



natural  
capital  
PROJECT

# TRADEOFF!

Roads to a Resilient future

## Moderators

Hildegard Meyer, WWF DCP

Gabriella Nagy, CEEweb

Thor Morante, CEEweb

Margot Vanhecke, CEEweb

Stanford | Department  
of Biology



Stanford  
**WOODS**  
INSTITUTE for the  
ENVIRONMENT



The Nature  
Conservancy



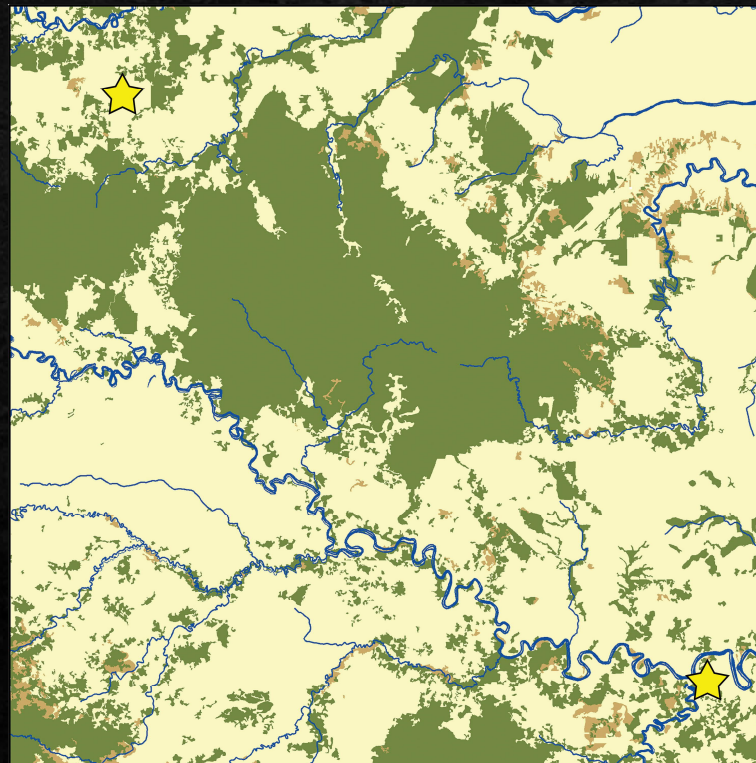
INSTITUTE ON THE  
ENVIRONMENT  
UNIVERSITY OF MINNESOTA  
Driven to Discover™

# WELCOME!



natural  
capital  
PROJECT

## LET'S BUILD A ROAD!



Agriculture Forest Grass/Shrub Rivers

# BENEFITS OF ROAD CONSTRUCTION

- Increase connectivity between population centers
- Increase access to healthcare and other social services
- Connect farmers to markets
- Accommodate expanding populations





# COSTS OF ROAD CONSTRUCTION

natural  
capital  
PROJECT

- Topography and water crossings
- Zoning and re-zoning
- Land tenure and land acquisition
- Resettlement of displaced populations





## ROUND 1



natural  
capital  
PROJECT

- Build a road connecting to the two population centers to earn 6,000 points (representing the development benefits the road provides)
- Lose points for the costs of road development (re-zoning, acquiring right-of-way, construction, etc.)
  - Lose points per cell crossed by the road
  - The darker the cell, the more points you lose
- Win by building the road with highest score (benefits - costs)


# SCORES

## ROUND ONE



natural  
capital  
PROJECT





## Natural Capital

Stock of natural assets

## Ecosystem Services

Benefits people obtain from ecosystems





Food, fuel,  
fiber



Erosion  
control



Climate  
regulation



Clean  
water

Coastal  
protection



Spiritual  
fulfilment





## According to the Millennium Ecosystem Assessment:

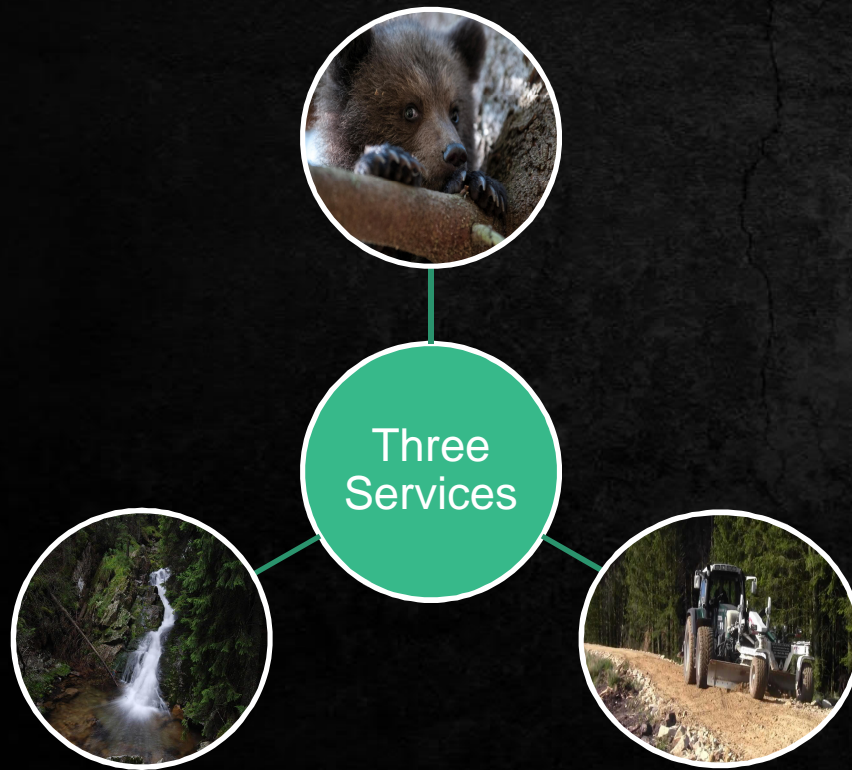
- Approximately 60% (15 out of 24) of the ecosystem services evaluated are being degraded or used unsustainably
- The degradation of ecosystem services often causes significant harm to human well-being and represents a loss of a natural asset or wealth of a country

Image: Tomas Hulik

# ENVIRONMENTAL VALUES

## TRADEOFF! ROADS TO A RESILIENT FUTURE

natural  
capital  
PROJECT



- **Habitat quality** for wildlife
- Reducing risk of damage to the road due to **erosion**
- **Clean water** for downstream communities for drinking and irrigation



