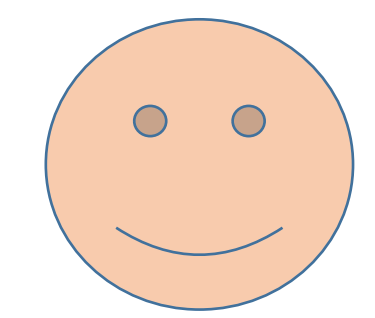
Citati

Load by land-river segment and land use

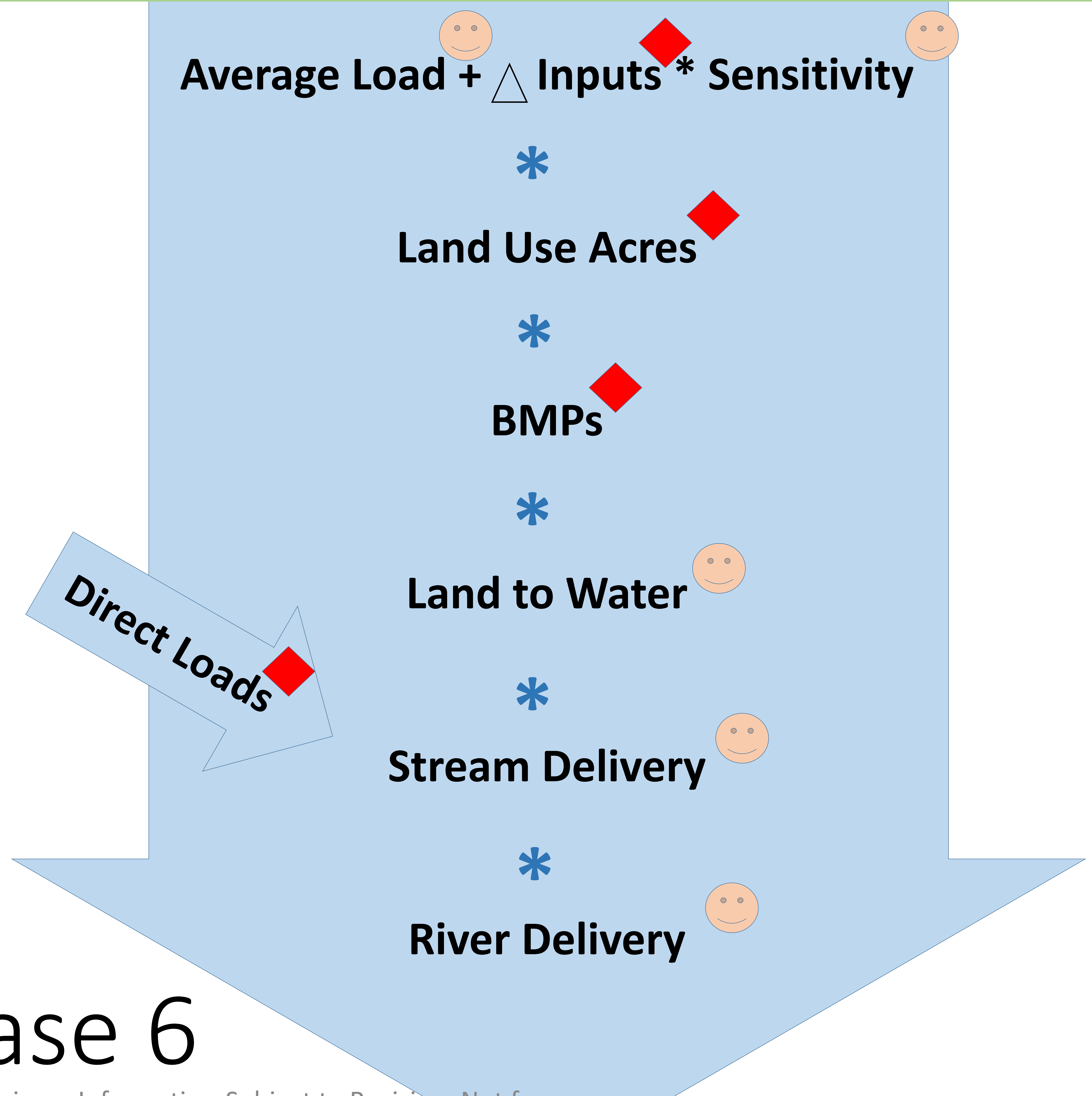
# Phase 6 Model Structure

## Structure

◆ Specified by WQGIT



Calibrated with  
estimated priors



## Phase 6

Preliminary Information-Subject to Revision. Not for

Citati

Load by land-river segment and land use

# SCALE

# Phase 6

# CB Watershed

# Jurisdiction-Basins

# LRsegs

1

20

2200

## CBP decisions

## CBP decisions

## State/county decisions



# SCALE

## Phase 6

# Phase 7

# CB Watershed

# Jurisdiction-Basins

# LRsegs

# NHD catchments

1

20

2200

80,000

# CBP decisions

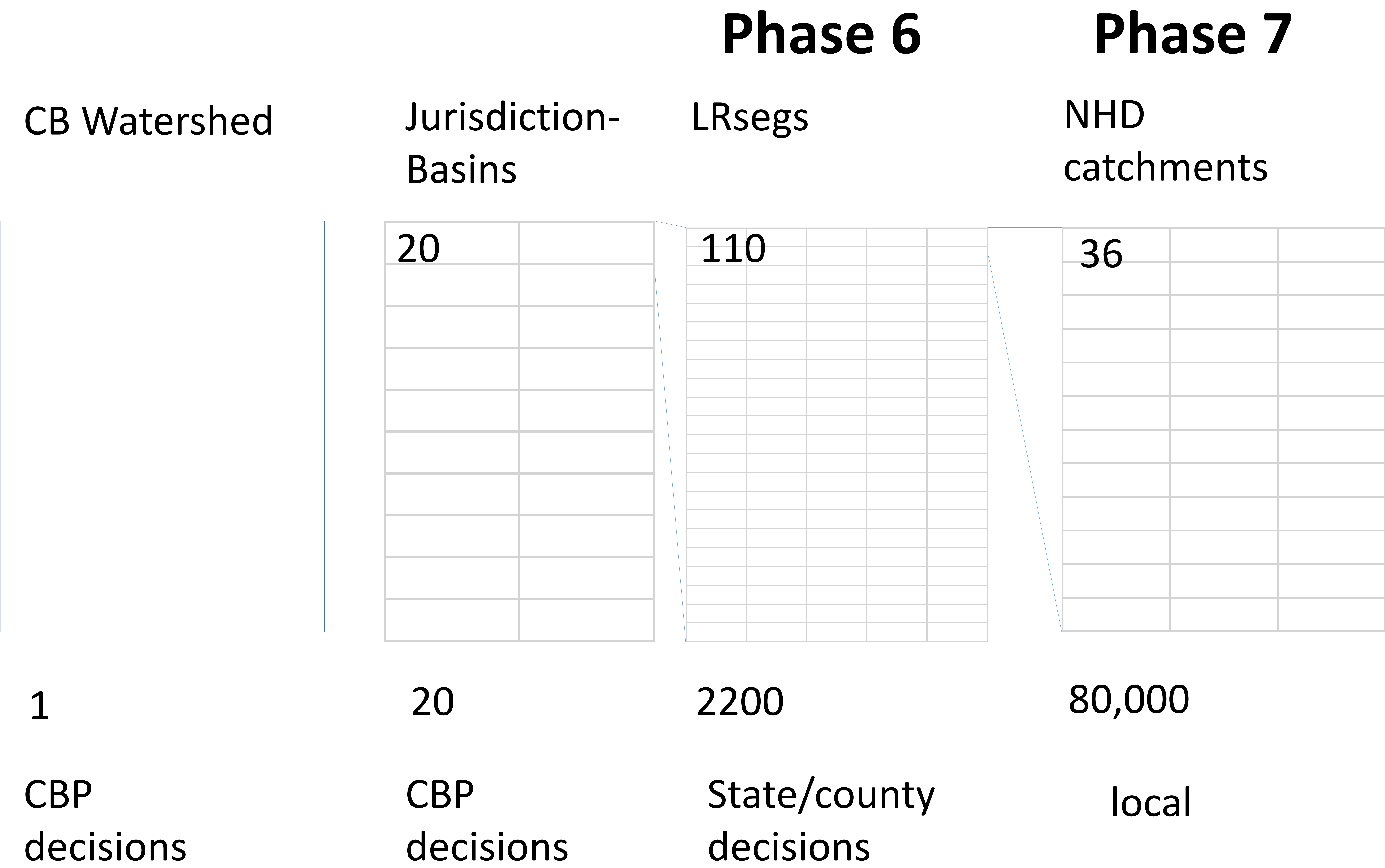
# CBP decisions

## State/county decisions

local

# SCALE

Opportunity and needs  
~ meter scale



...  
Geomorphometry

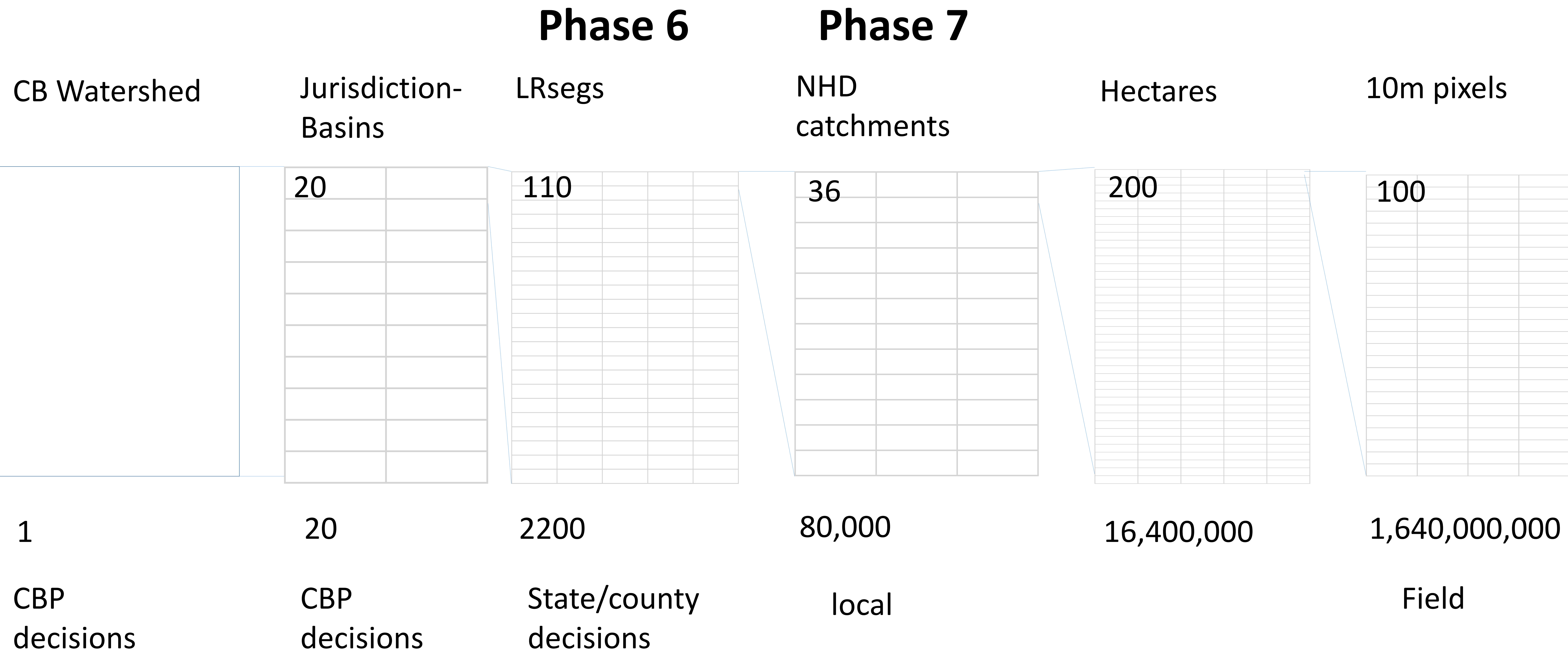
Land Use

Fine-scale tools  
(field doc)

