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Assessing Ephemeral Gully Erosion Using Aerial Remote Sensing

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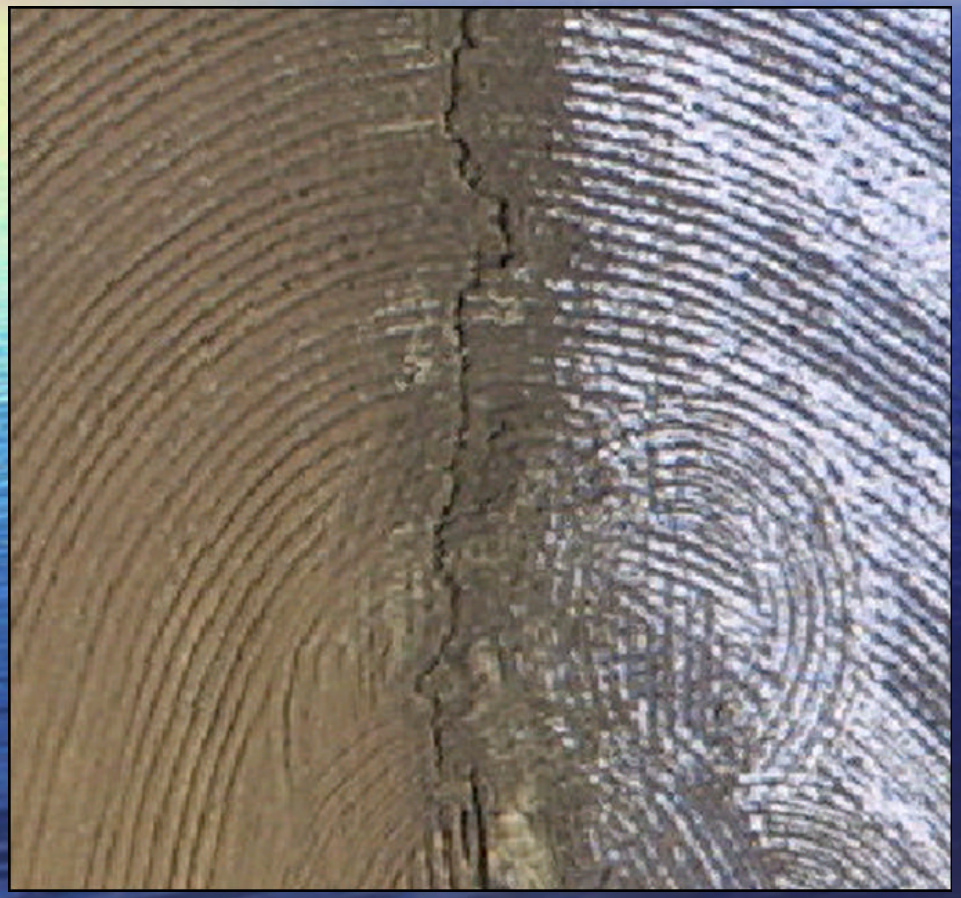
Presentation Outline

- Background of Ephemeral Gully Erosion
- Study Goals
- Project Area
- Approach
  - Image collection and analysis
  - Estimated sediment volumes
  - Erosion Potential Index
- Conclusions

Study Objectives

1. Use High Resolution Remote Sensing Images to Quantify Ephemeral Gully Erosion for TMDL
2. Determine if Images could be used to Identify best locations for TMDL Implementation
3. Use High Resolution results to develop an Erosion Potential Index for watershed scale analysis using readily available Landsat images

Ephemeral Gullies



Definition –

Channelized flow areas formed downslope of rill networks in locations controlled primarily by macrorelief