# ENVIRONMENTAL VALUES

## TRADEOFF! INFRASTRUCTURE EDITION

natural  
capital  
PROJECT



Habitat quality for wildlife,  
providing tourism opportunities  
and sustaining natural heritage  
values



# ENVIRONMENTAL VALUES

## TRADEOFF! INFRASTRUCTURE EDITION

natural  
capital  
PROJECT



Reduced risk of erosion onto the road





# ENVIRONMENTAL VALUES

## TRADEOFF! INFRASTRUCTURE EDITION

natural  
capital  
PROJECT



Providing **clean water** for downstream communities for drinking and irrigation needs



## ROUND 2



natural  
capital  
PROJECT

- Choose the road that maximizes total benefits by minimizing costs and natural capital losses
- Lose points in road development costs
- Lose points for impacting natural capital
  - Lose points per cell crossed by the road
  - (For ES) Lose points in the buffer around the road
  - The darker the cell, the more points you lose
- (Optional) Add wildlife crossings and conservation blocks to mitigate impacts



## ROUND 2



natural  
capital  
PROJECT



Wildlife crossing



Image © World Wildlife Fund

Conservation area



# SCORES

## ROUND TWO



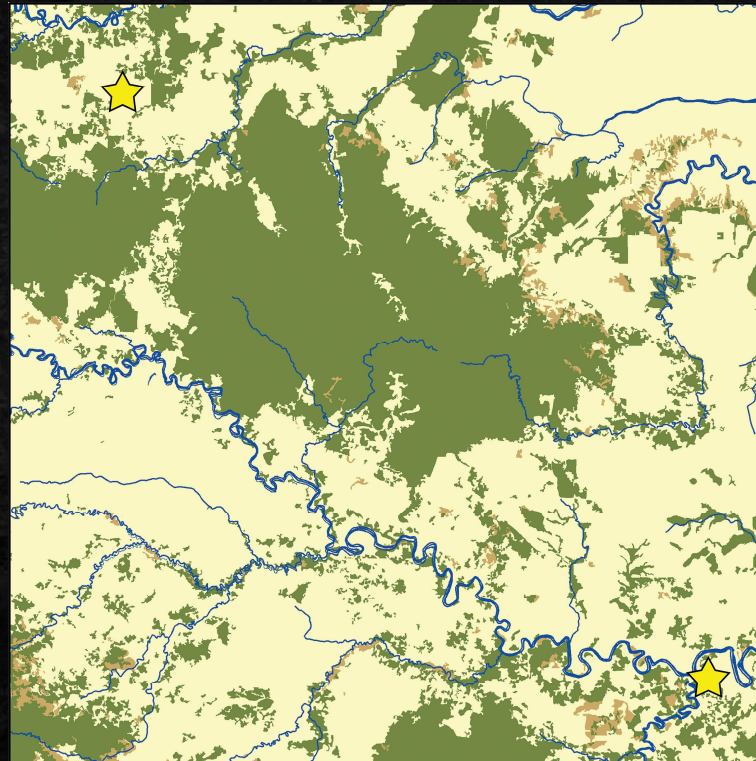
natural  
capital  
PROJECT

## ROUND 3

### IMPACTS OF CLIMATE CHANGE



natural  
capital  
PROJECT

