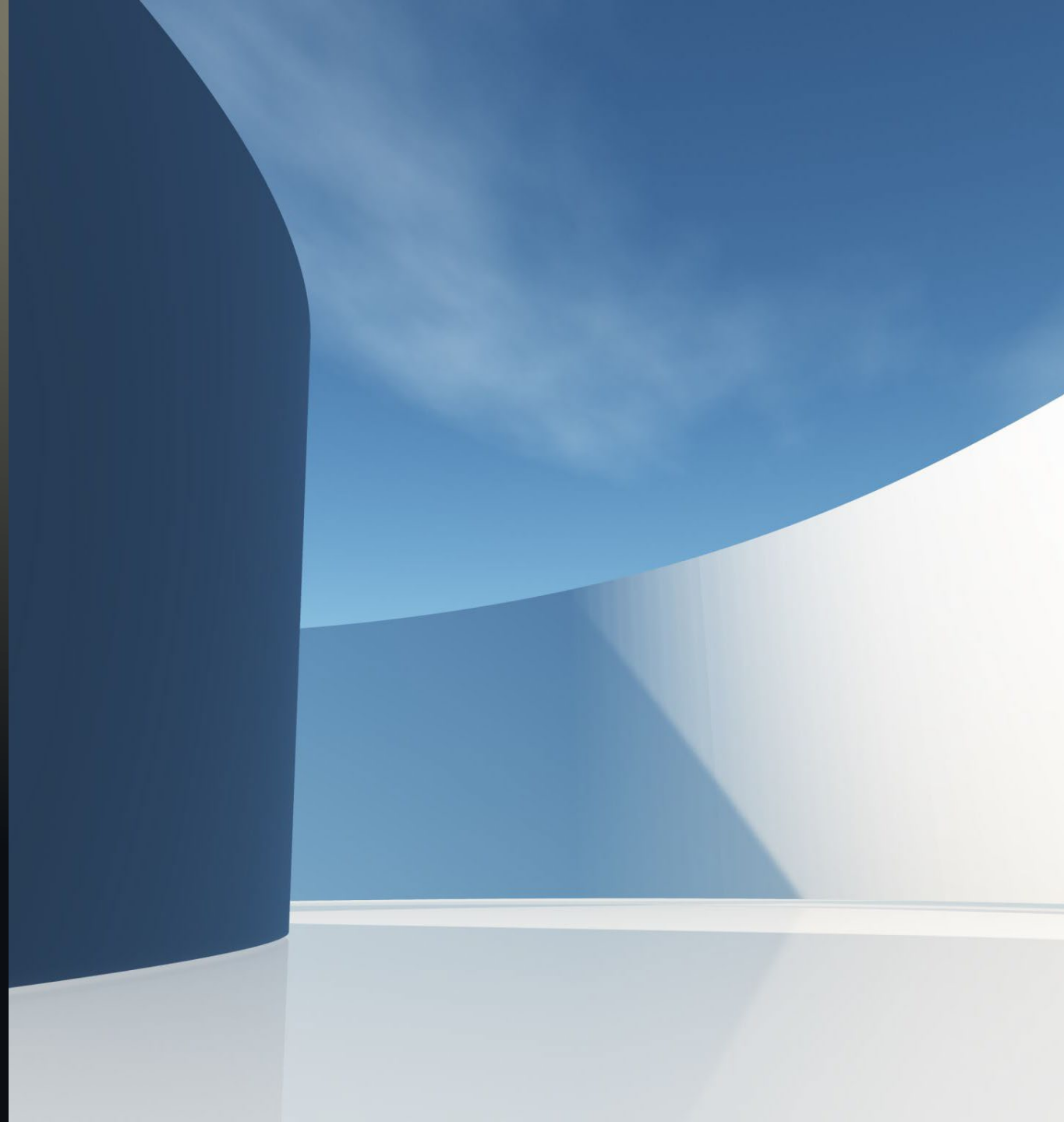
Oregon EJ Mapping Tool Decision Points

BACKGROUND INFORMATION



Decision Points: Why are they important?

Composite indices are complex and there are many options for the EJ Council to choose from that will determine how the Oregon EJ Mapping Tool is structured and how the information is displayed.

HB 4077, sections 10-12 include language that will help guide the EJ Council through the decision-making process, but the content leaves a lot of room for flexibility.

All environmental justice mapping tools get evaluated, critiqued, and scrutinized. Therefore, it is important to have a rationale that supports each decision made in the development of the Oregon EJ Mapping Tool.

DECISION POINTS 1-10

- #1 • Indicator domain selection
- #2 • Geographic units (tracts, grids, etc.)
- #3 • Geographic designations • Geographic comparisons
- #4 • Domain/indicator weighting
- #5 • Domain aggregation (multiplicative, additive, etc.)
- #6 • Data standardization (percentiles, z-scores, other)
- #7 • Indicator selection - community listening session priorities and data gaps
- #8 • Sensitivity analysis results - revisit indicator selection and data gaps
- #9 • EJ community thresholds/flags
- #10 • EJ mapping tool visualizations & reporting

Domain Aggregation

ENVIRONMENTAL JUSTICE MAPPING
DECISION POINT 5

OCTOBER 10, 2024 RECORDING LINK

DECISION POINT #5 – DOMAIN AGGREGATION

Key Terms

Cumulative Impacts

- When multiple sources of pollution and other environmental stressors combine over time to cause adverse effects to human health and wellbeing.