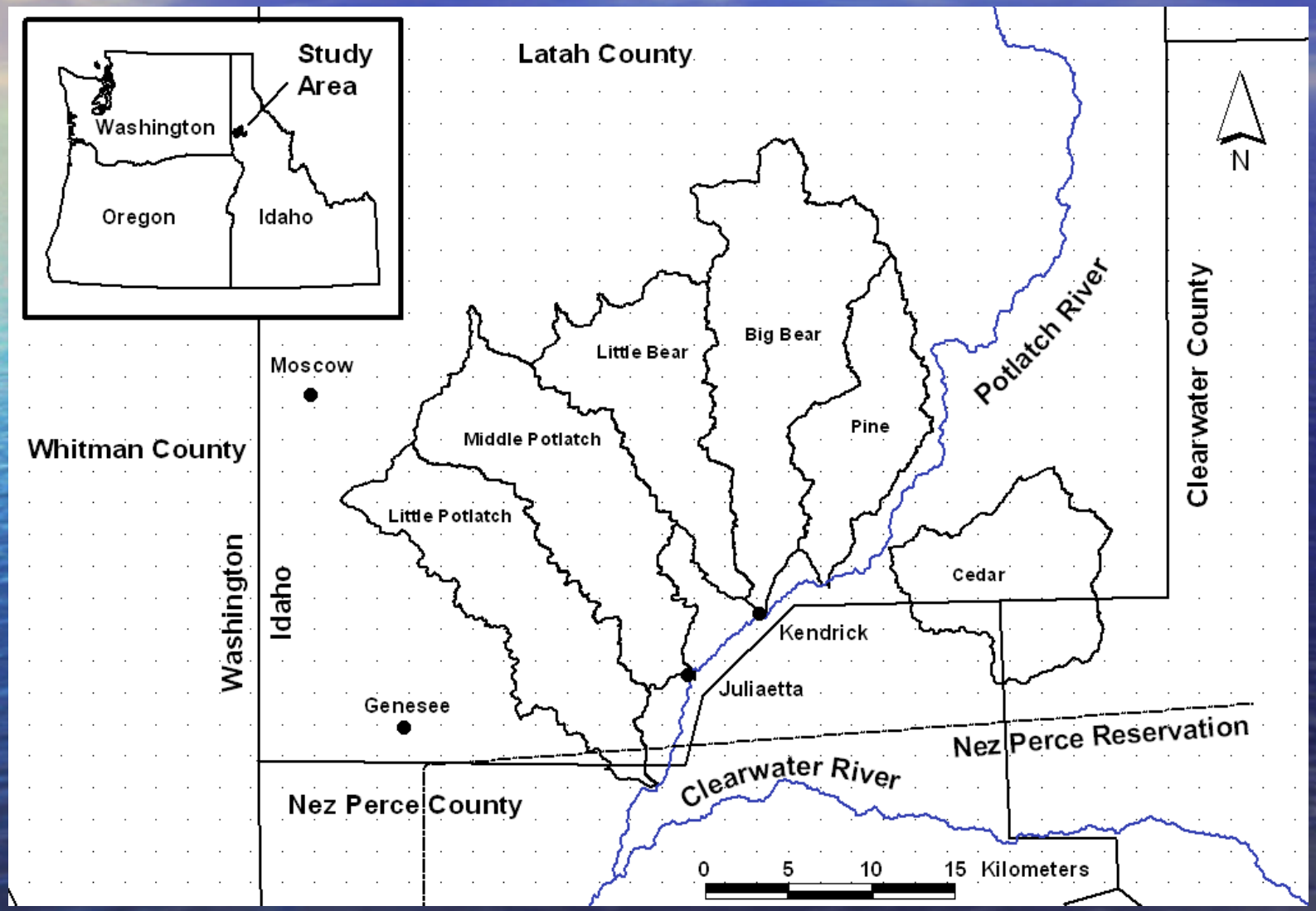
Small enough to be obliterated by normal tillage operations