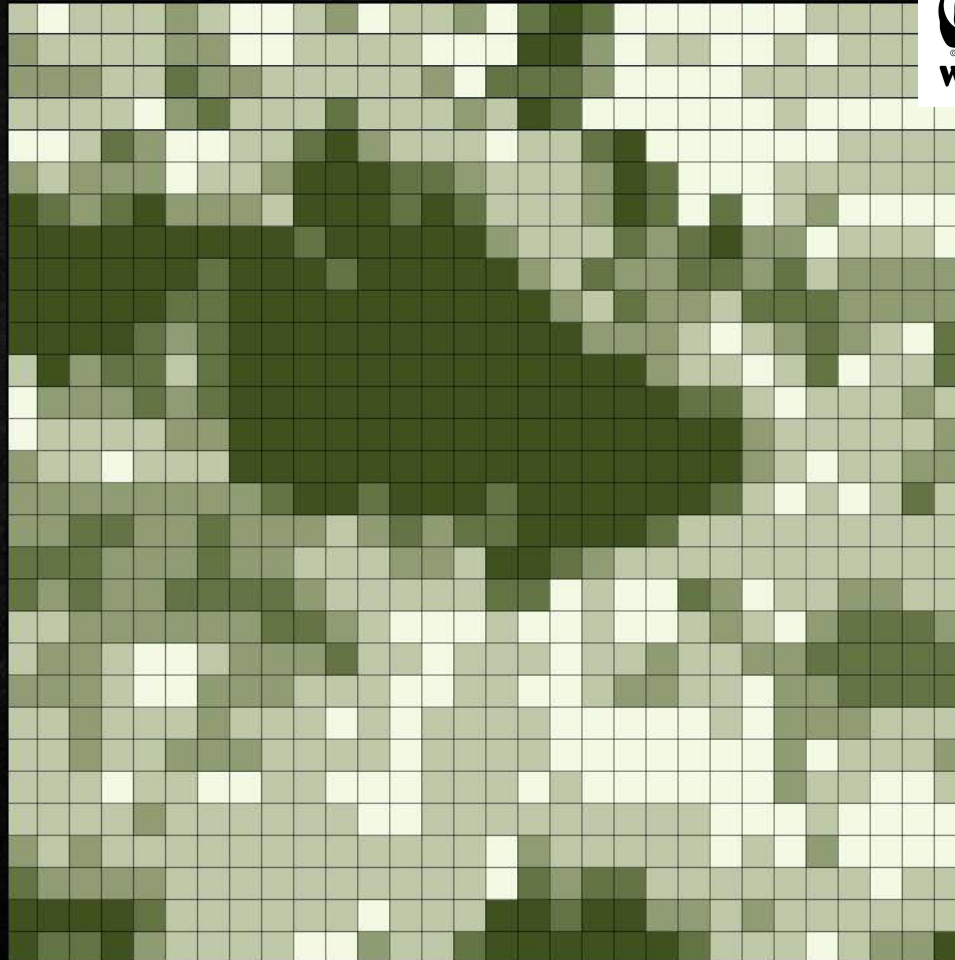


Agriculture Forest Grass/Shrub Rivers



CURRENT

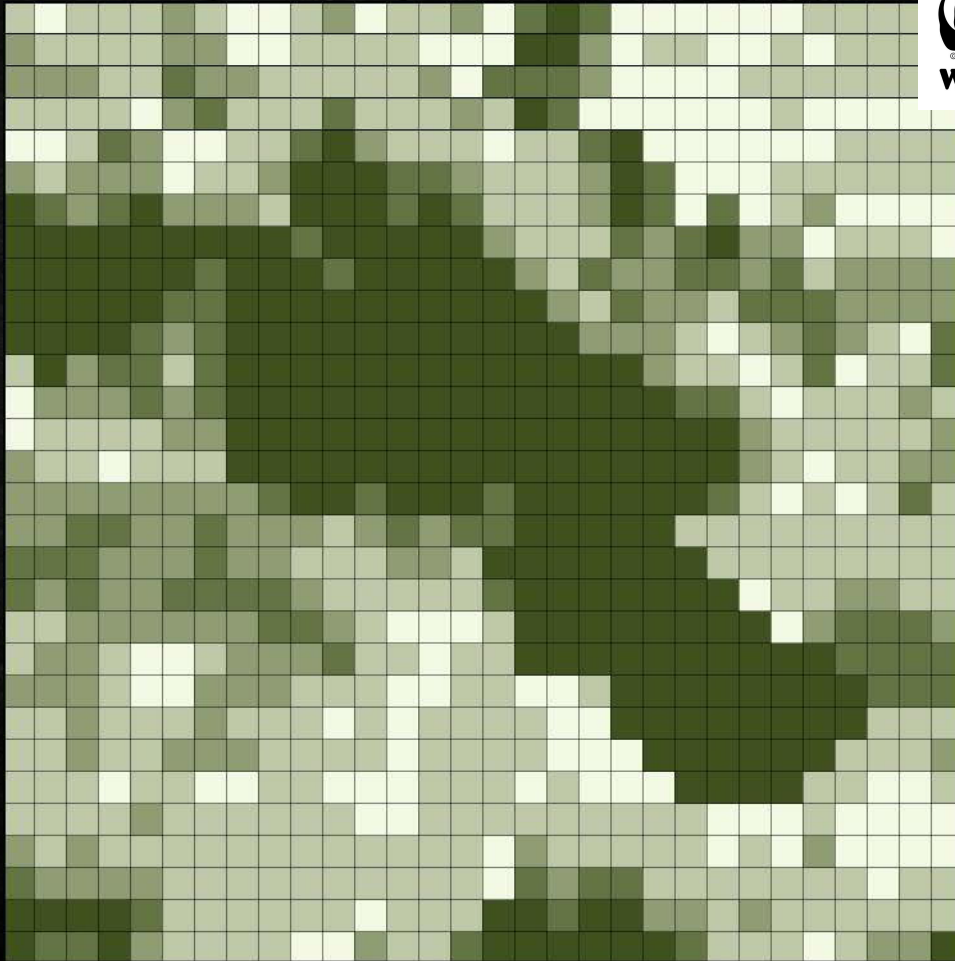
HABITAT QUALITY



natural  
capital  
PROJECT

# FUTURE CLIMATE

## HABITAT QUALITY



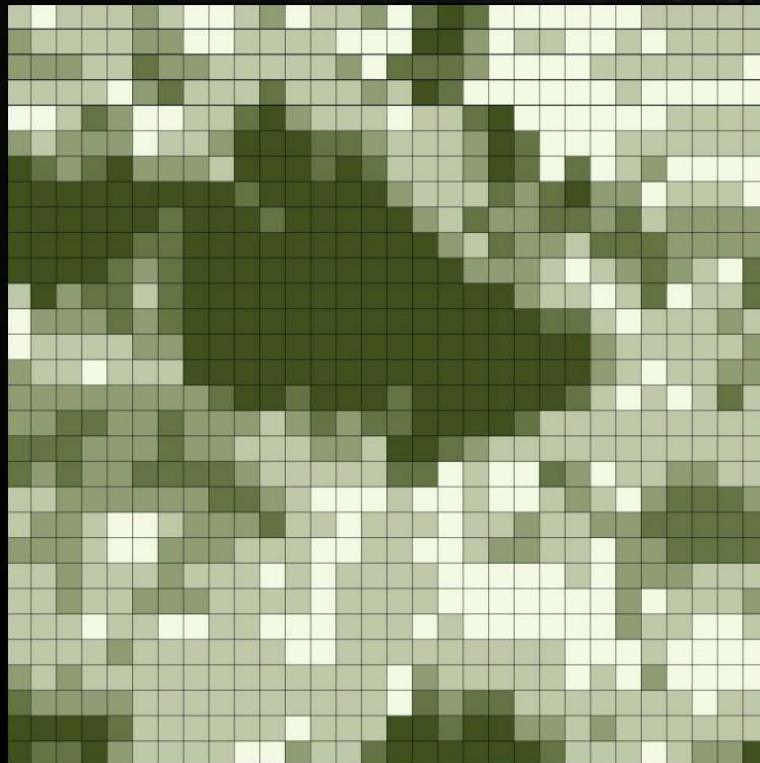
natural  
capital  
PROJECT



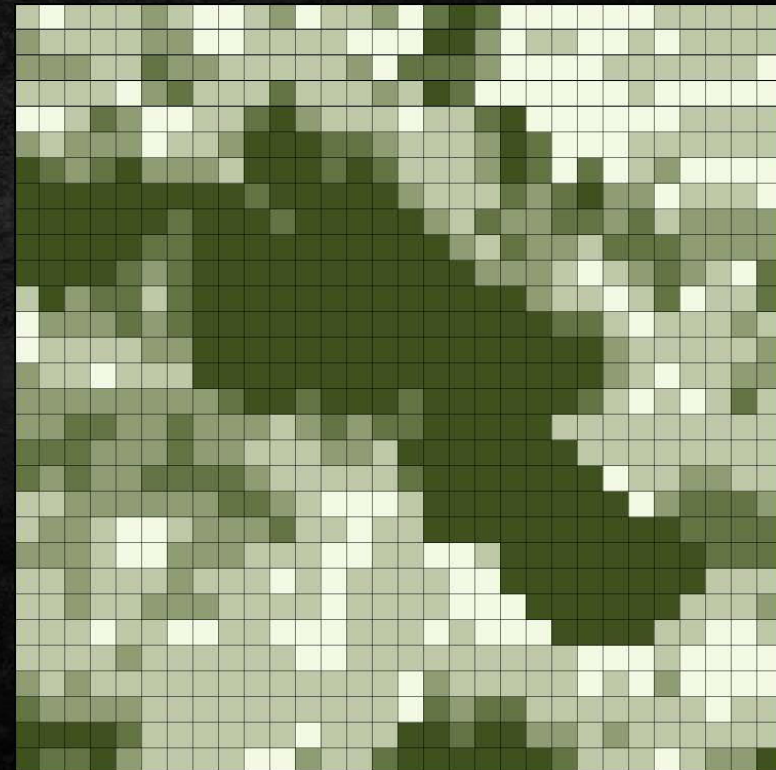
# HABITAT QUALITY



natural  
capital  
PROJECT



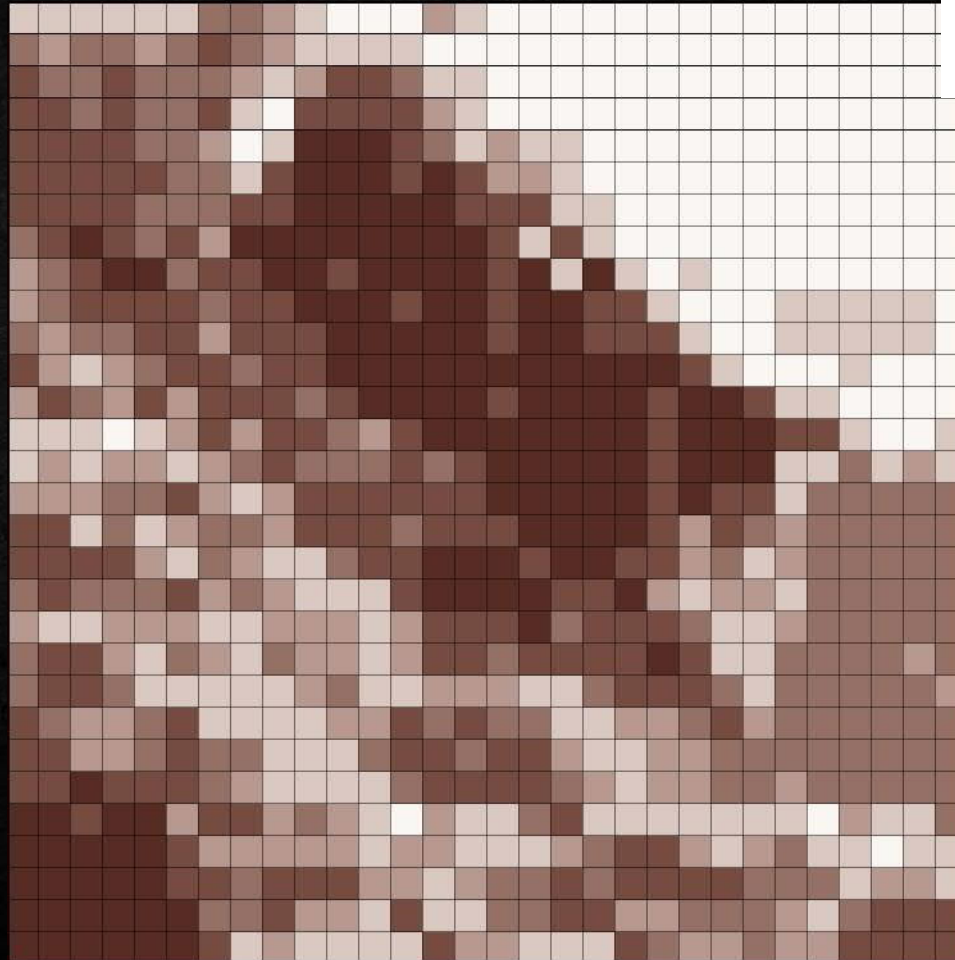
Current climate



Future climate

CURRENT

EROSION RISK

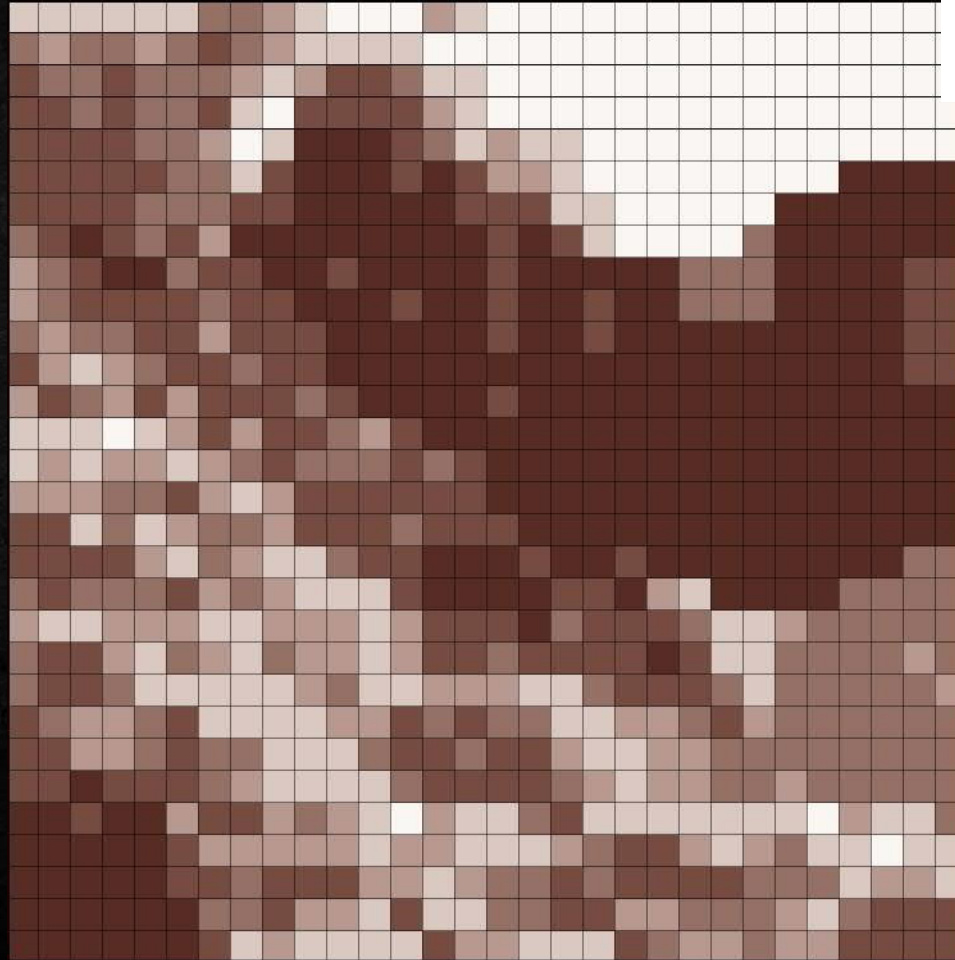


natural  
capital  
PROJECT



# FUTURE CLIMATE

## EROSION RISK

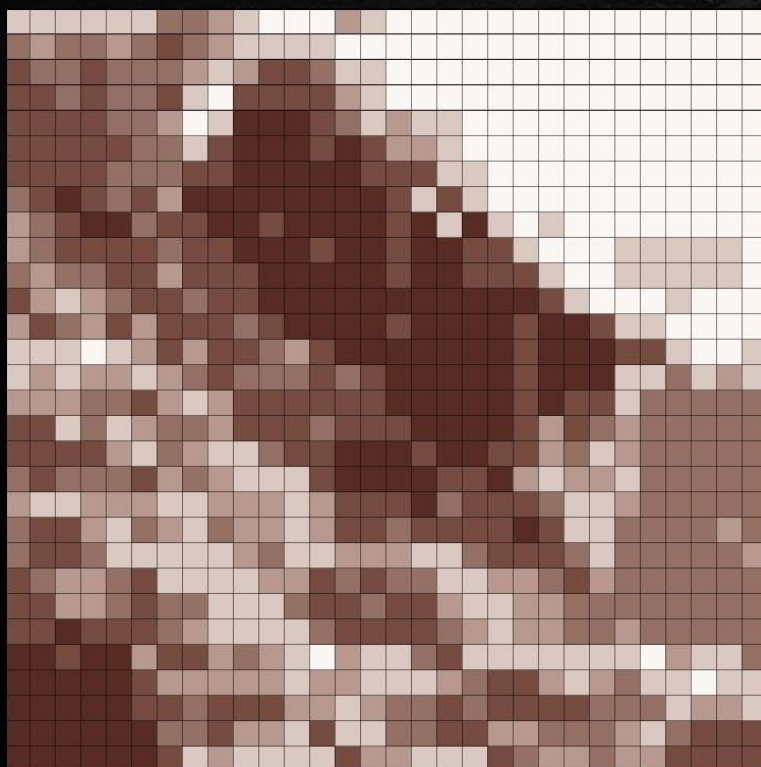


