

Phosphorus Risk Index Quantitative vs. Qualitative

Which is Appropriate?
Which is Best?

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What is Risk?

■ Risk (American Heritage Dictionary)

- The possibility of suffering harm or loss
- A factor, element, or course involving uncertain danger

■ Risk Assessment

- Process of gathering information to estimate the level of risk to people or the environment

■ Risk – Phosphorus Risk Index (Storm)

- Probability that a specific phosphorus concentration and/or loading to a receiving water body will cause an adverse response

What Should the Index Be Called?

Phosphorus Risk Index

Phosphorus Index

Phosphorus Loss Index

Phosphorus Index Purpose USDA NRCS

“.... a tool for understanding the contribution that individual landform and management parameters have toward **risk** of phosphorus movement and ... a method for developing management guidelines for phosphorus at the site to lessen their impact on water quality.”

Phosphorus Index Purpose USDA NRCS

“The Phosphorus Index is not intended to be an evaluation scale [tool] for determining whether land users are abiding within water quality or nutrient management standards that have been established by local state or federal agencies.”

P Index Thresholds

- If a P Index is not linked to specific water quality objectives, how do we know where to set the thresholds?
- If thresholds are not based on water quality, are they arbitrary?

SUMMARY

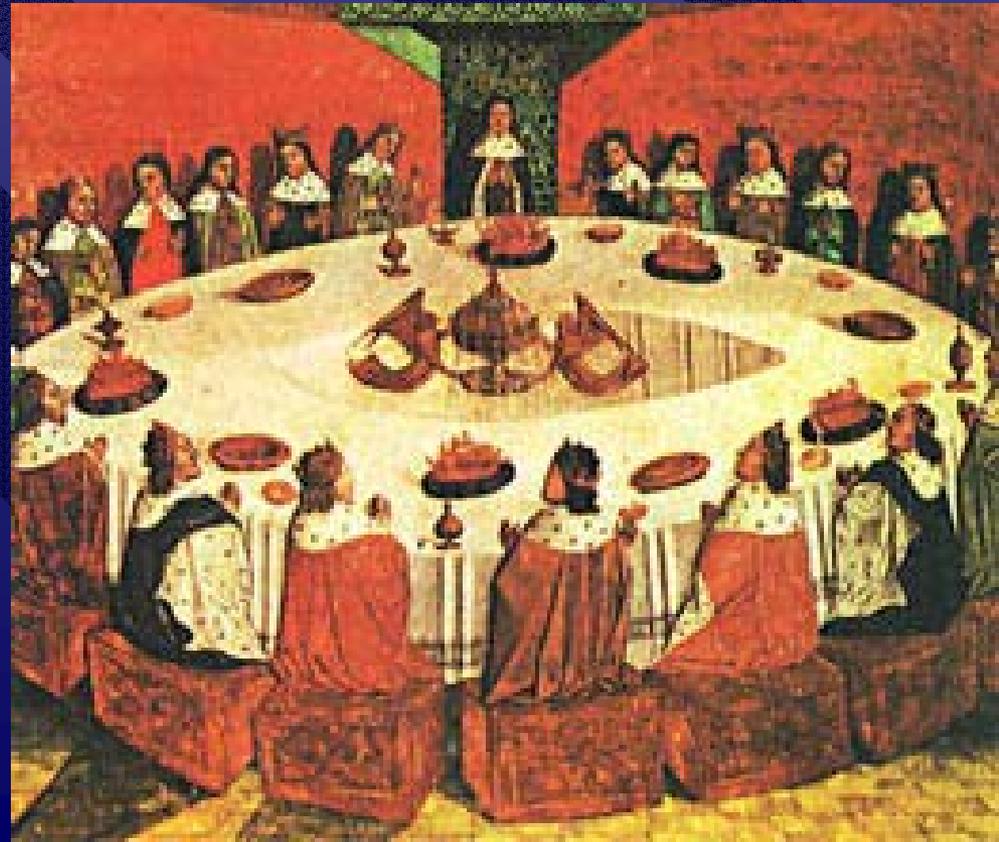
Phosphorus Index Purpose

■ USDA NRCS – Intended Application

- Qualitative tool**
- Used by planners and farmers to assess the relative potential for phosphorus to leave field**
- Used by planners to set guidelines for nutrient application rates and limits**
- To allow for regional differences, each State will develop their own index**