Reasons for Concern -

1. Sediment Source
2. Collection System

Study Area

284 mi^2 of agricultural lands in the lower Potlatch River basin



Acquisition of Imagery

Cessna 182 single engine fixed wing aircraft

Approximately 2500 feet above the ground surface

45 North-South flight lines

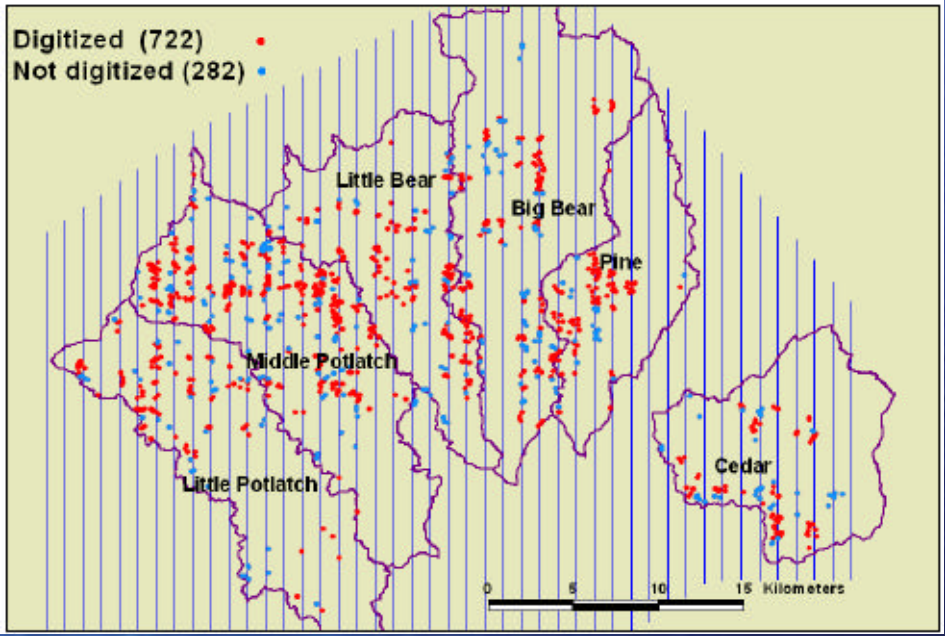
1-km spacing

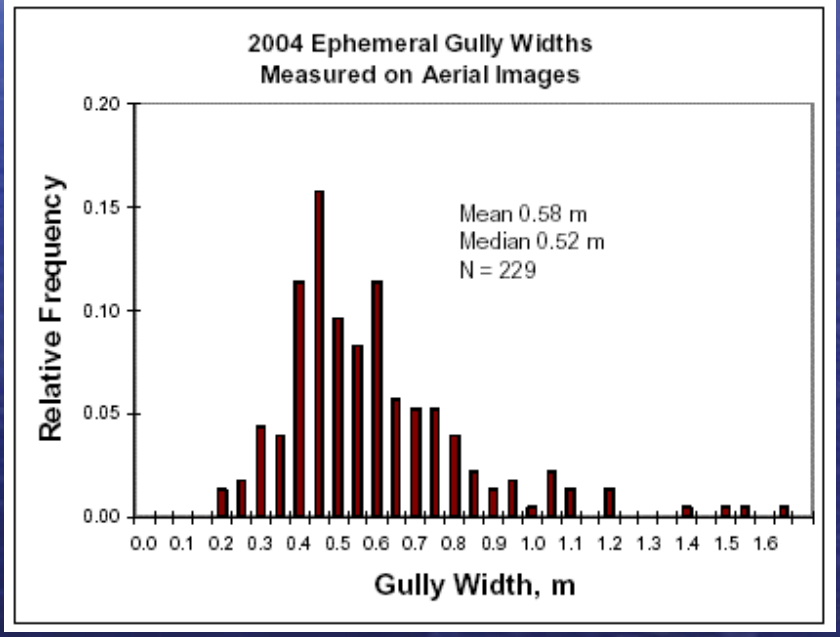
image swath approximately 650 meters wide