natural  
capital  
PROJECT

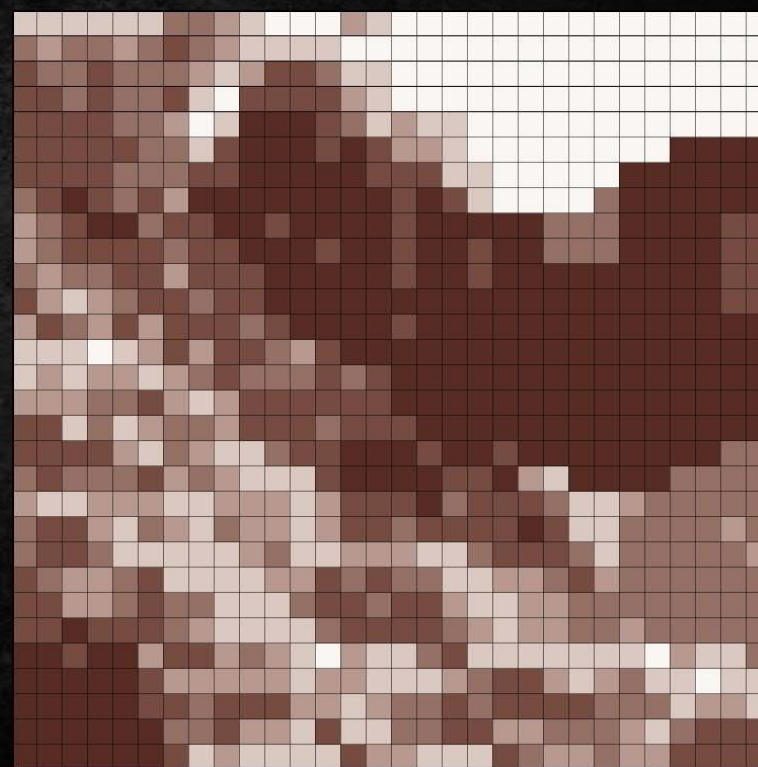
# EROSION RISK



natural  
capital  
PROJECT



Current climate



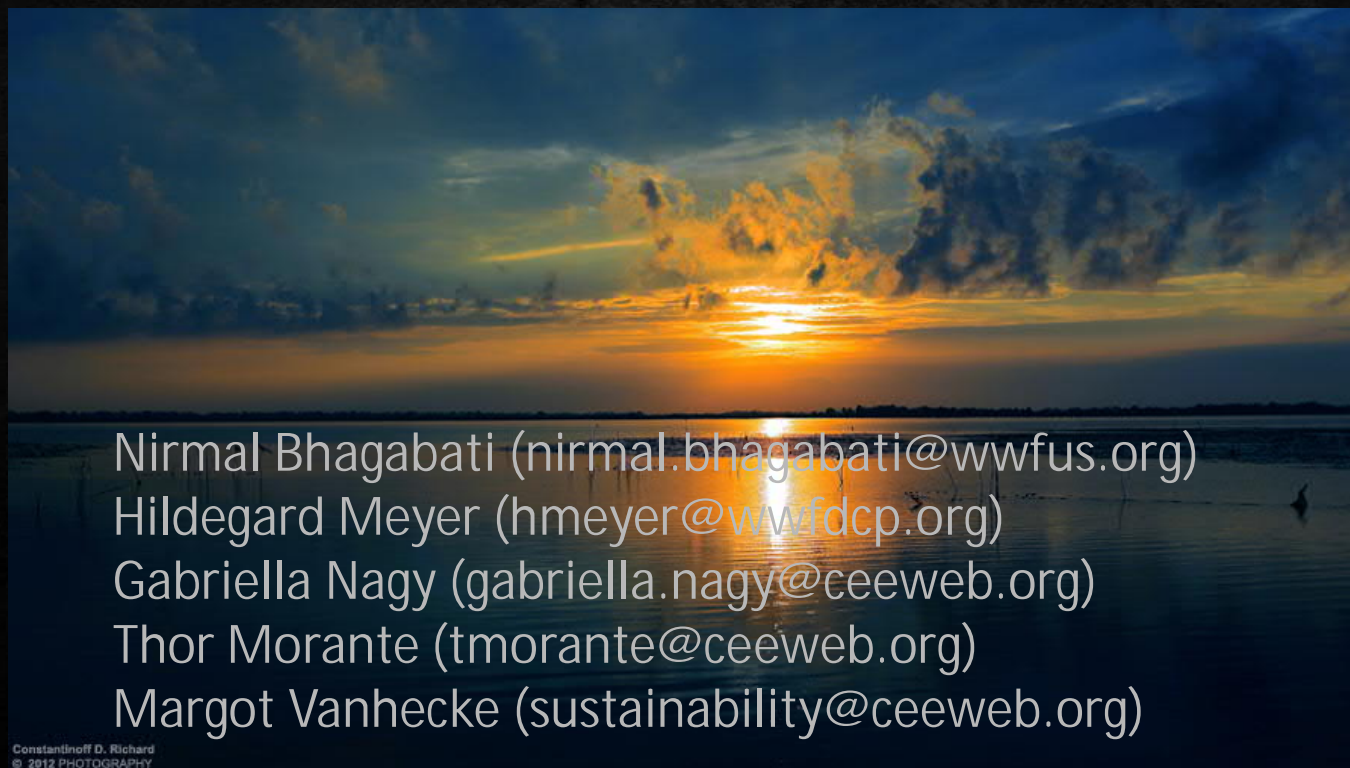
Future climate





natural  
capital  
PROJECT

# THANK YOU FOR PLAYING!



Nirmal Bhagabati ([nirmal.bhagabati@wwfus.org](mailto:nirmal.bhagabati@wwfus.org))  
Hildegard Meyer ([hmeyer@wwfdcp.org](mailto:hmeyer@wwfdcp.org))  
Gabriella Nagy ([gabriella.nagy@ceeweb.org](mailto:gabriella.nagy@ceeweb.org))  
Thor Morante ([tmorante@ceeweb.org](mailto:tmorante@ceeweb.org))  
Margot Vanhecke ([sustainability@ceeweb.org](mailto:sustainability@ceeweb.org))