Methods to Develop Phosphorus Index

Knights of the Round Table Method



Methods to Develop Phosphorus Index

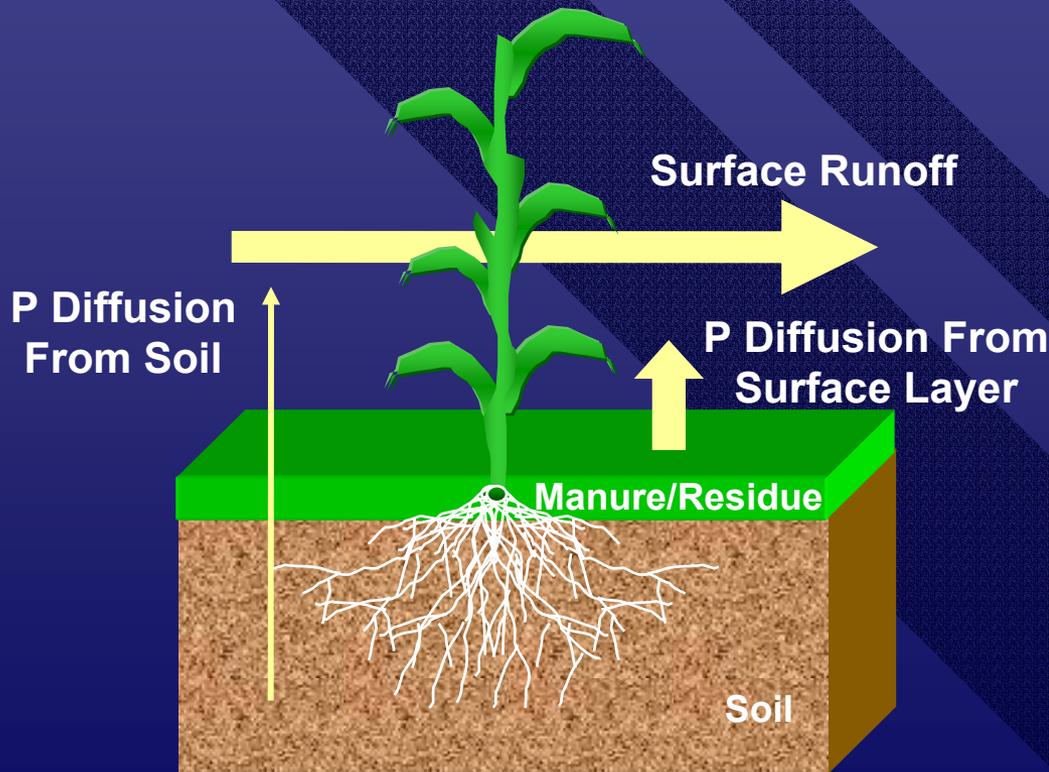
**Empirical Method
Using
Lab, Plot, and/or Field Data**

Example:

$$\text{P Load} = 0.2 * x1 + 1.5 * x2$$

Methods to Develop Phosphorus Index

Physically Based Method



Comparing Methods

Round Table vs. Physically Based

■ Round Table

- **Strictly qualitative**
- **Useful to the field planner**
- **Guide for selecting management approach**
- **Identify field-level problem areas**

■ Physically Based

- **Quantitative**
- **Provides loading estimate**
- **May be used to predict off-site impact**
- **Prioritize management practices based on water quality impact**

Using a Phosphorus Index to accurately quantify phosphorus loading requires a physically based hydrologic modeling framework

Edge of Field Loss



Water Body Loading



Phosphorus Index Applications

■ Qualitative Mode

- Demonstrate “relative” impacts from varying management practices at the field level
- Implement limits on P fertilization

■ Quantitative Mode

- Determine P loading to receiving water bodies
- Accurately determine magnitude of differences in P loss between management practices
- Directly integrate nutrient management plans into watershed planning
- Aid in the implementation of a TMDL