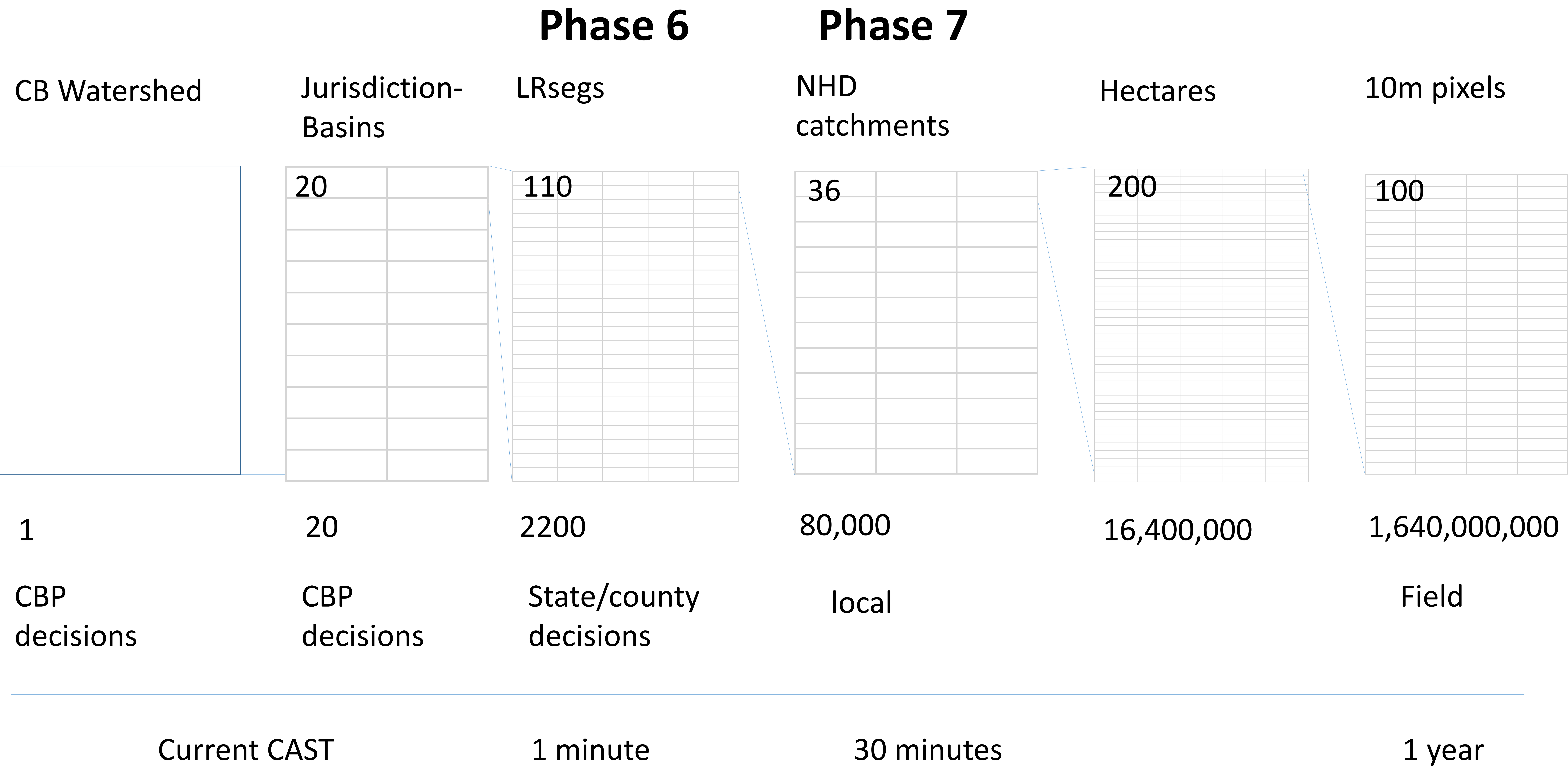
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# SCALE