Constantinoff D. Richard  
© 2012 PHOTOGRAPHY



natural  
capital  
PROJECT

# EXTRA SLIDES

## ROUND 2

natural  
capital  
PROJECT



From Wikimedia commons

Wildlife crossing



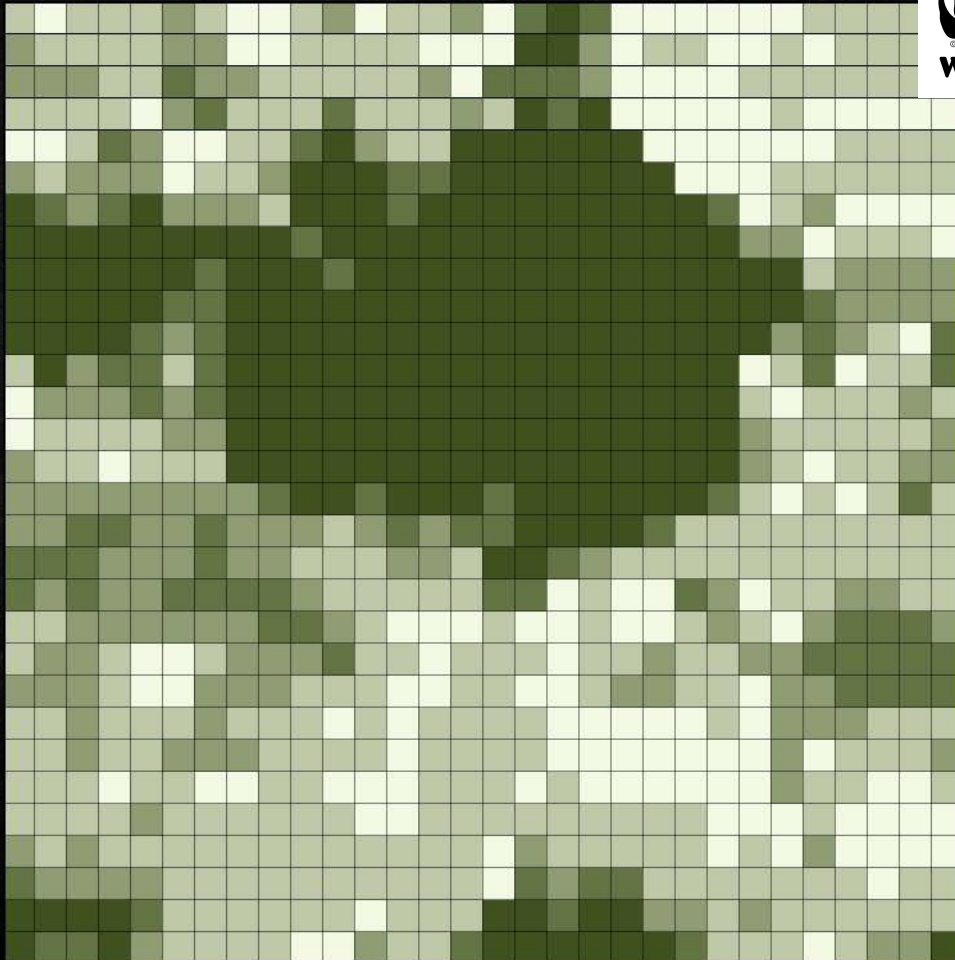
Image © World Wildlife Fund

Conservation area



CLIMATE CHANGE

HABITAT QUALITY

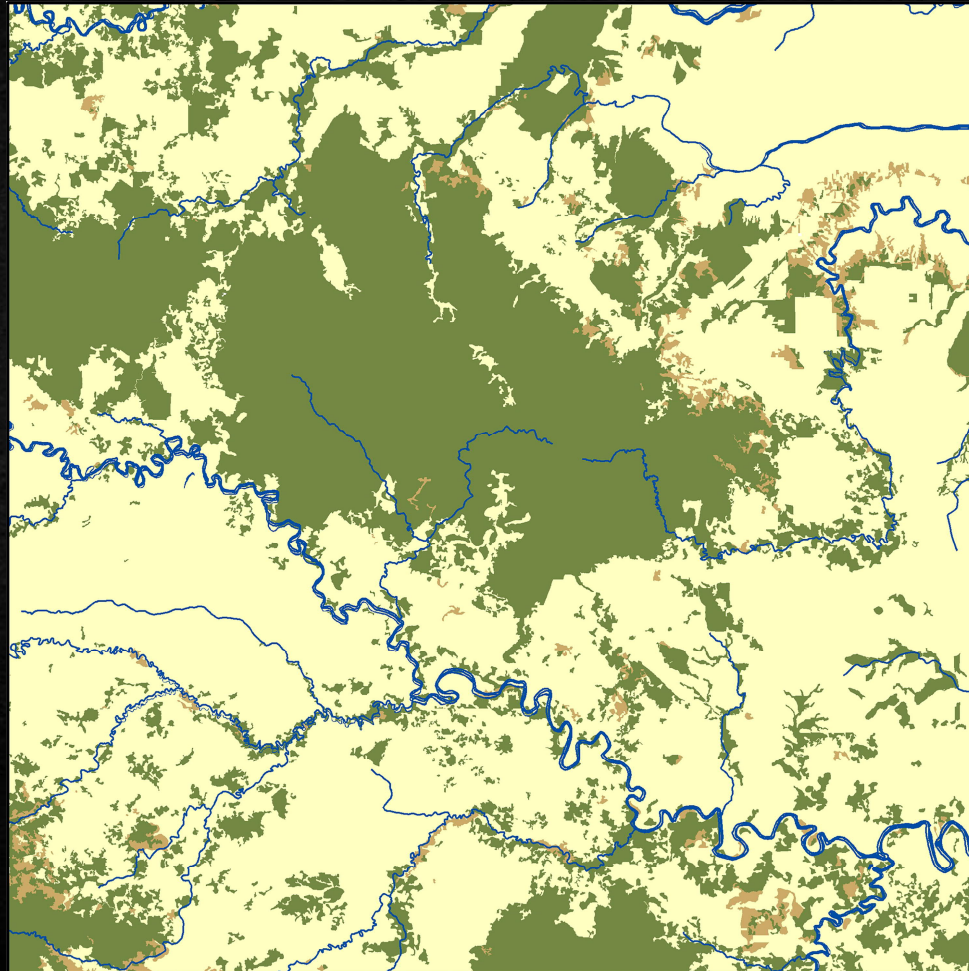


natural  
capital  
PROJECT

# ROUND 3

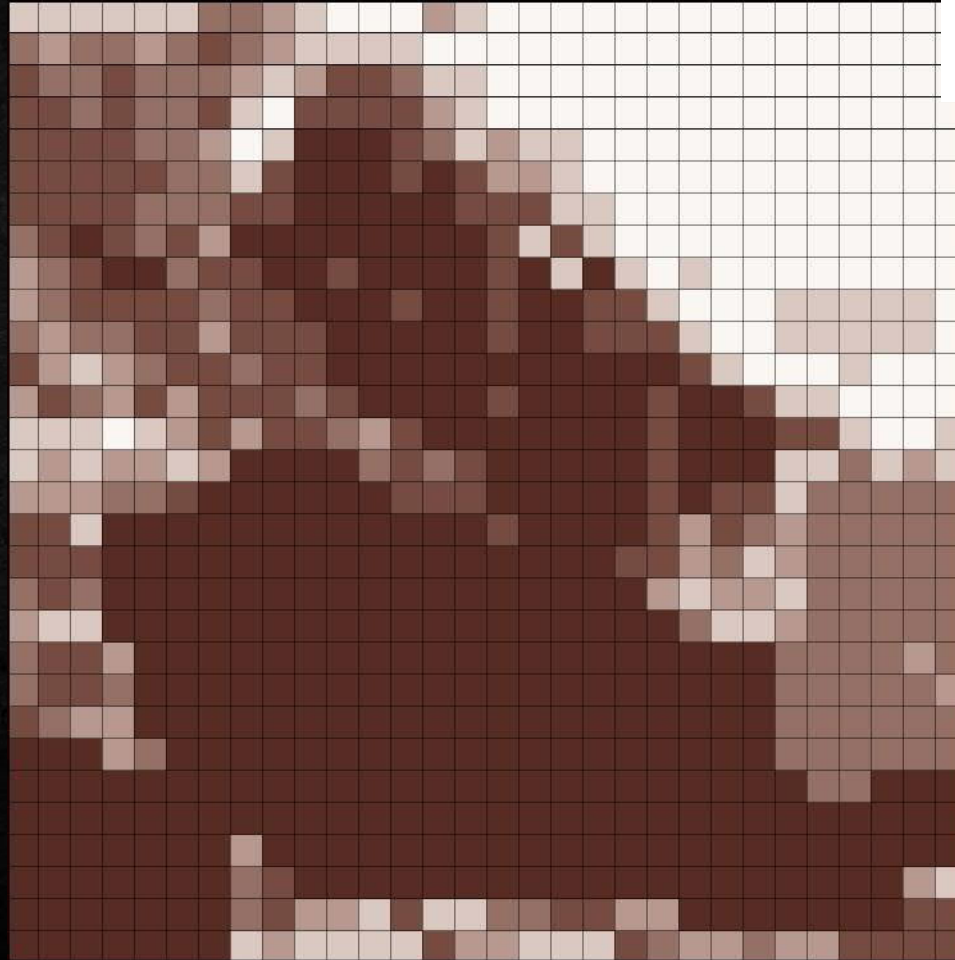
## CLIMATE CHANGE

natural  
capital  
PROJECT



# FUTURE CLIMATE

## EROSION RISK

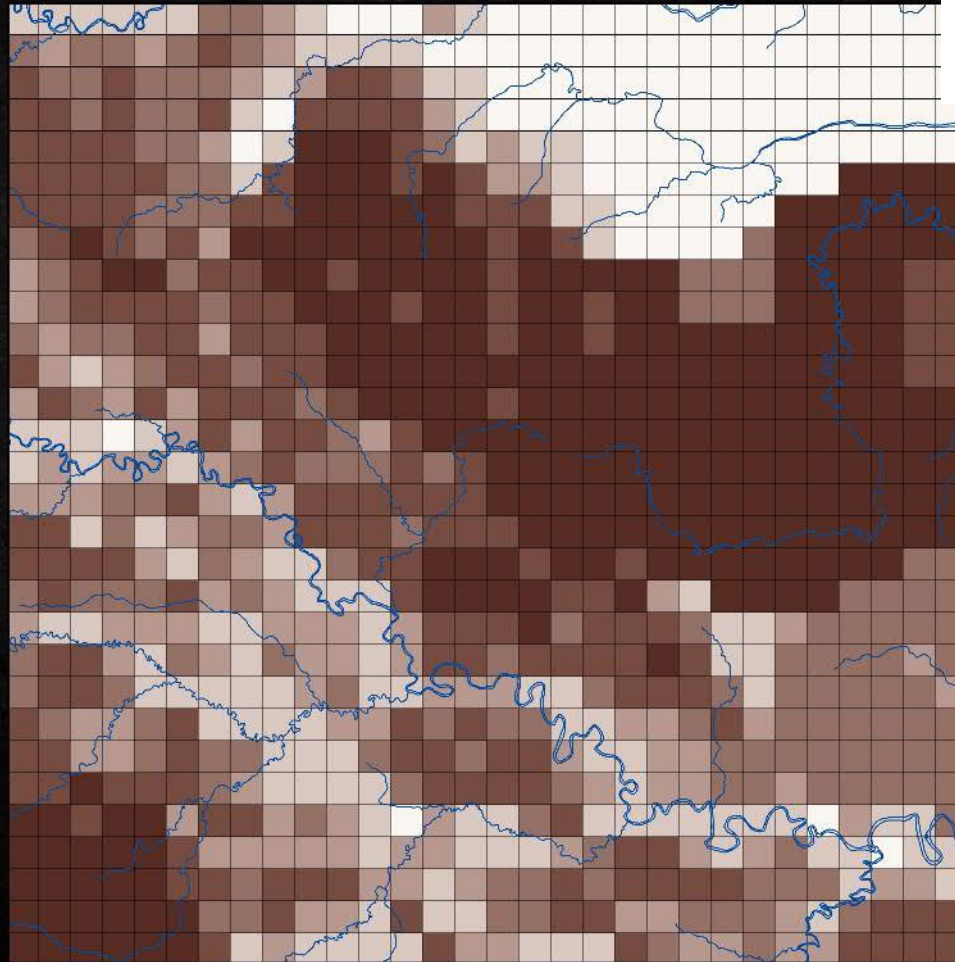


natural  
capital  
PROJECT



# FUTURE CLIMATE

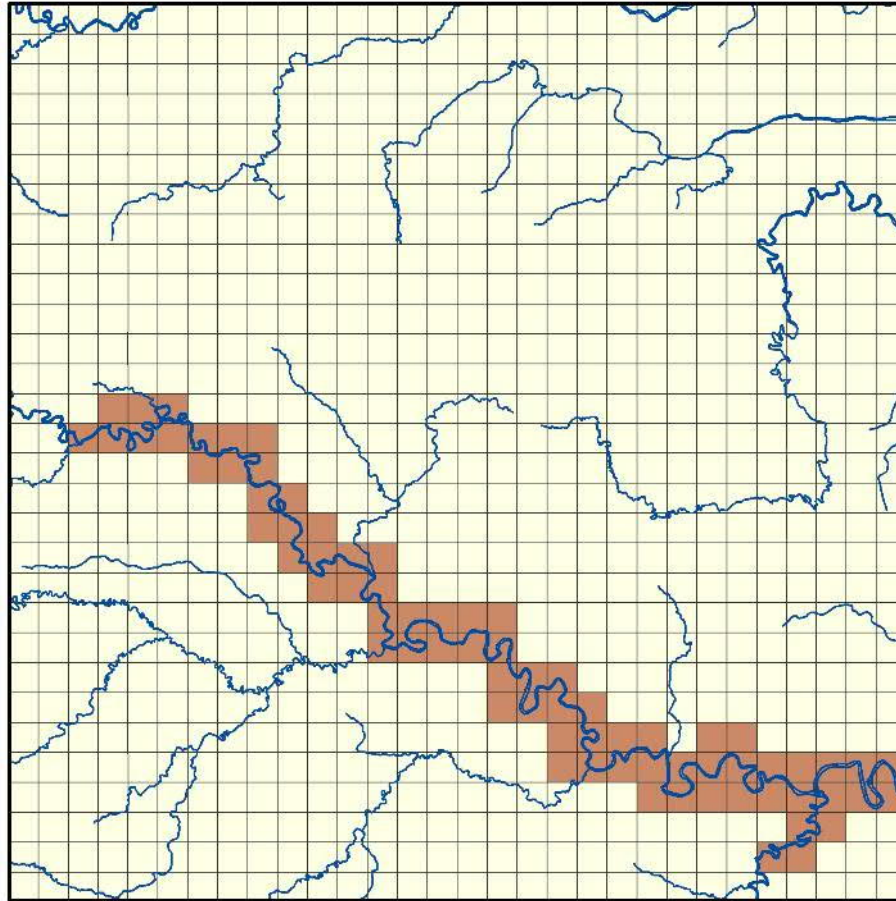
## EROSION RISK



natural  
capital  
PROJECT