Qualitative vs. Quantitative Index

Qualitative Index

■ Advantages

- Can be used to improve farm planning
- Typically easy to use
- Rational framework and easy to explain

■ Disadvantages

- Difficult to account for interactions between physical processes
- May not accurately predict management effects on P loss
- Difficult to link directly to water quality objectives

Qualitative vs. Quantitative Index

Quantitative Index

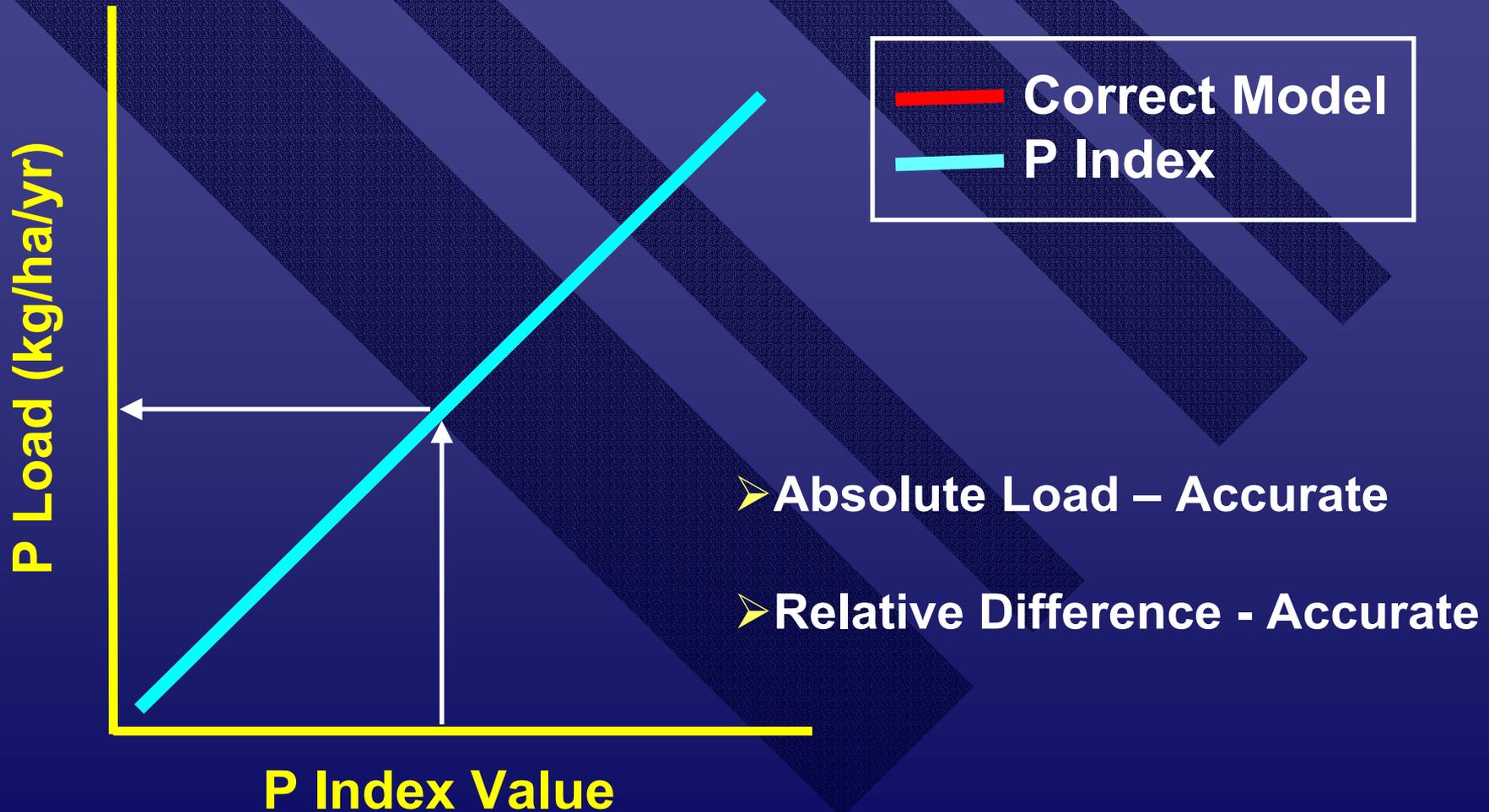
■ Advantages

- Directly integrate nutrient management plans into watershed planning to meet specific water quality objectives
- May provide additional options for plans