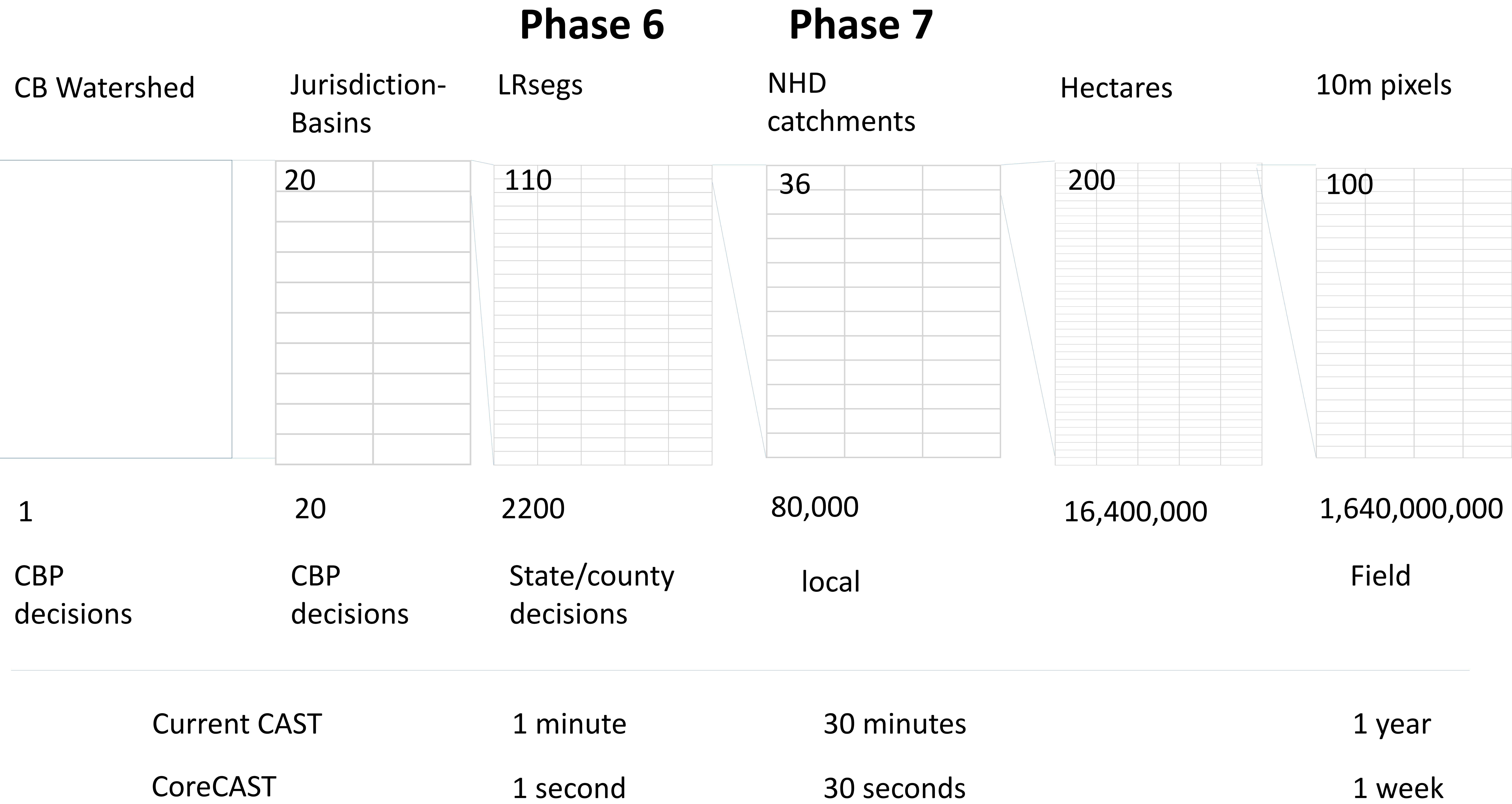


# SCALE

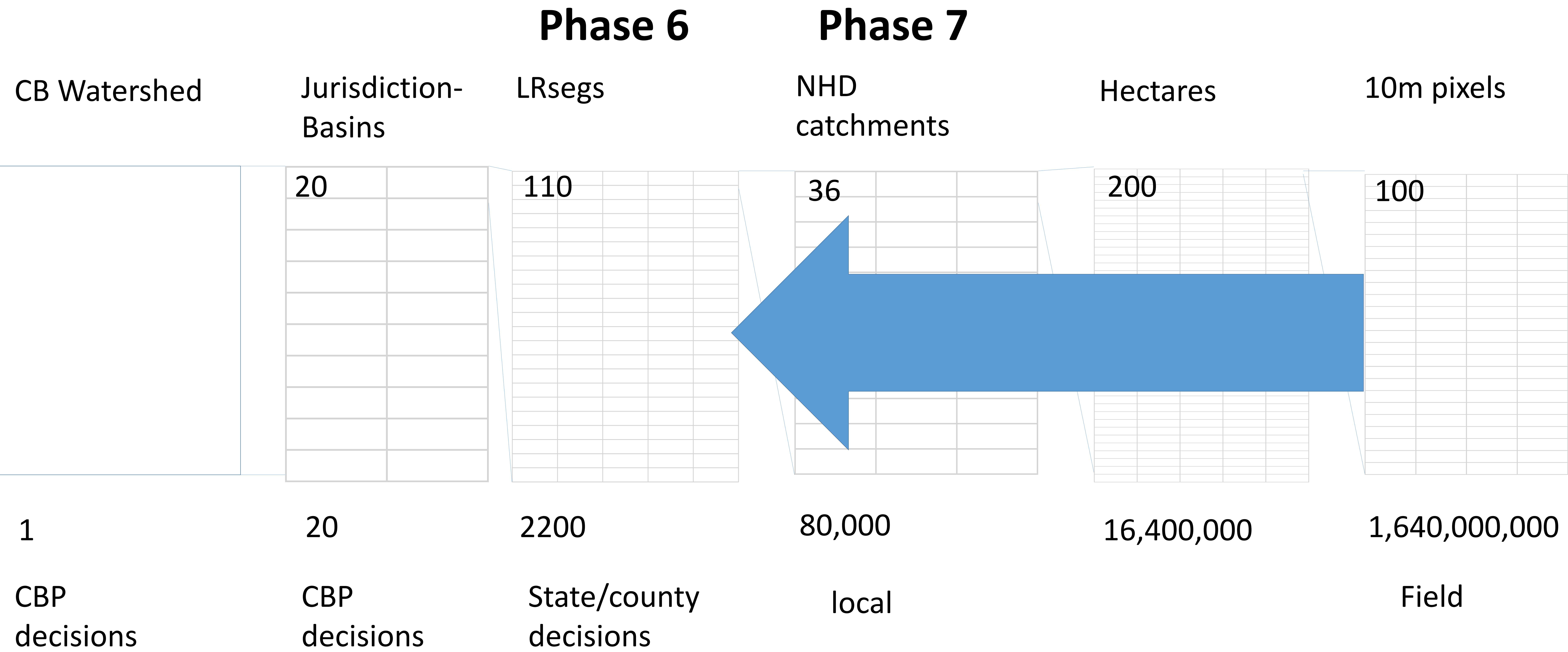




# SCALE



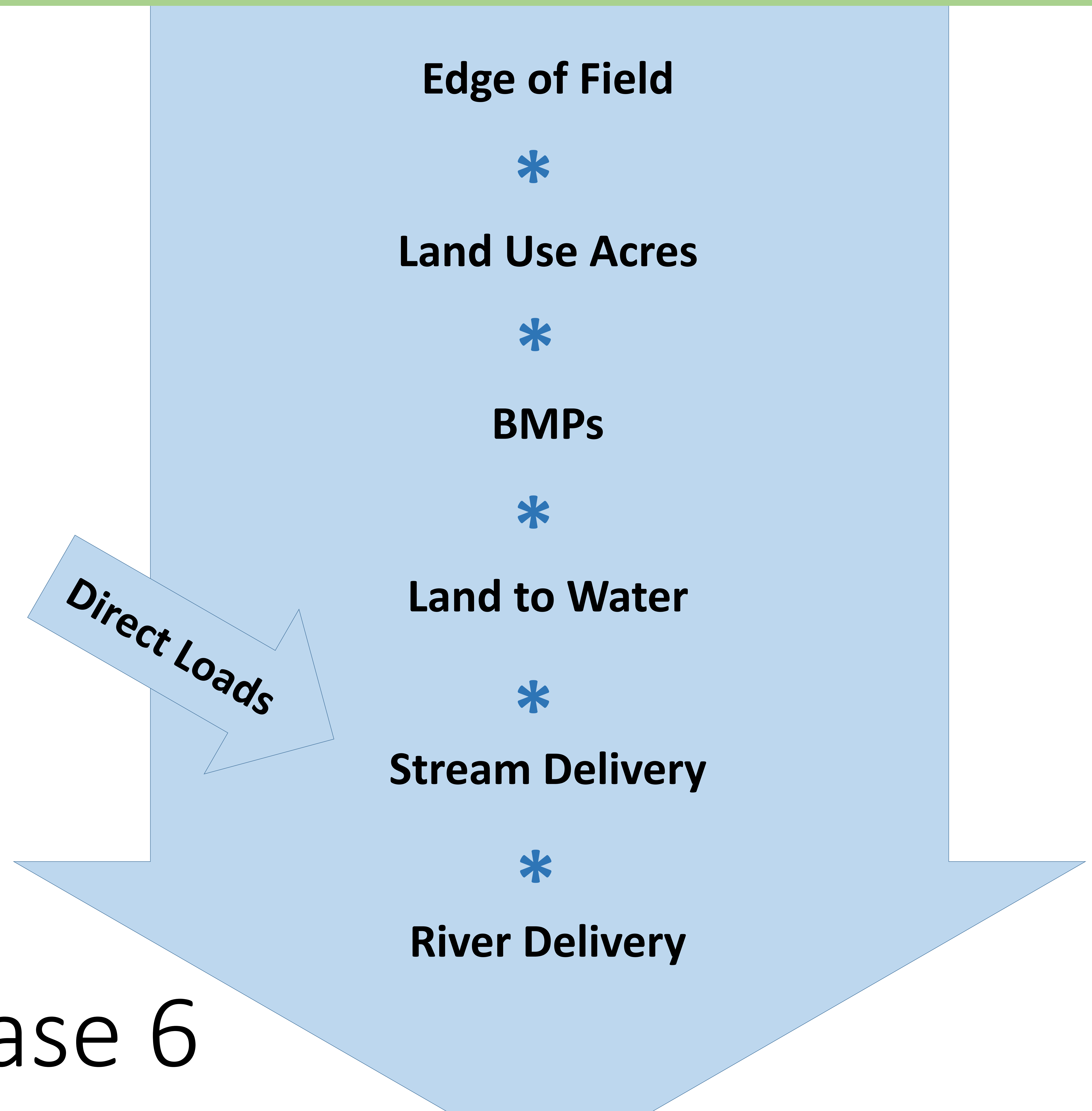
# SCALE



We already know how roll up meter scale applications to a larger scale



# Steady State Phase 6 Model Structure



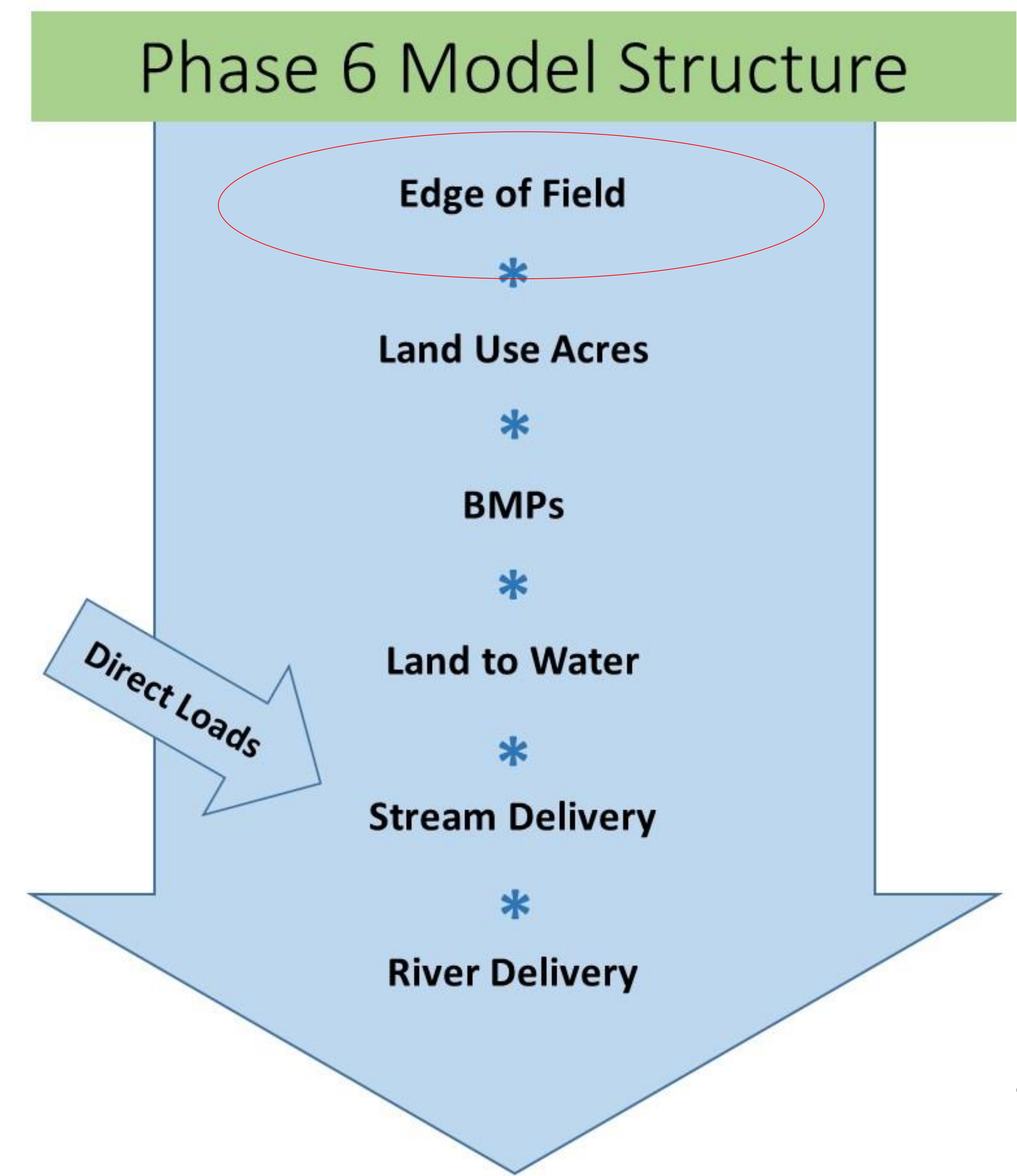