Additive Effects

- When the effects of one exposure are independent of other exposures.

Multiplicative Effects

- When the effects of one exposure are associated with other exposures.

Synergistic Effects

- When combined impacts are greater than the sum of individual impacts.

DECISION POINT #5 – DOMAIN AGGREGATION Additive Model

CDC Environmental Justice Index - additive models allow for a greater influence of individual modules on the overall model. In the case of the EJI, this means that a community that experiences high levels of social vulnerability and environmental burden could receive a high overall EJI score, even if it does not score high for health vulnerability. This feature may be seen as a strength or a weakness of the model, something which has been a topic of debate in states which have implemented a multiplicative model.

DECISION POINT #5 – DOMAIN AGGREGATION Multiplicative Model

CalEnviroScreen:

Existing research on environmental pollutants and health risk has consistently identified socioeconomic and sensitivity factors as "effect modifiers" that multiply the risks posed by the pollutants.

Some people (such as children) may be 10 times more sensitive to some chemical exposures than others. Risk assessments apply numerical factors or multipliers to account for potential human sensitivity in deriving acceptable exposure levels (US EPA, 2012).

Priority rankings done by various emergency response organizations to score threats have used scoring systems with the formula:

Risk = Threat × Vulnerability (Brody et al., 2012).

Note: US EPA, 2012 the original citation is no longer available on the U.S. EPA website. This information is not cited in the rationale for the Oregon Environmental Justice Mapping Tool.

DECISION POINT #5 – DOMAIN AGGREGAT

Additive Equation

(Environmental Exposures **+** *Environmental Hazards* **+** *Climate Change Risks* **+** *Built Environment* **+** *Human Health* **+** *Social Factors)/6 = EJ Index Score*

Multiplicative Equation

(Environmental Exposures **+** *Environmental Hazards* **+** *Climate Change Risks* **+** *Built Environment)/4* ***x*** *(Human Health + Social Factors)/2 = EJ Index Score*

DECISION POINT #5 – DOMAIN AGGREGATION

In this hypothetical example, all subdomain scores are equal, but the combined multiplicative score is higher than the additive score.

Additive Equation

$$(0.3\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE) + 0.3\,(HH) + 0.3\,(SF))/6 = \mathbf{0.3}$$

Multiplicative Equation

$$(0.3\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE))/4 \times (0.3\,(HH) + 0.3\,(SF))/2 = \mathbf{0.7}$$

DECISION POINT #5 – DOMAIN AGGREGATION

When an environmental burden (Place) subdomain score is increased, the multiplicative index score increases more than the additive index score

Additive Equation

$$(0.6\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE) + 0.3\,(HH) + 0.3\,(SF))/6 = 0.4$$

Multiplicative Equation

$$(0.6\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE))/4 \times (0.3\,(HH) + 0.3\,(SF))/2 = 0.9$$

DECISION POINT #5 – DOMAIN AGGREGATION

When a disadvantaged community (People) subdomain score is increased, the increase in the multiplicative score compared to the increase in the additive score is even more pronounced because there are fewer subdomains in the People domain.

Additive Equation

$$(0.3\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE) + \mathbf{0.6}\,(HH) + 0.3\,(SF))/6 = \mathbf{0.4}$$

Multiplicative Equation

$$(0.3\,(EE) + 0.3\,(EH) + 0.3\,(CCR) + 0.3\,(BE))/4 \times (\mathbf{0.6}\,(HH) + 0.3\,(SF))/2 = \mathbf{1.1}$$

DECISION POINT #5 – RECOMMENDATION

The Methodology Workgroup recommends using **CalEnviroScreen** 's multiplicative approach to domain aggregation where the subdomains are summed, but the primary domains (Place & People) are multiplied.

(Environmental Exposures **+** *Environmental Hazards* **+** *Climate Change Risks* **+** *Built Environment)/4* ***x*** *(Human Health + Social Factors)/2 = EJ Index Score*

DECISION POINT #5 – RATIONALE

- Cumulative impacts are not independent. Health effects caused by environmental exposures are multiplicative in vulnerable populations (McHale et al., 2017).

- Evidence from human studies have shown that population characteristics can modify the response to pollution burden multiplicatively, providing scientific support for the use of a multiplier (Alexeeff et al., 2012).

- Priority rankings done by various emergency response organizations to score threats have used scoring systems with the formula:
  Risk = Threat × Vulnerability (Brody et al., 2012).

- Applying additive aggregation to subdomains will provide more insight into the interactions of the indicators (VanderWeele & Knol, 2014).

Cumulative impacts are not independent. Health effects caused by environmental exposures are multiplicative in vulnerable populations (McHale et al., 2017). Note: the article was downloaded from the Oregon State Library on August 22nd, 2024.

ADOPTED DECISION POINT 5

Multiplicative Approach

- ***(Environmental Exposures + Environmental Hazards + Climate Change Risks + Built Environment)/4 x (Human Health + Social Factors)/2 = EJ Index Score***