GPR of 0.2 meters

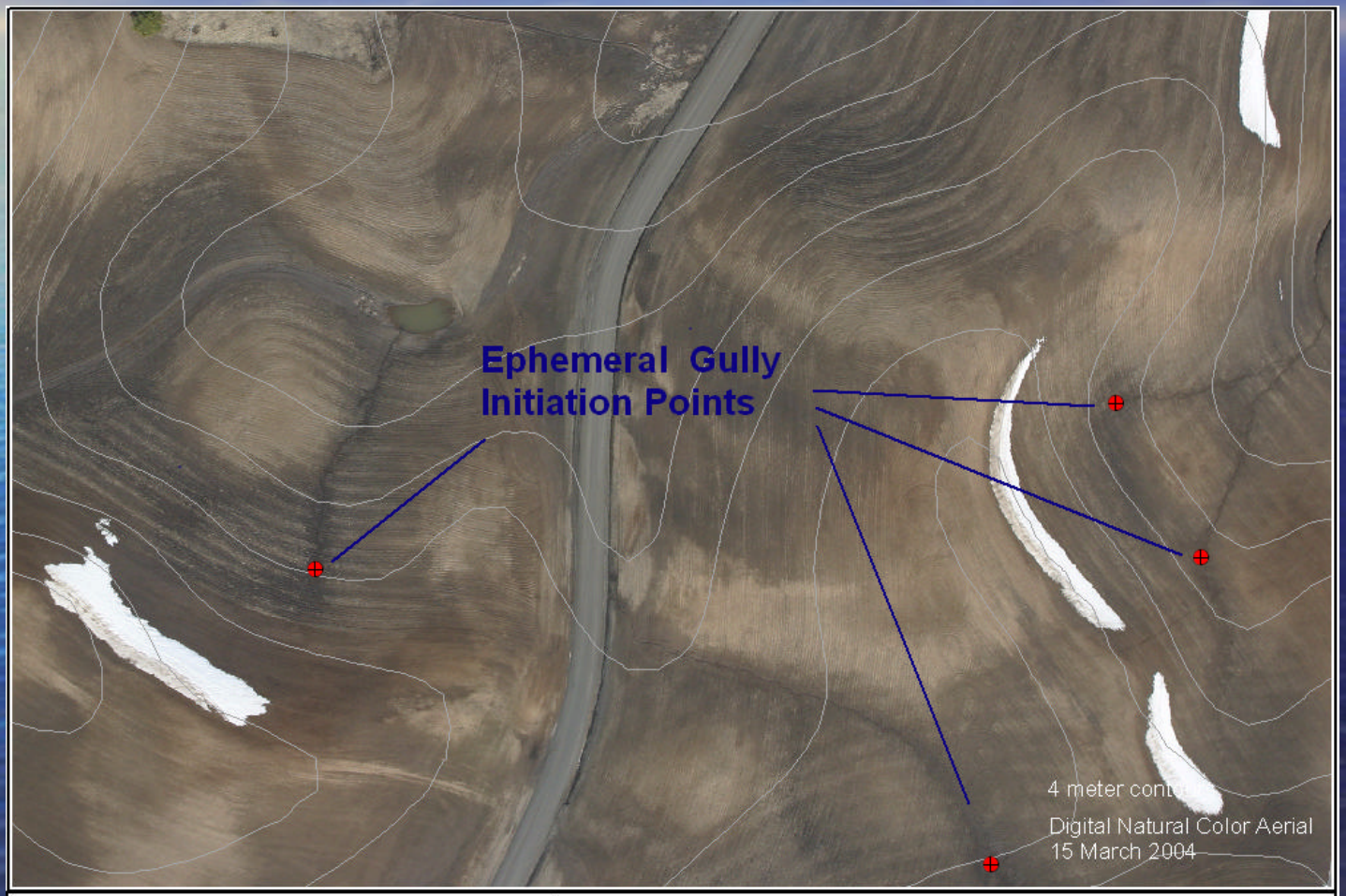
Gully Characteristics

1004 ephemeral gully systems were identified





Analysis of Gully Initiation Points in Aerial Images



Potlatch Basin Soil Loss
Ephemeral Gully Initiation Points

0 20 40 60 Meters
0 50 100 150 200 250 Feet

Teasdale Environmental Associates, PLLC
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Digitized Results

Assuming uniform distribution of sampled results to entire agricultural watershed-

Subbasin	Digitized Ephemeral Gully Length (km)	Estimated Basin Gully Length (km)	Ephemeral Gully Density (km/km^2)