## Phase 6

Load by land-river segment and land use

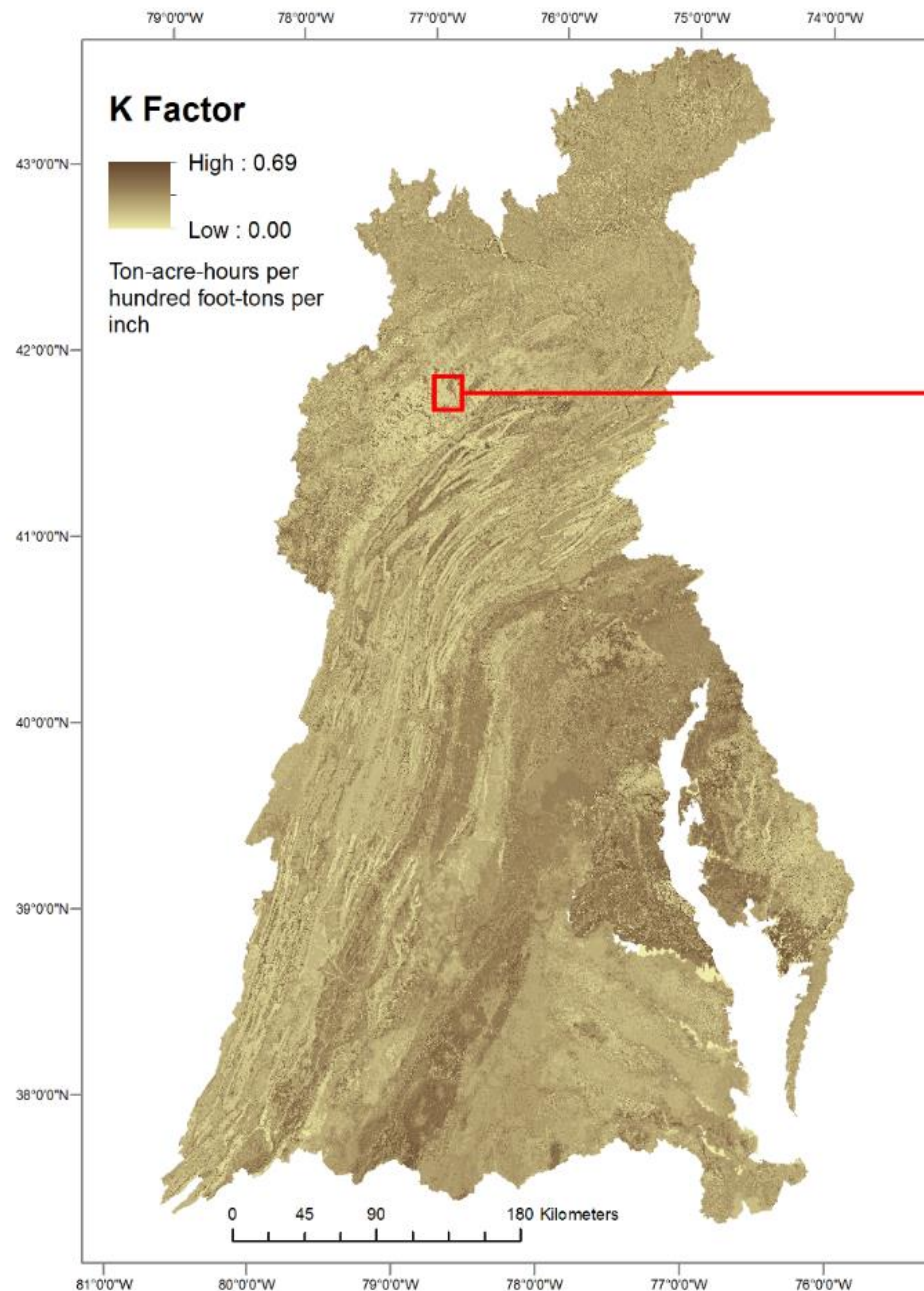


$$\text{RUSLE} \Rightarrow R * K * LS * C * P$$

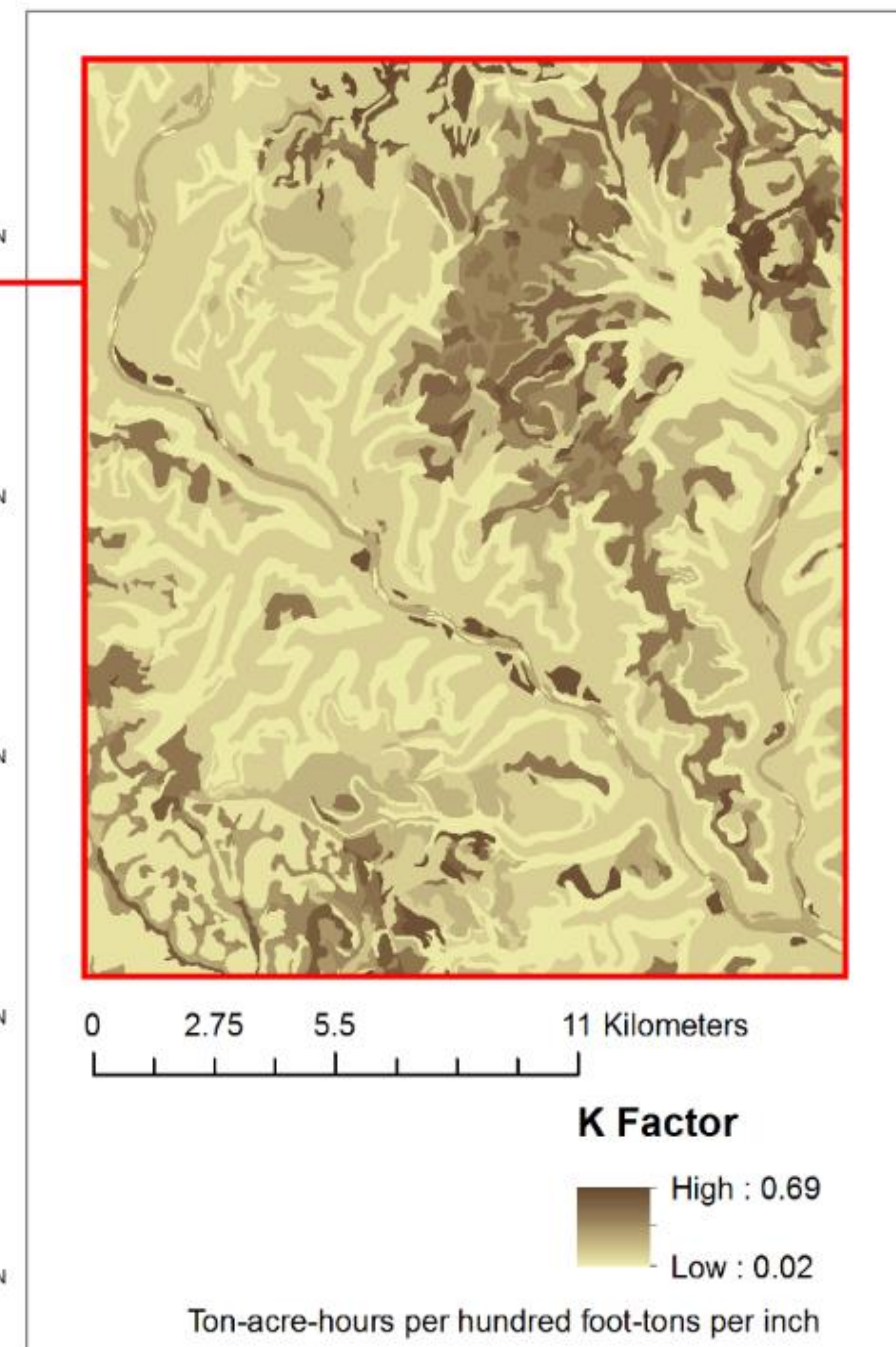
- R = Runoff
  - K = Erodibility
  - LS = slope length
  - C = Cover
