Assessing the Impacts of climate change and urban development on water-related ecosystem services across multiple spatial scales









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Water-related Ecosystem Services (WES)

- Definition: benefits obtained from ecosystems for which current ecosystem composition, structure, and function are reliant on a supply of water.
- Types of WES
 - Provisioning (Water supply)
 - Regulating (Temperature regulation, Flood control)
 - Cultural (Recreation, Aesthetics, Cultural identity)
 - Supporting (Nutrient cycling, Aquatic habitat provision)



Climate Change Impacts on WES

■Water supply: extractive + in situ
→provisioning + cultural WES

Water quality: regulating WES





기사본문 오늘의 영상 하늘에서 본 녹조…급속히 확산 '식수비상'

<앵커 멘트>

최근 계속되는 폭염으로 주요 식수원에서 녹조 현상이 급속히 확산되고 있습니다.

방제는 엄두도 못낼 수준이라고 하는 데 얼 마나 심각한 지 한승연 기자가 헬기를 타고 둘러봤습니다.

<리포트>

북한강과 남한강이 만나는 팔당호.

Research Questions

1. Does the supply of WES differ by location and the type of WES?

2. What are the relative impacts of climate change and land development on WES?

3. Do the spatial patterns of WES provision levels change under different environmental scenarios?

4. How do we bundle WES for informed land decisionmaking?





Climate Change, 1900-2100





Source: Mote and Salathe (2010) Climatic Change

Land Cover Change Scenarios, 2050









Current UGB

Medium Development

High Development



Mixed Forest Woody Wetland Shrub **Emergent Wetlands**



Mixed Forest High Development Shrub

Woody Wetland **Emergent Wetlands**





Mixed Forest Shrub

High Development















Normalized Water Yield



Normalized Sediment Retention



Normalized Nitrogen Retention







Weighting scheme

20 Km

Base Climate + Low Land

Water yield: 0.4 Sedmt. retention: 0.3 N retention: 0.3





Conclusions

- 1. The supply of WES differs by location and the type of WES (Upper areas provide the most water yield and sediment retention, while lower valleys have the highest nitrogen retention).
- 2. The combined impacts of climate change and urban development are projected to reduce the provision of WES in urban fringe areas, with changes in water yield more sensitive to climate change than land conversion.
- 3. The spatial patterns of individual WES provision levels generally persist under future environmental change scenarios.
- 4. WES Bundling is a complex sociopolitical process, requiring transparent communications between scientists and various stakeholders.

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Questions or comments: contact Heejun Chang at changh@pdx.edu

www.pdx.edu/ecosystem-services



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InVEST Water Models' Objectives

• VALUE OF EACH PARCEL ON THE LANDSCAPE

- Need to determine contribution (production function) of each parcel in ecosystem service of interest
- Where are the sources of nutrients/sediment?
- Where are the nutrients/sediment retention area
- How much is retained?
- What is the value of this retention?