Big Bear	18.5	29.8	0.23
Cedar	13.3	28.6	0.28
Little Bear	19.0	40.8	0.38
Little Potlatch	15.1	32.6	0.25
Middle Potlatch	40.9	87.9	0.61
Pine	11.9	25.5	0.31
Total	118.6	255.1	0.35

Ephemeral Erosion

ephemeral gullies during 2003-2004 are mostly between 0.1 to 0.2 m deep

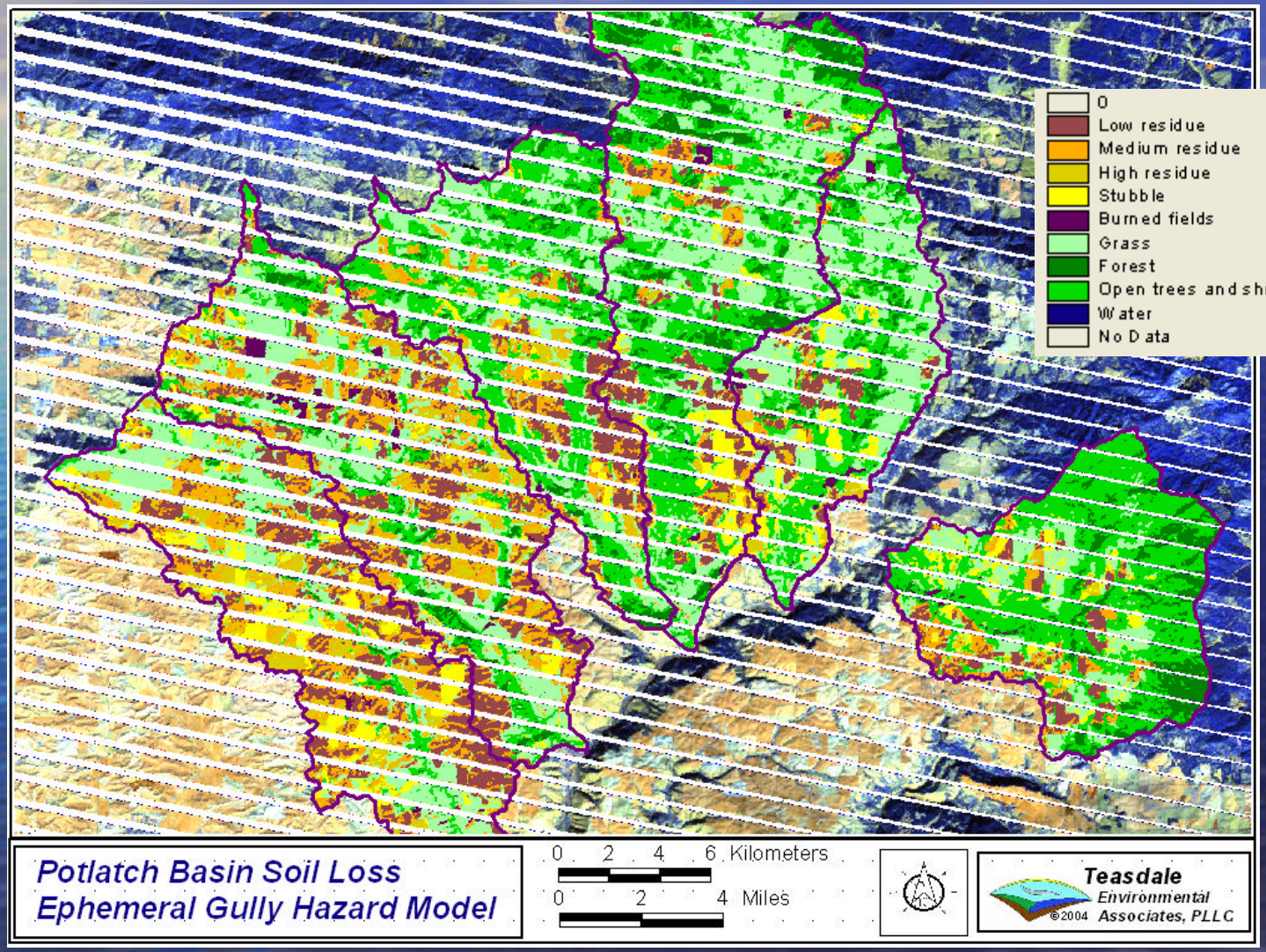
Subbasin	Erosion Volume (m^3/km^2)	Gully[1] Erosion ($mton/km^2$)	Gully Erosion (ton/acre)
Big Bear	28.0	33.6	0.15
Cedar	33.7	40.4	0.18
Little Bear	45.2	54.2	0.24
Little Potlatch	29.9	35.9	0.16
Middle Potlatch	73.7	88.4	0.39
Pine	37.4	44.8	0.20
All	41.6	49.9	0.22