    - By land use and Land-River segment
  - P = Practice
    - = 1 since no action loads
- } Evaluated at 10 meter resolution







## Chesapeake Bay Watershed K Factor



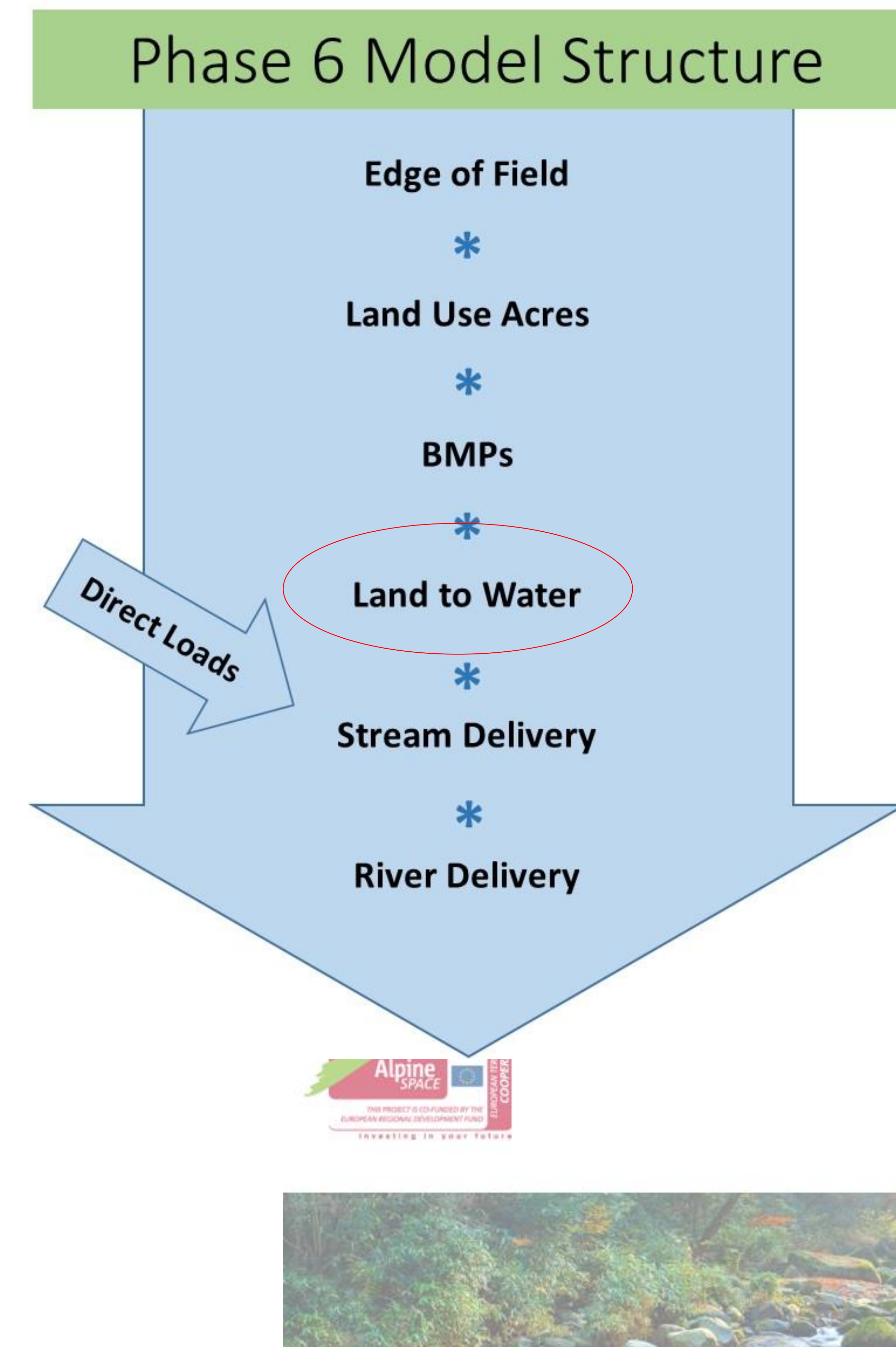
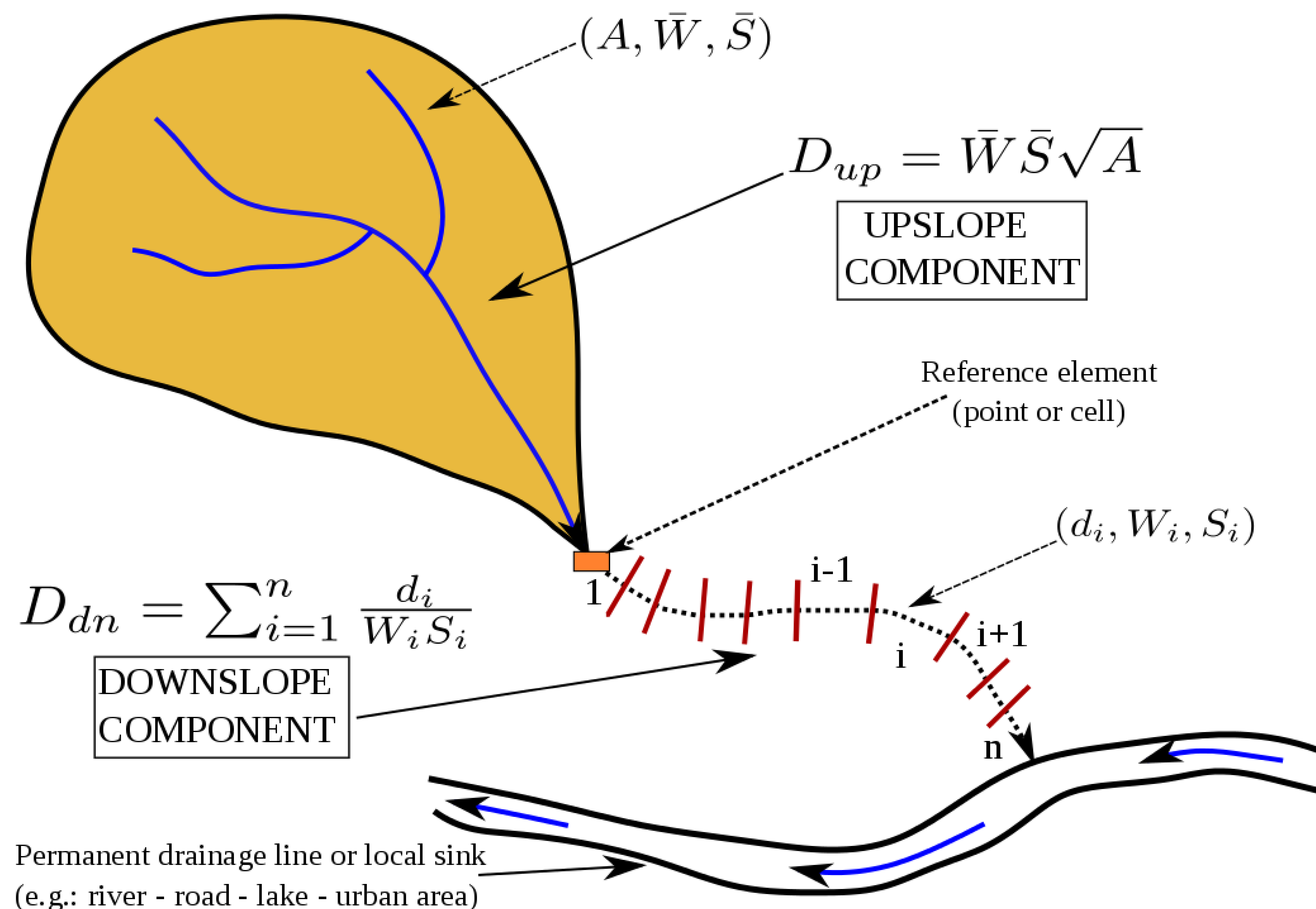
NRCS gSSURGO 2015