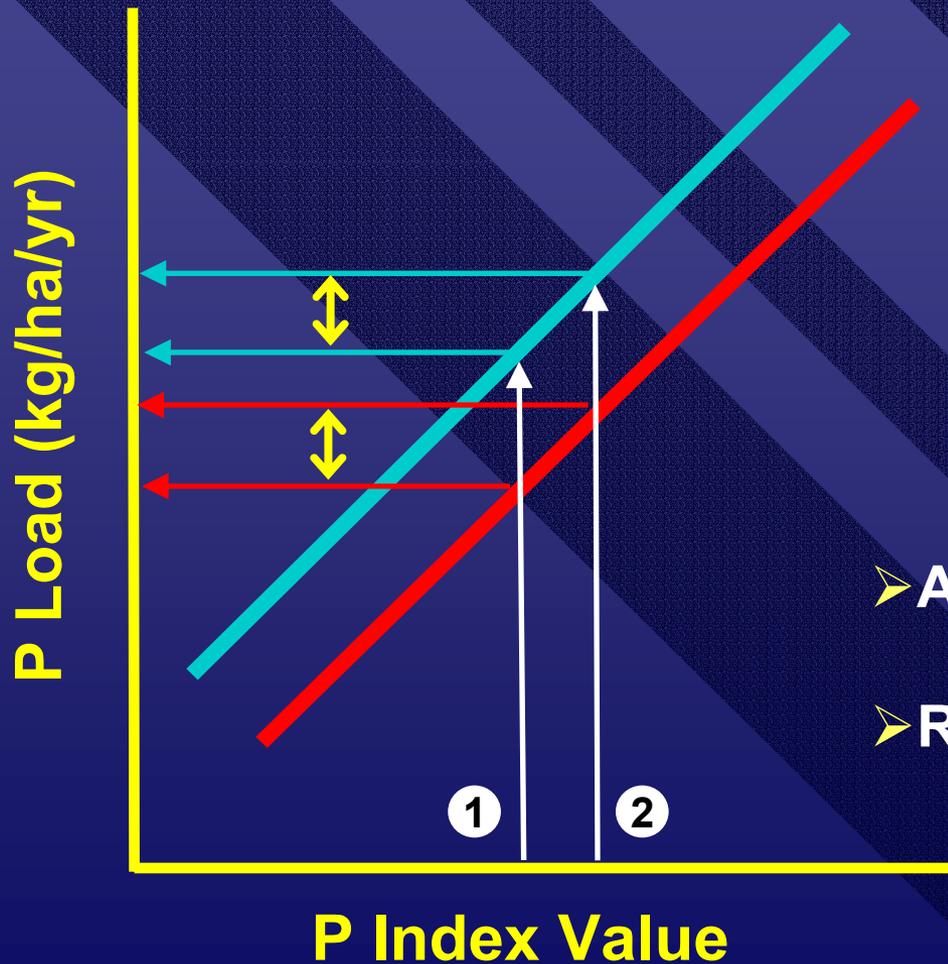
■ Disadvantages

- Complex model that may not be suited for use in the field
- May require extensive training
- Requires a comprehensive research base

Phosphorus Index – Is It Accurate?