Developing an Erosion Potential Index

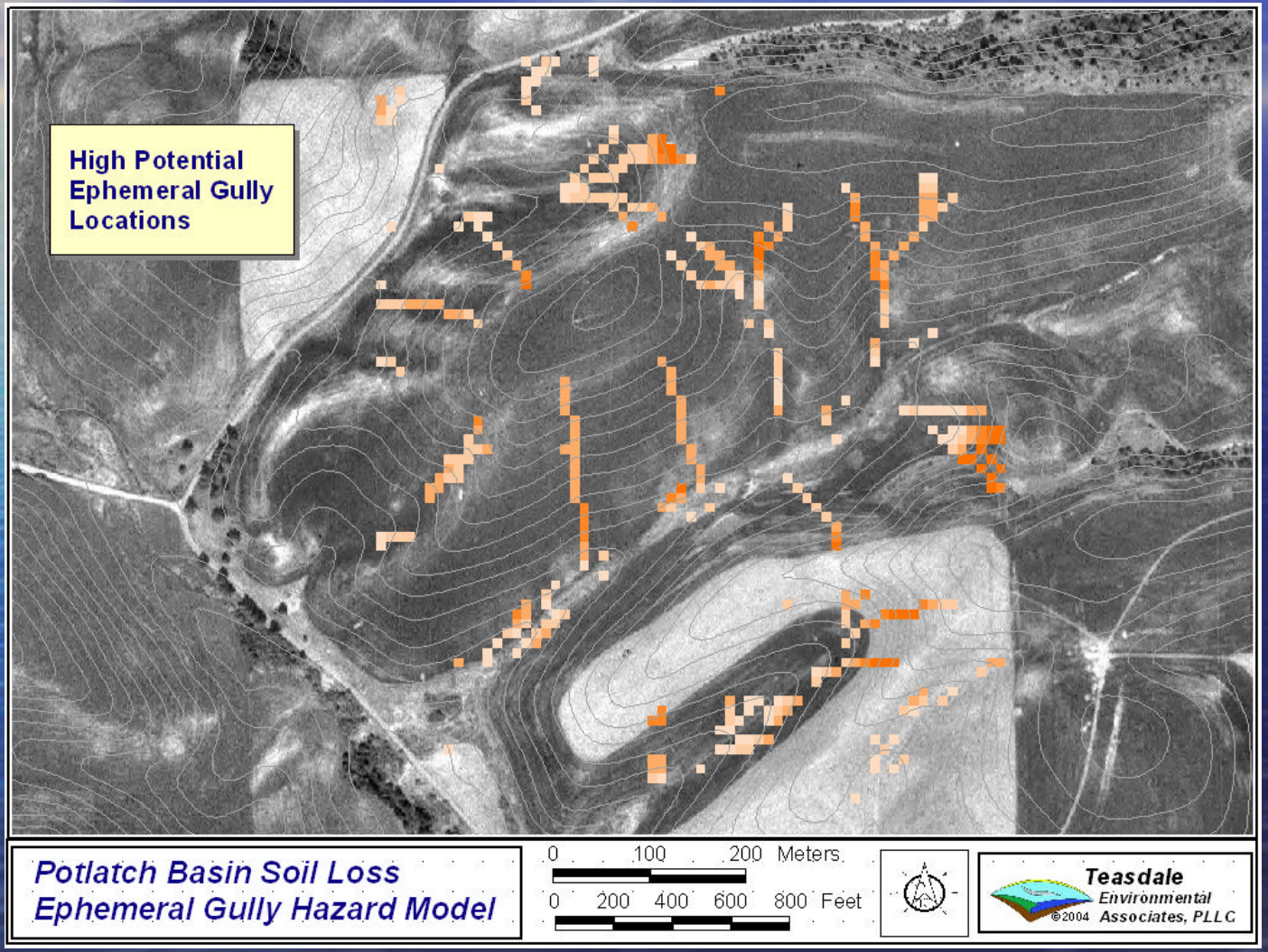
- Because access to high resolution aerial images is limited
  - Develop an EPI based on widely available Landsat data
    - Slope (S) – 10m DEM
    - Soil Erodibility (K) - SSURGO
    - Normalized Difference Index (NDI)
      - Landsat 7 shortwave infrared bands (5 and 7)