# Sediment Delivery to Small Streams

$$IC = \log_{10} \left( \frac{D_{up}}{D_{dn}} \right)$$

**IC = Index of Connectivity**

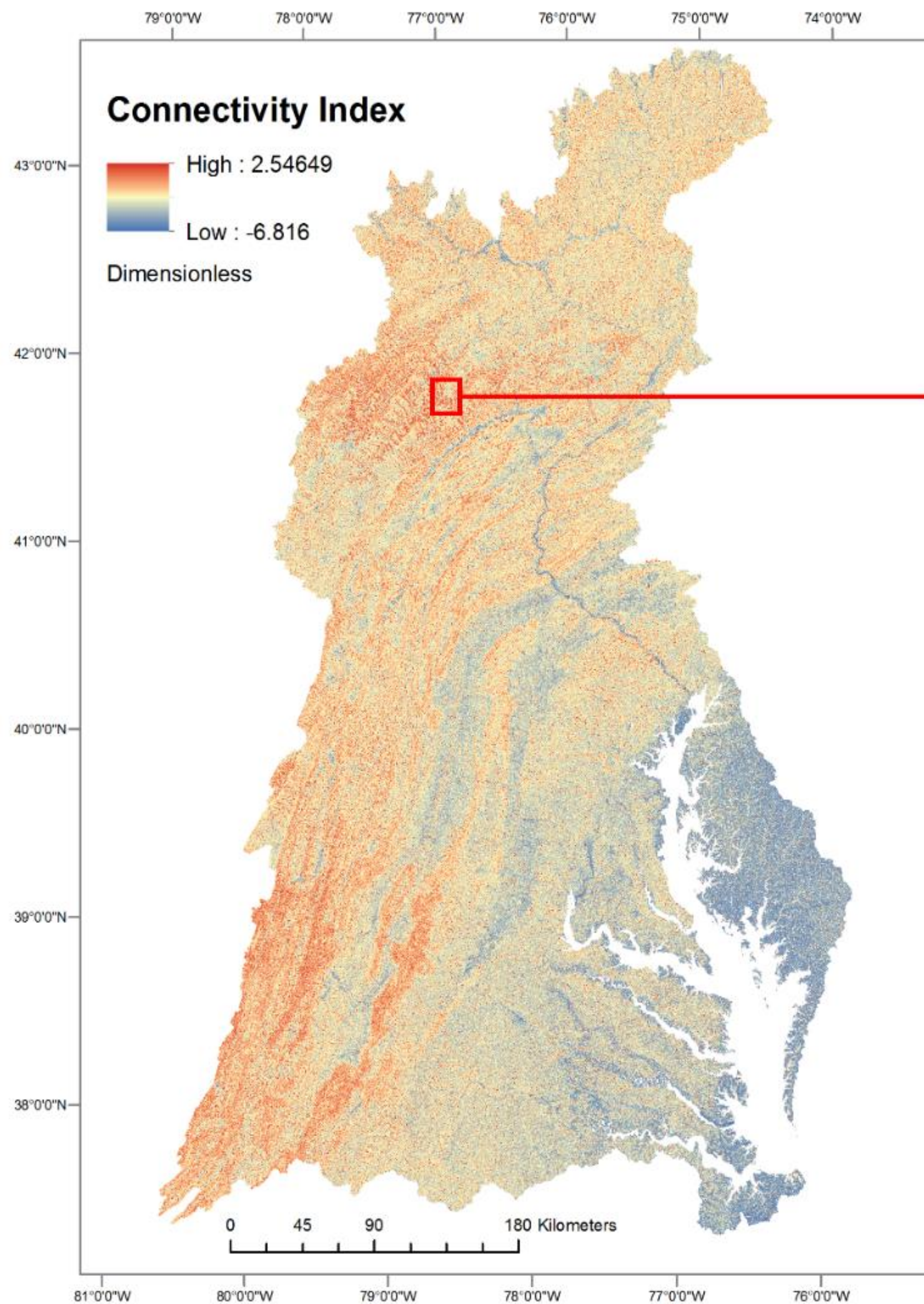


**Guidelines on the Sediment Connectivity**  
**ArcGis 10.1 and 10.2 Toolbox**

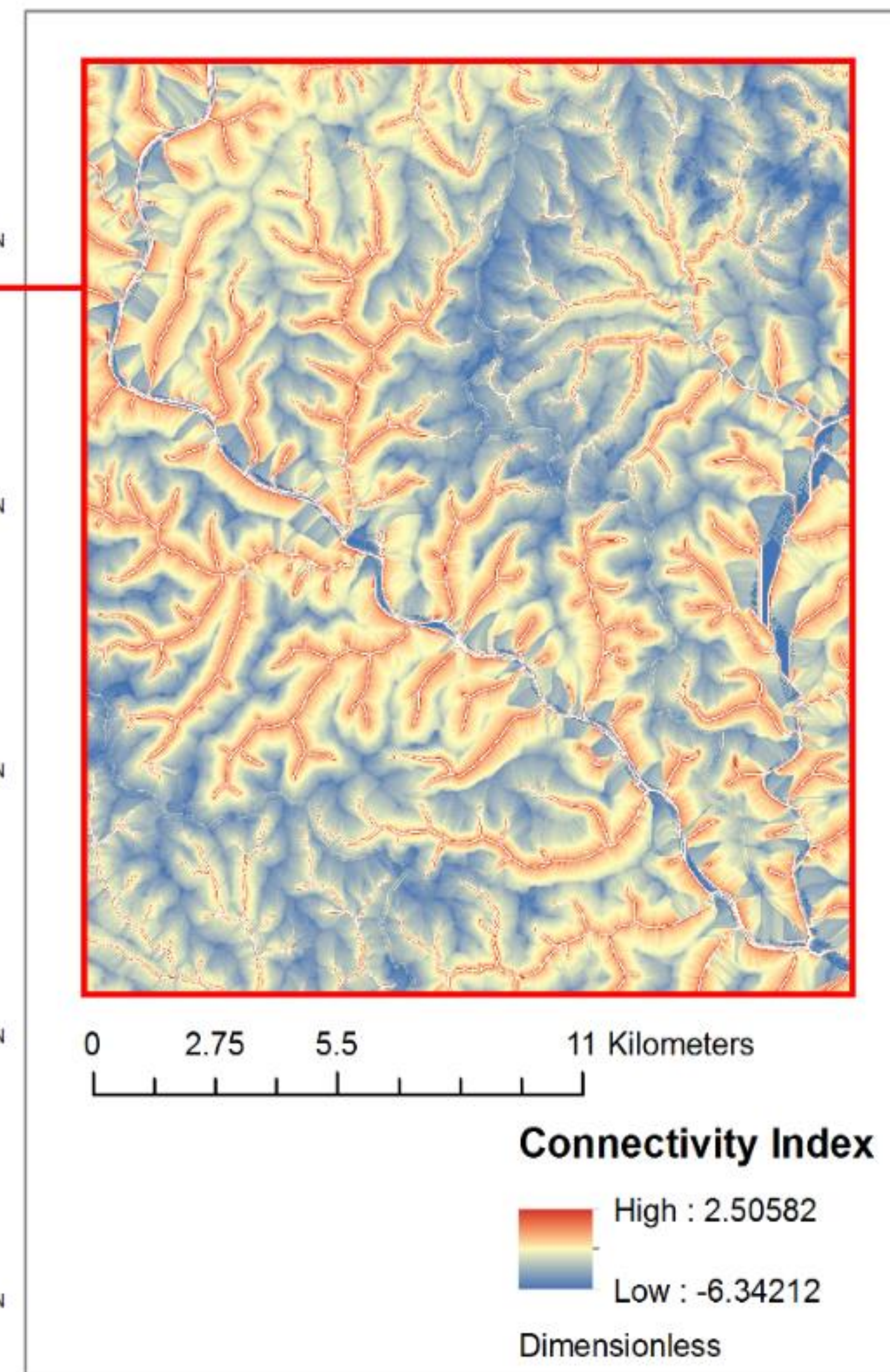
**Release: 1.1**

**Marco Cavalli, Stefano Crema, Lorenzo Marchi**  
**CNR-IRPI Padova (PP4)**



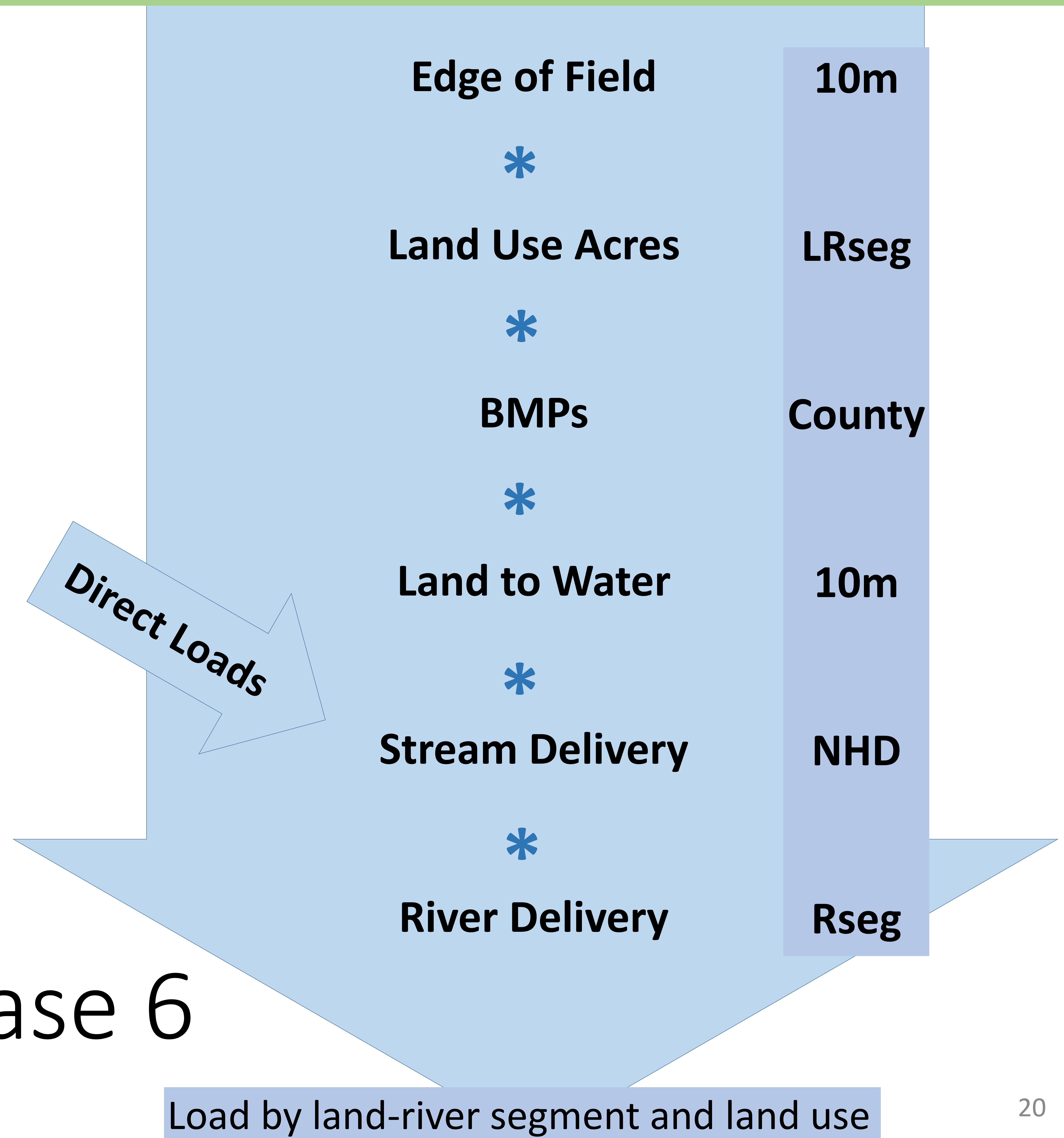


## Chesapeake Bay Watershed Connectivity Index



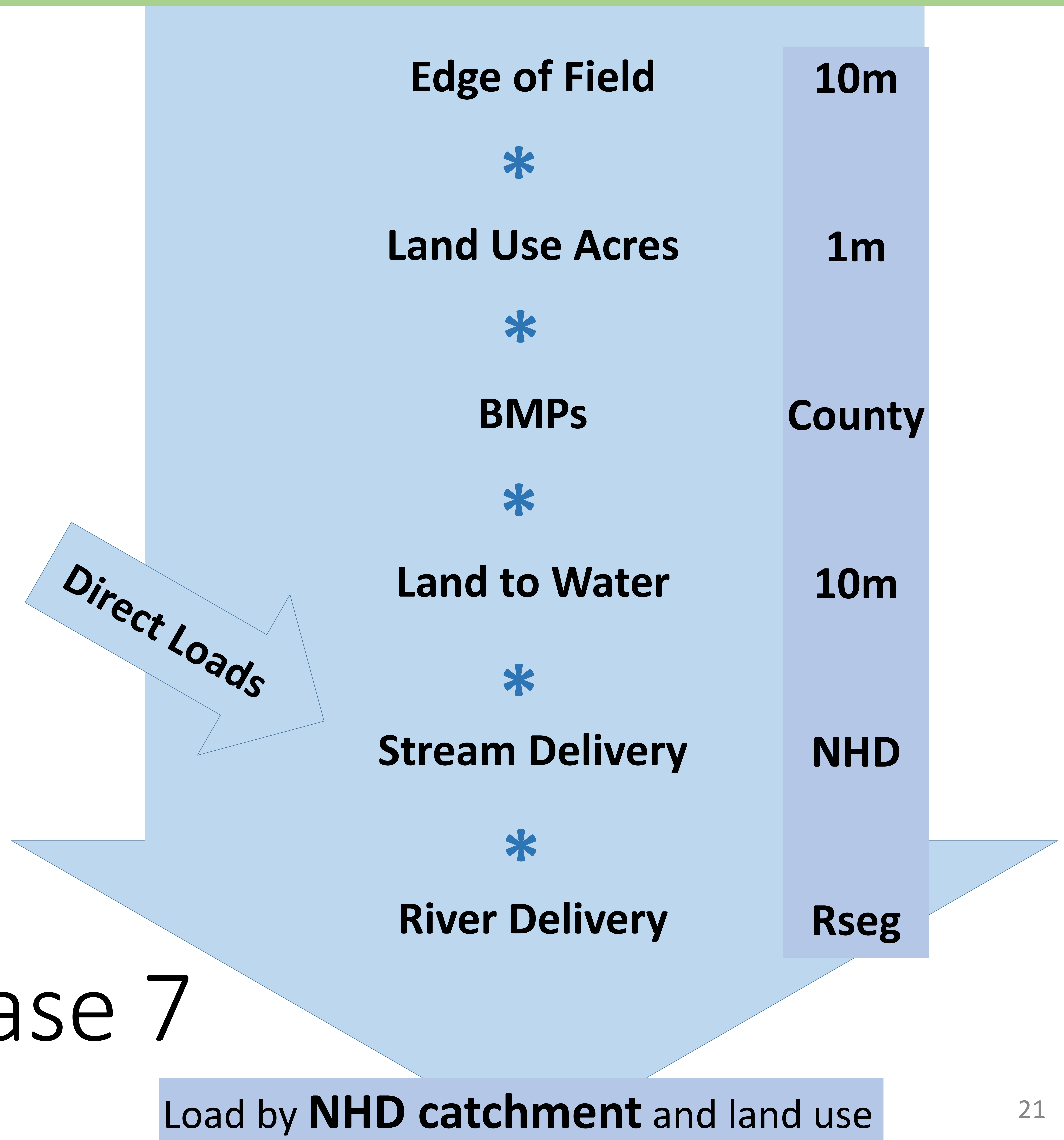