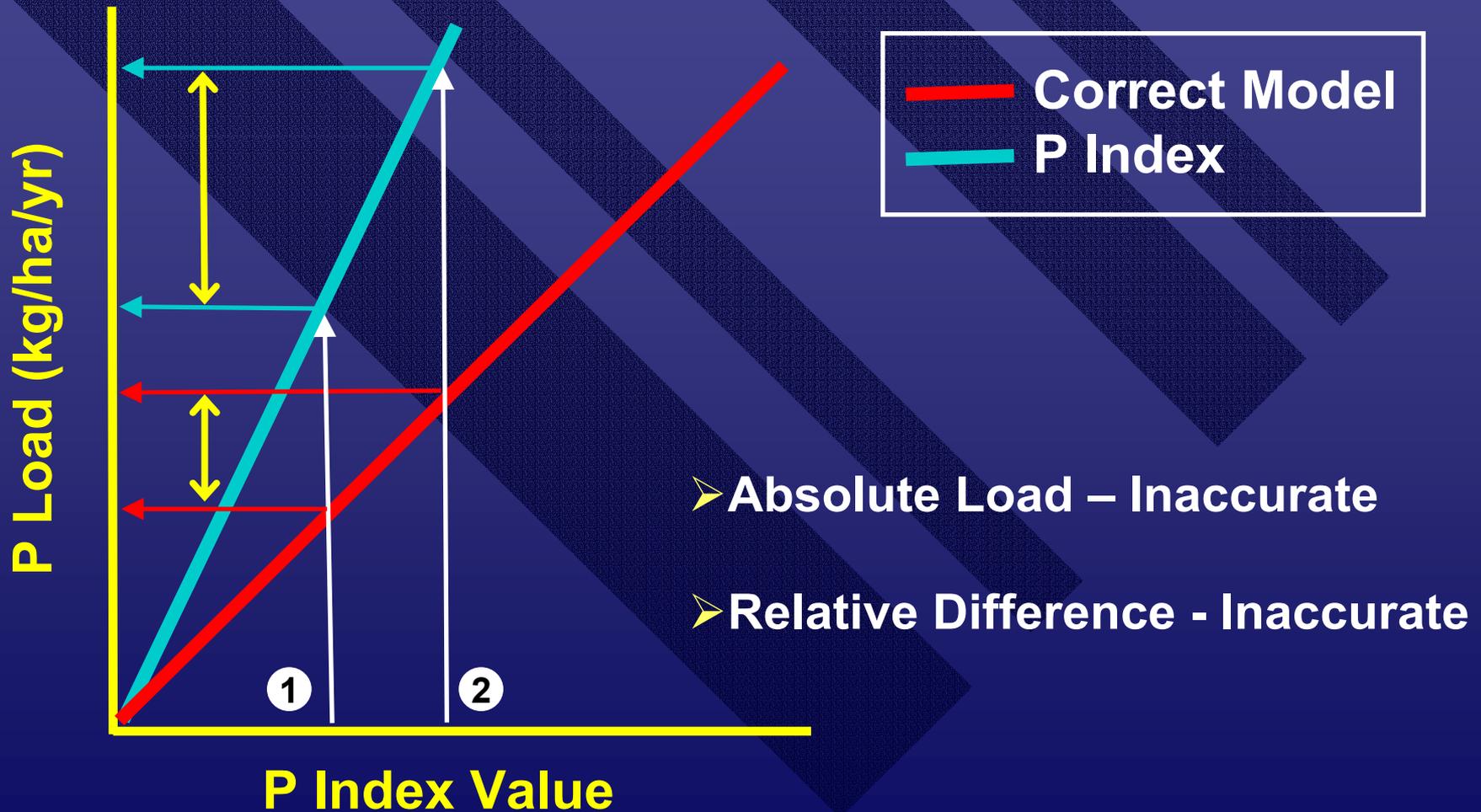
Phosphorus Index – Is It Accurate?



— Correct Model
— P Index

- Absolute Load – Inaccurate
- Relative Difference - Accurate

Phosphorus Index – Is It Accurate?



Issues with Qualitative Index

- May not accurately predict P loss
- May not accurately predict relative P loss change with varying management
- May not be applicable over a wide range of conditions
- May be too restrictive or not restrictive enough
- A lot of MAYs: extensive testing should be conducted



Issues with Quantitative Index

- Potential to accurately predict effect of BMPs on P loss
- Should conduct extensive validation and testing
- May require unique expertise to develop
- Should utilize specific water quality endpoints
- Can be applied in both quantitative and qualitative modes