$$NDI = \frac{B5 - B7}{B5 + B7}$$

Maximum Likelihood Classification



High Hazard Potential Ephemeral Gully Locations



Comparison of measured to predicted

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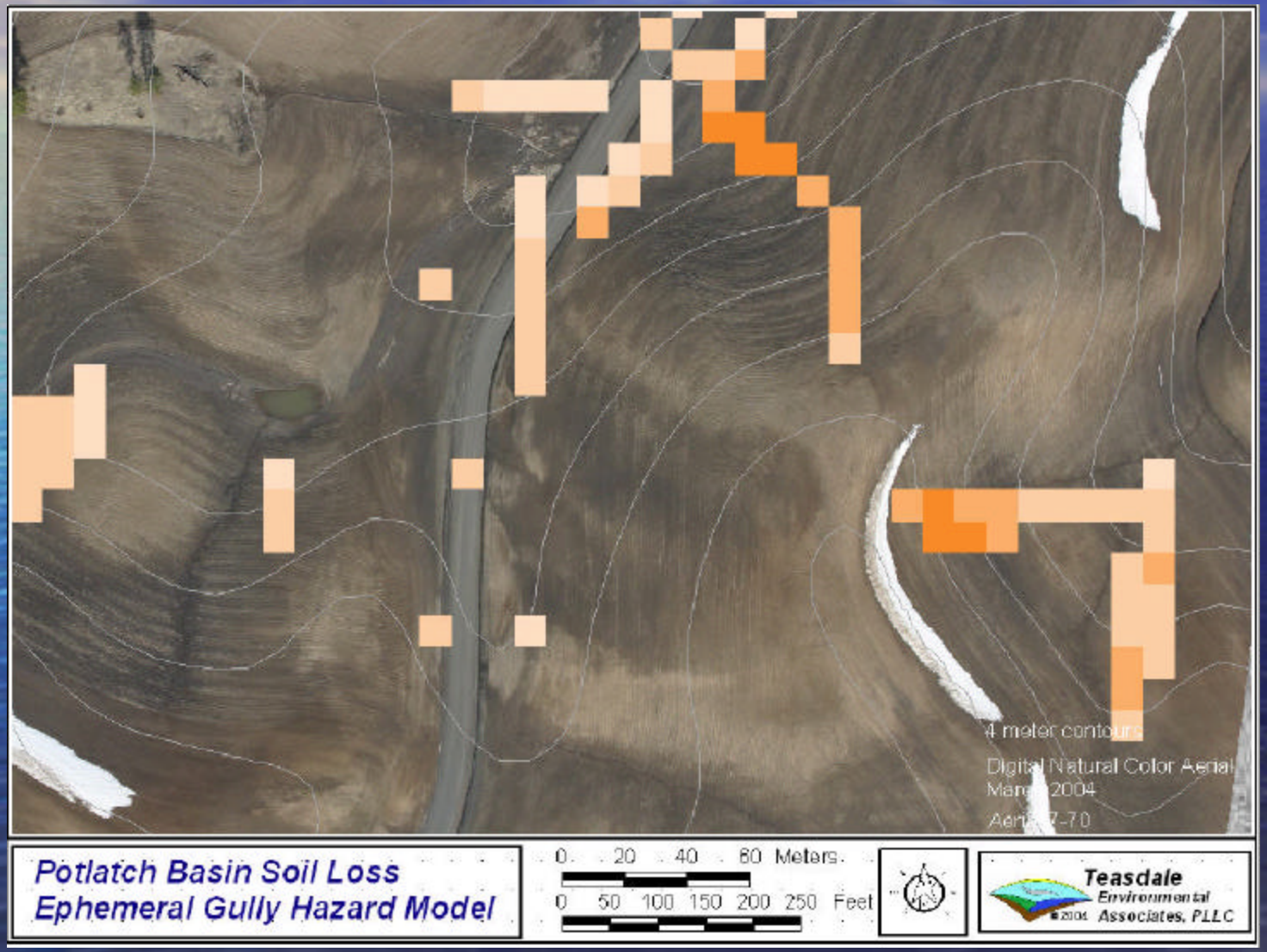