# CLIMATE CHANGE

## FLOOD RISK



natural  
capital  
PROJECT

## ROUND 1



natural  
capital  
PROJECT

- Build a road connecting to the two population centers to earn 6,000 points (representing the development benefits the road provides)
- Lose points for the costs of road development (re-zoning, acquiring right-of-way, construction, etc.)
  - Lose points per cell crossed by the road
  - The darker the cell, the more points you lose
- Win by building the road with highest score (benefits - costs)



# SCORES ROUND ONE

natural  
capital  
PROJECT

	TEAM 1	TEAM 2	TEAM 3	TEAM 4	TEAM 5	TEAM 6	TEAM 7	TEAM 8	TEAM 9	TEAM 10
Road Development Benefits	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Construction Costs										
Habitat Quality										
Erosion Risk										
Drinking Water										
Total Env'tl Losses										
FINAL SCORE (Benefits – Costs – Env'tl losses)										

# ROADS & SUSTAINABLE DEVELOPMENT

SDG9: Industry, Innovation, and Infrastructure

SDG11: Sustainable Cities and Communities



# SCORES ROUND TWO

natural  
capital  
PROJECT

	TEAM 1	TEAM 2	TEAM 3	TEAM 4	TEAM 5	TEAM 6	TEAM 7	TEAM 8	TEAM 9	TEAM 10
Road Development Benefits	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Construction Costs										
CA & WC Costs										
Habitat Quality										
Erosion Risk										
Drinking Water										
Total Env'tl Losses										
FINAL SCORE										