# Steady State Phase 6 Model Structure





# Steady State Phase 6 Model Structure



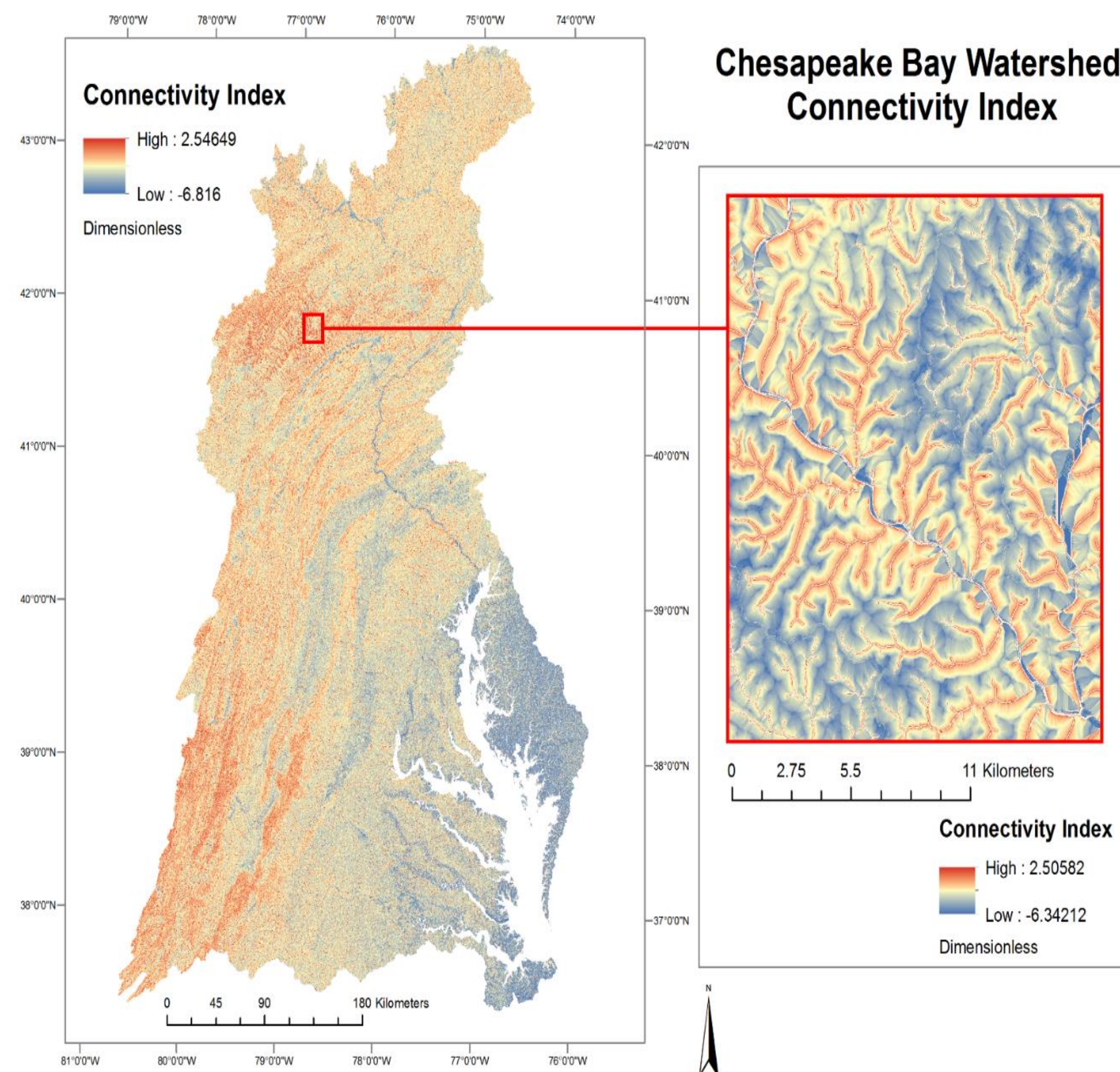
## Phase 7



# CBP Phase 7 Multi-scale Model – Calibration Mode

10m pixel

Distributed  
Static  
Model

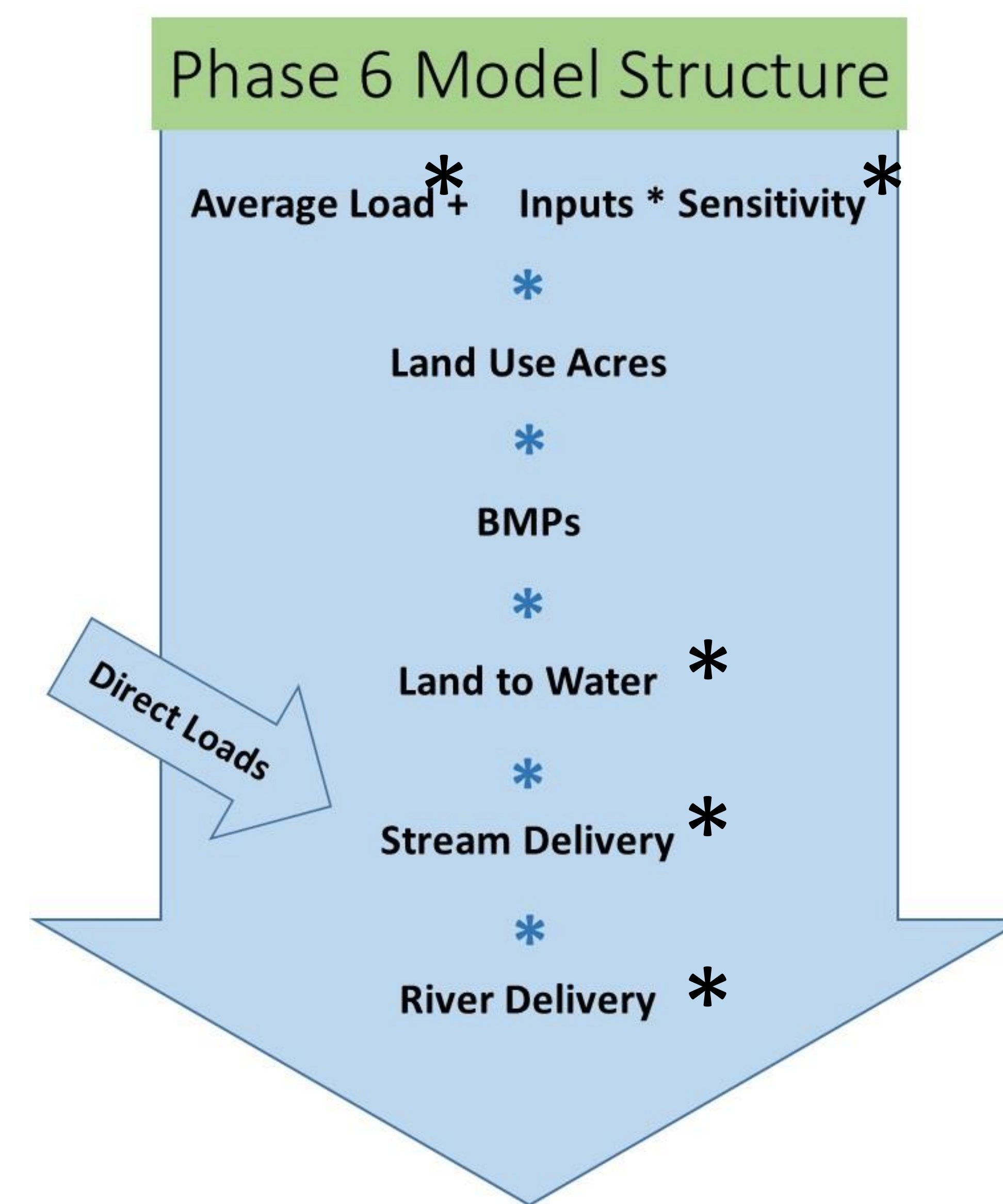


Generation of  
summarized loading  
parameters for flow,  
N, P, and S

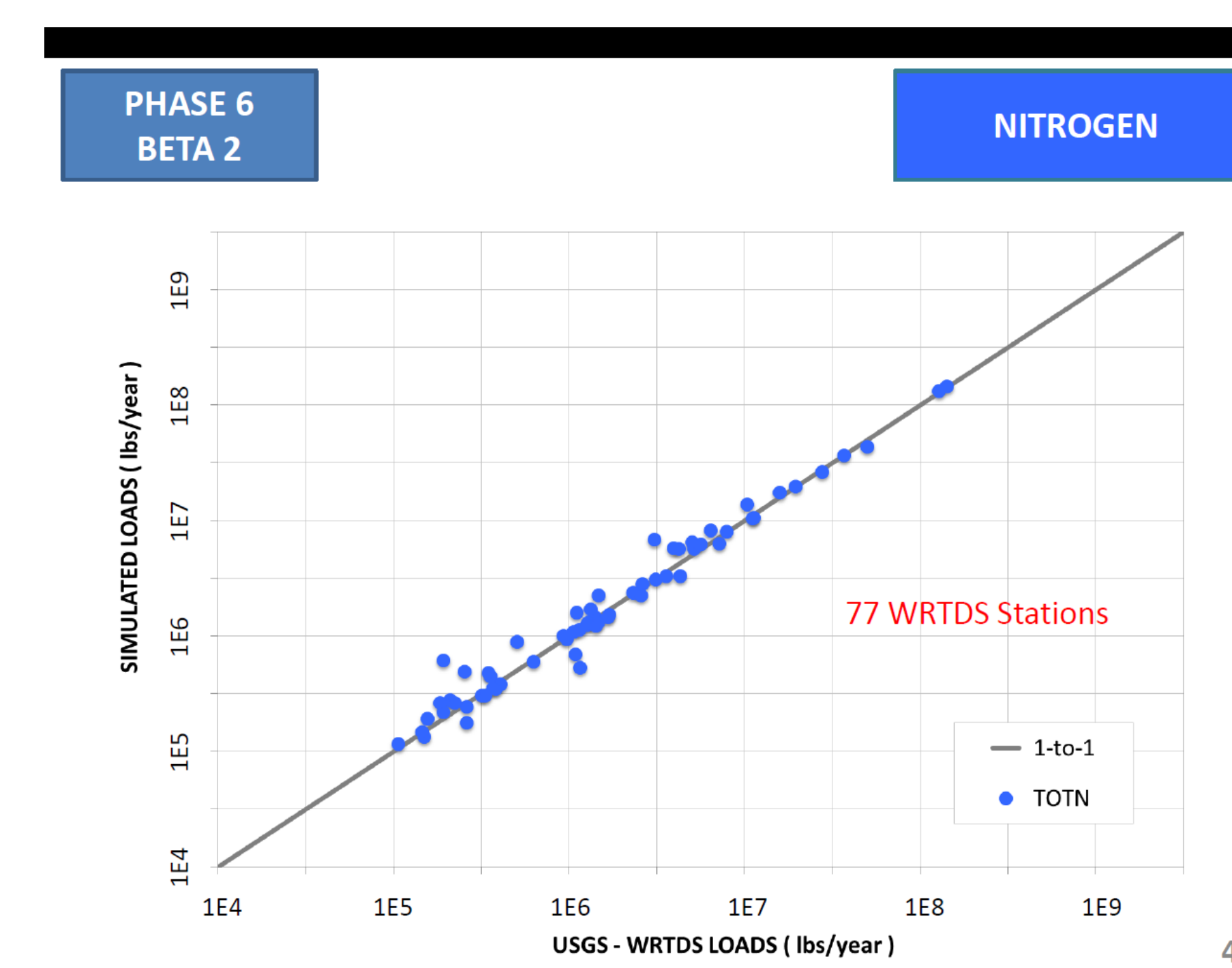
Adjust analysis based  
on feedback from  
CalCAST