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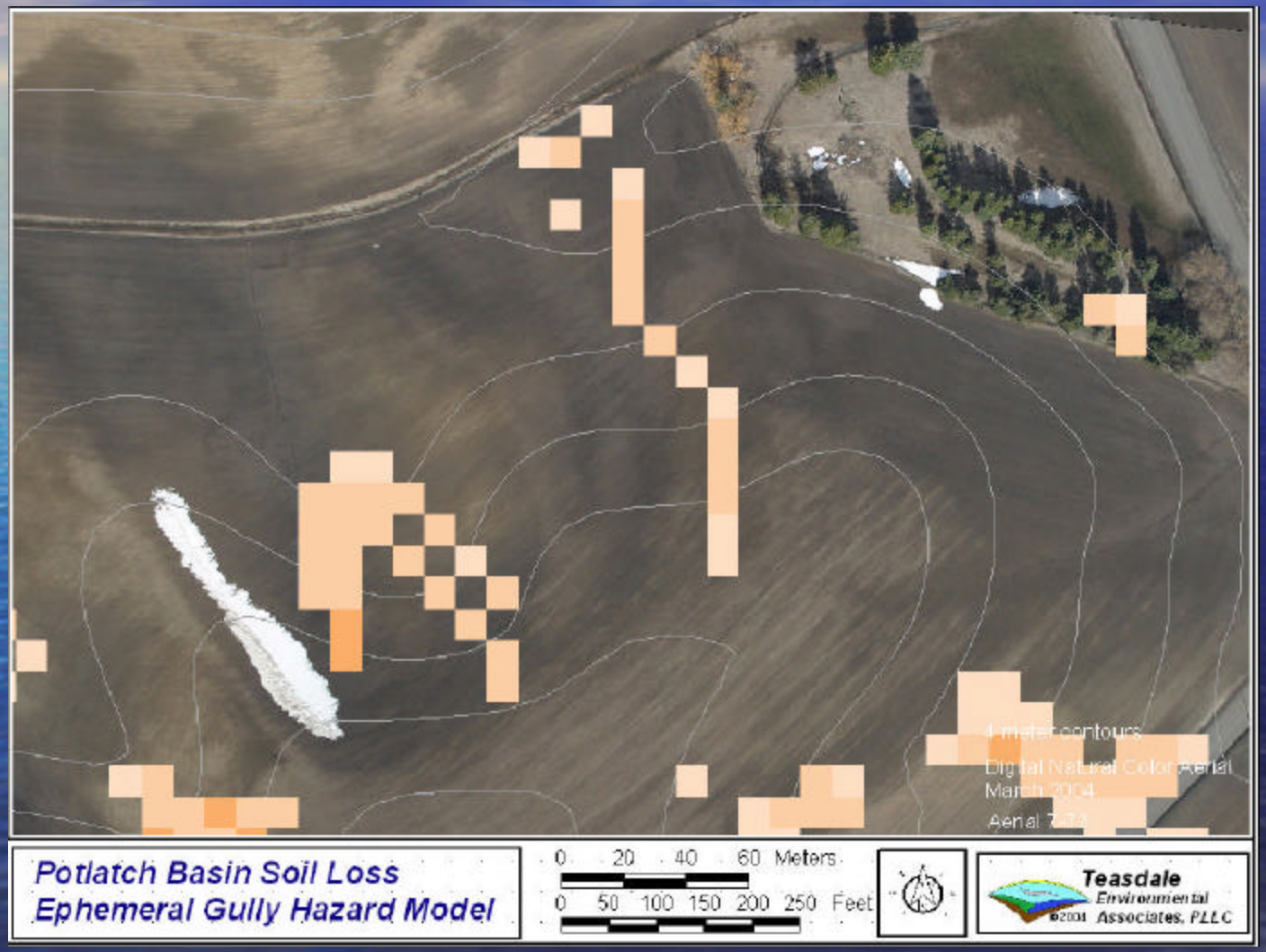
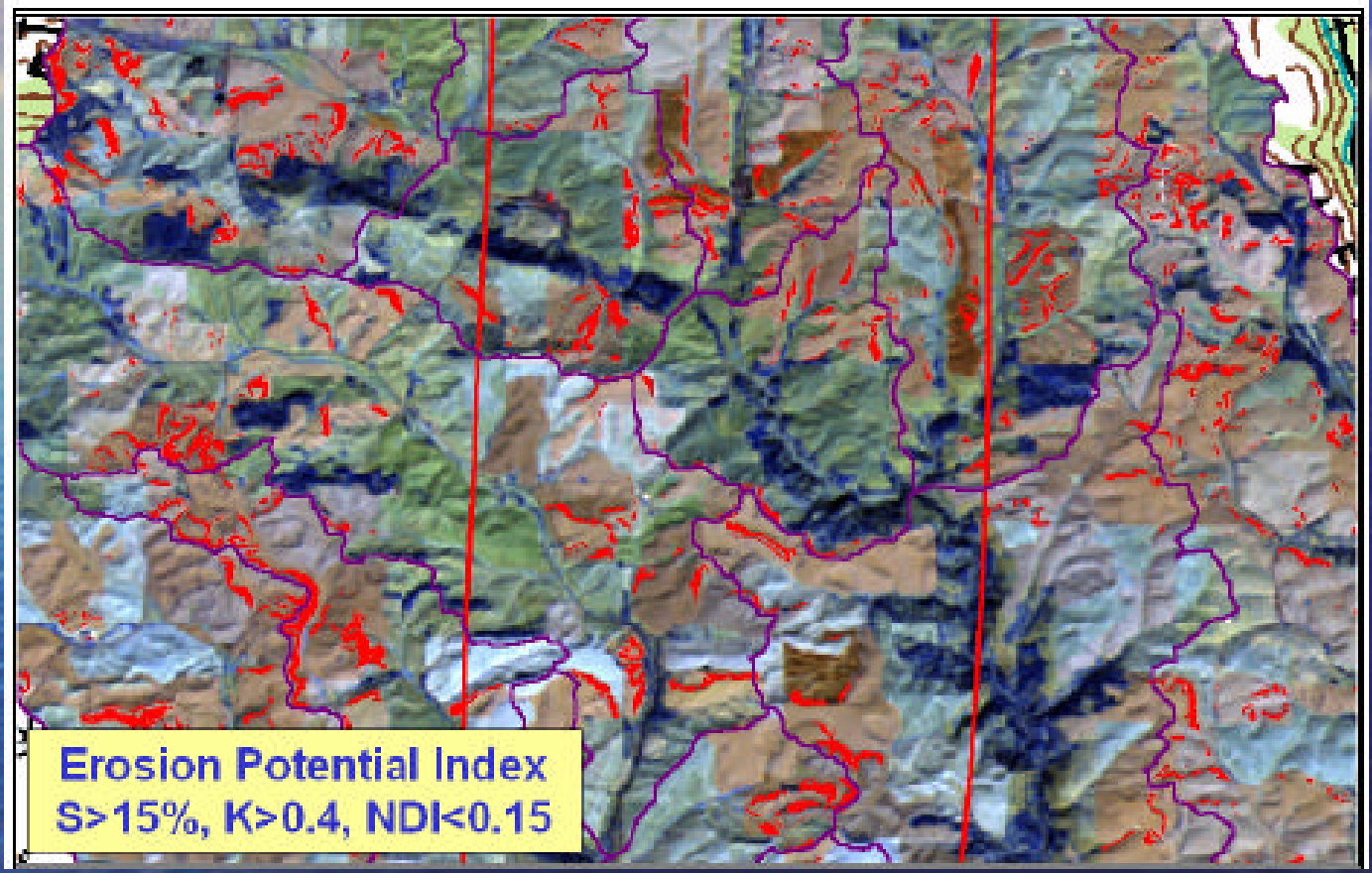


Landsat EPI



Conclusions

- Remote sensing can be used to estimate quantity and location of Ephemeral Gullies
- For 2003-04, Ephemeral Gully Erosion was not a significant source of sediment in the Potlatch Basin
    - 0.15 to 0.40 tons/acre
    - RUSLE2 predicts 7-11 tons/acre rills
- BMP locations for TMDL Implementation can be quickly identified
- EPI represents a good first estimate at the watershed scale but precipitation effects need to be added

Thank the Idaho Department of Environmental Quality

Questions?

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