NHD 100k

CalCAST



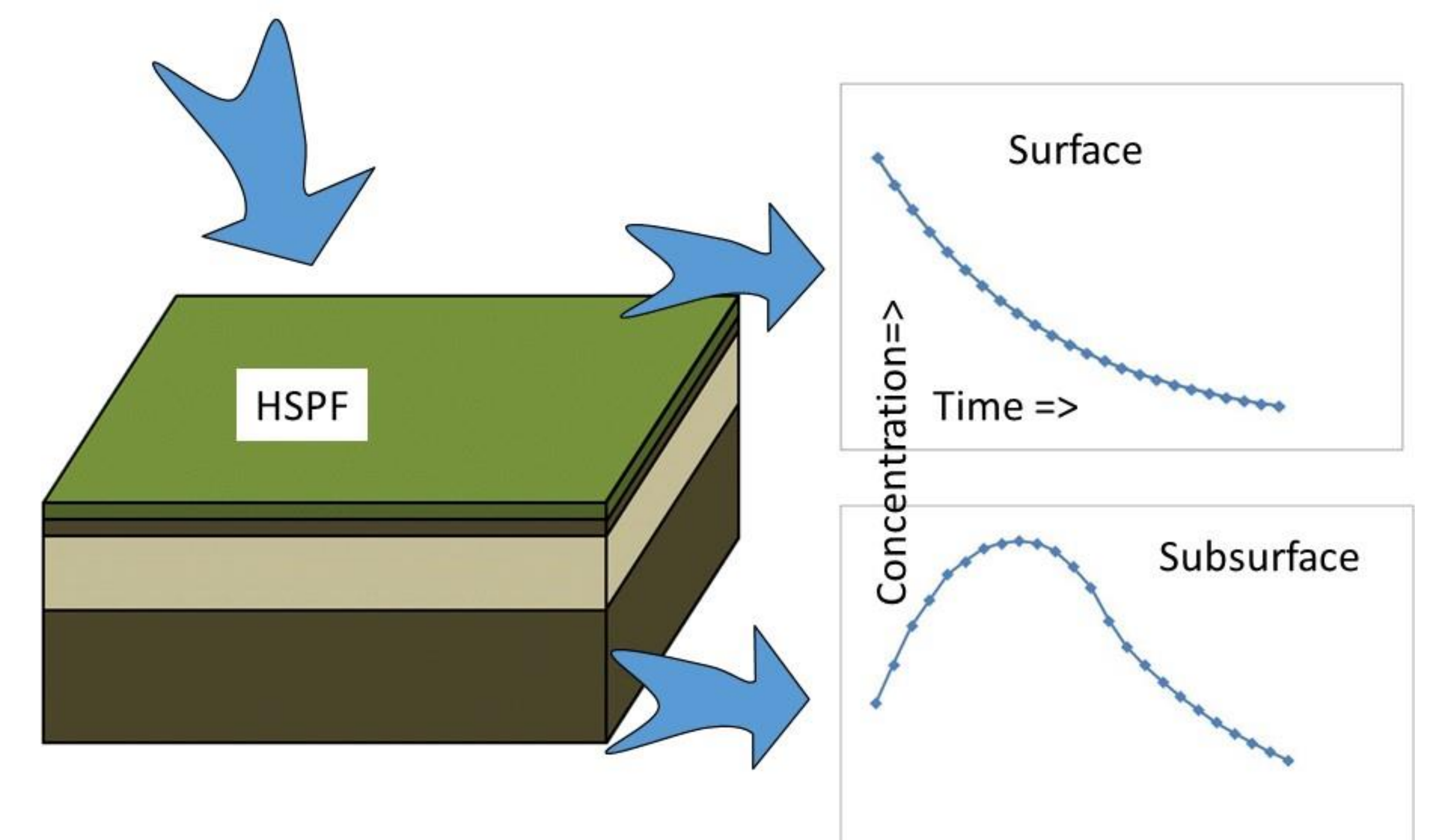
Calibration of meta-  
parameters to spatial  
loads



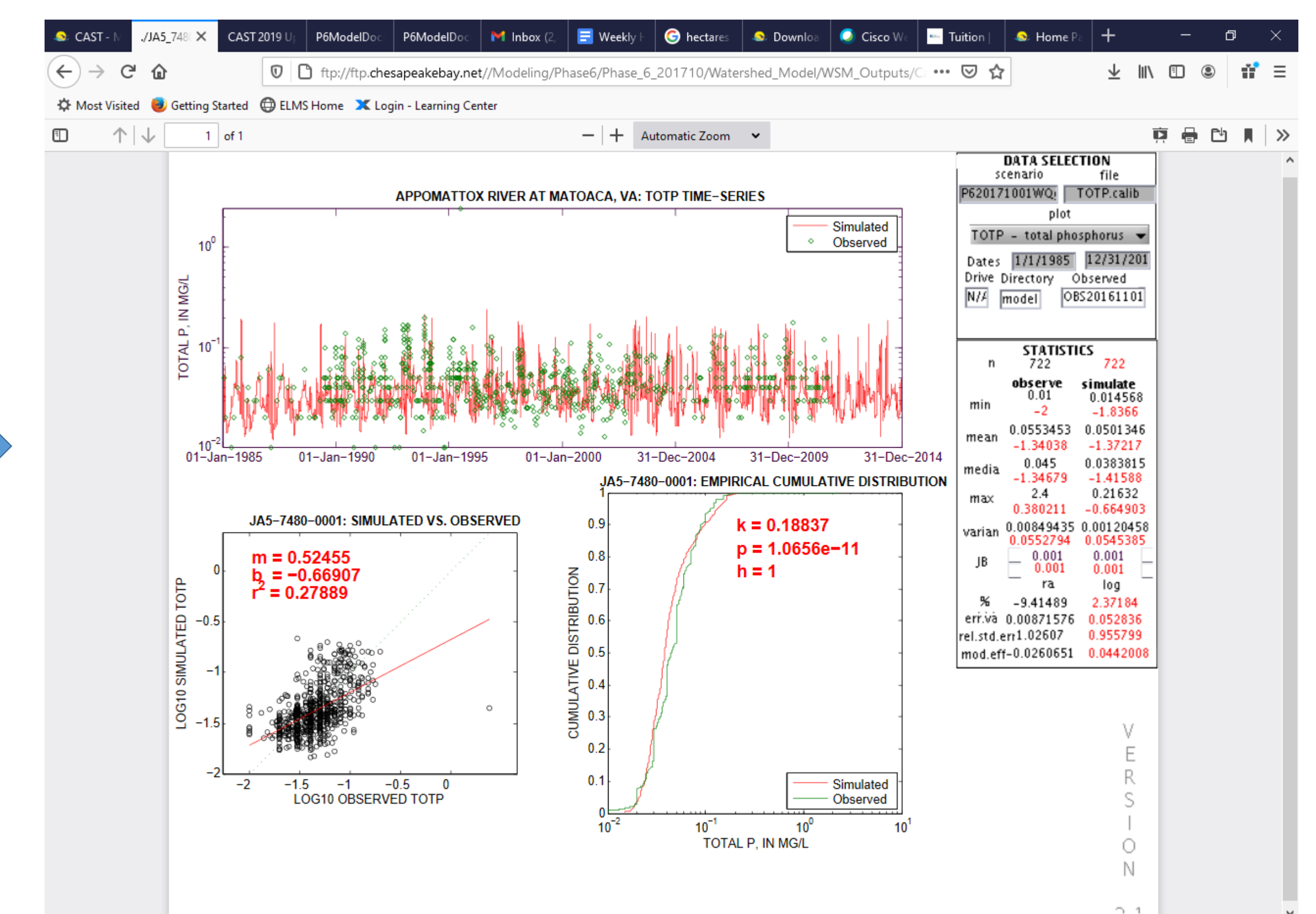
NHD 100k

Dynamic  
Model

Each Loading Event

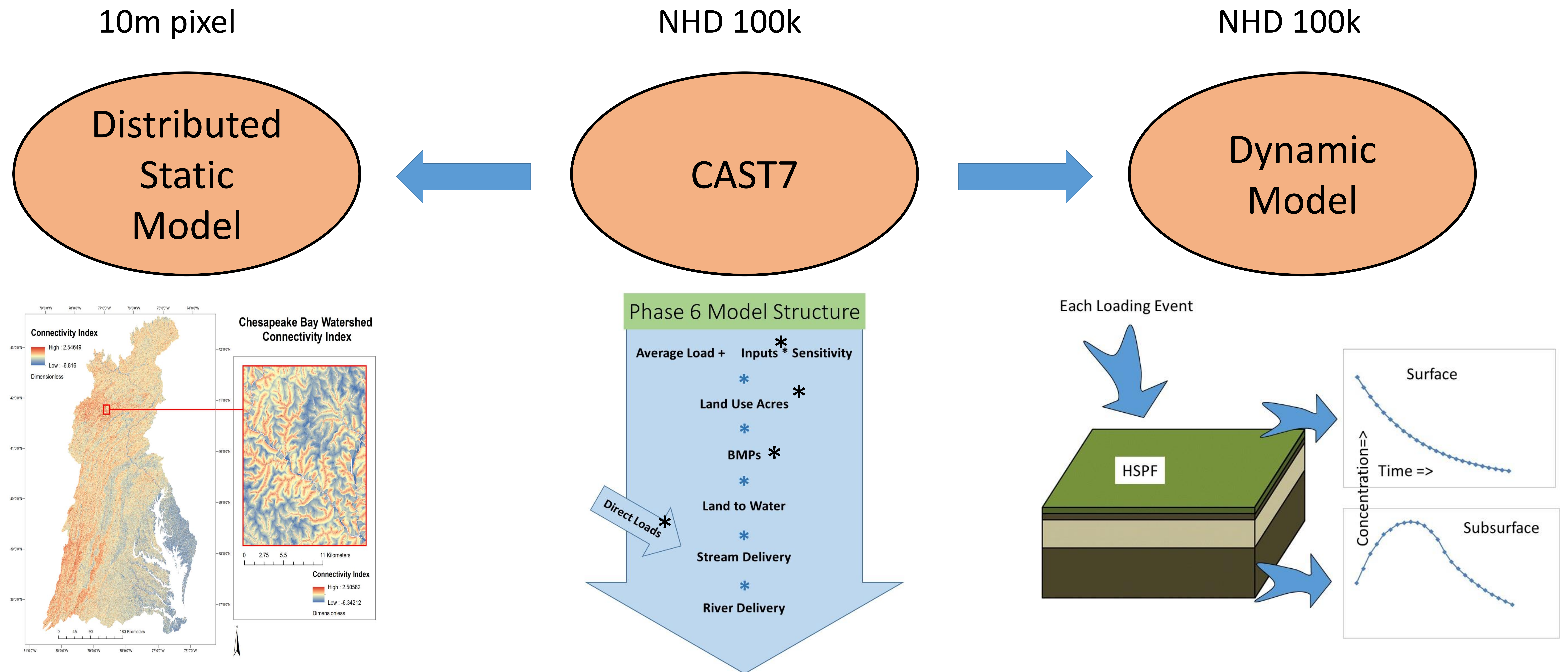


Temporal calibration





# CBP Phase 7 Multi-scale Model – Scenario Mode



CAST loads can be  
downscaled to finer  
scale to apply  
differential BMP  
crediting

(if credible methods  
are found)

CAST determines CBP  
official scenario loads

CAST loads are  
temporally  
disaggregated for  
estuarine model



# Next Steps

- Put together a CalCAST prototype
- Test system with hydrology
- Sediment next
- Nutrients