The use of remotely sensed imagery and GIS analysis for the automated detection of water infiltration in residential structures

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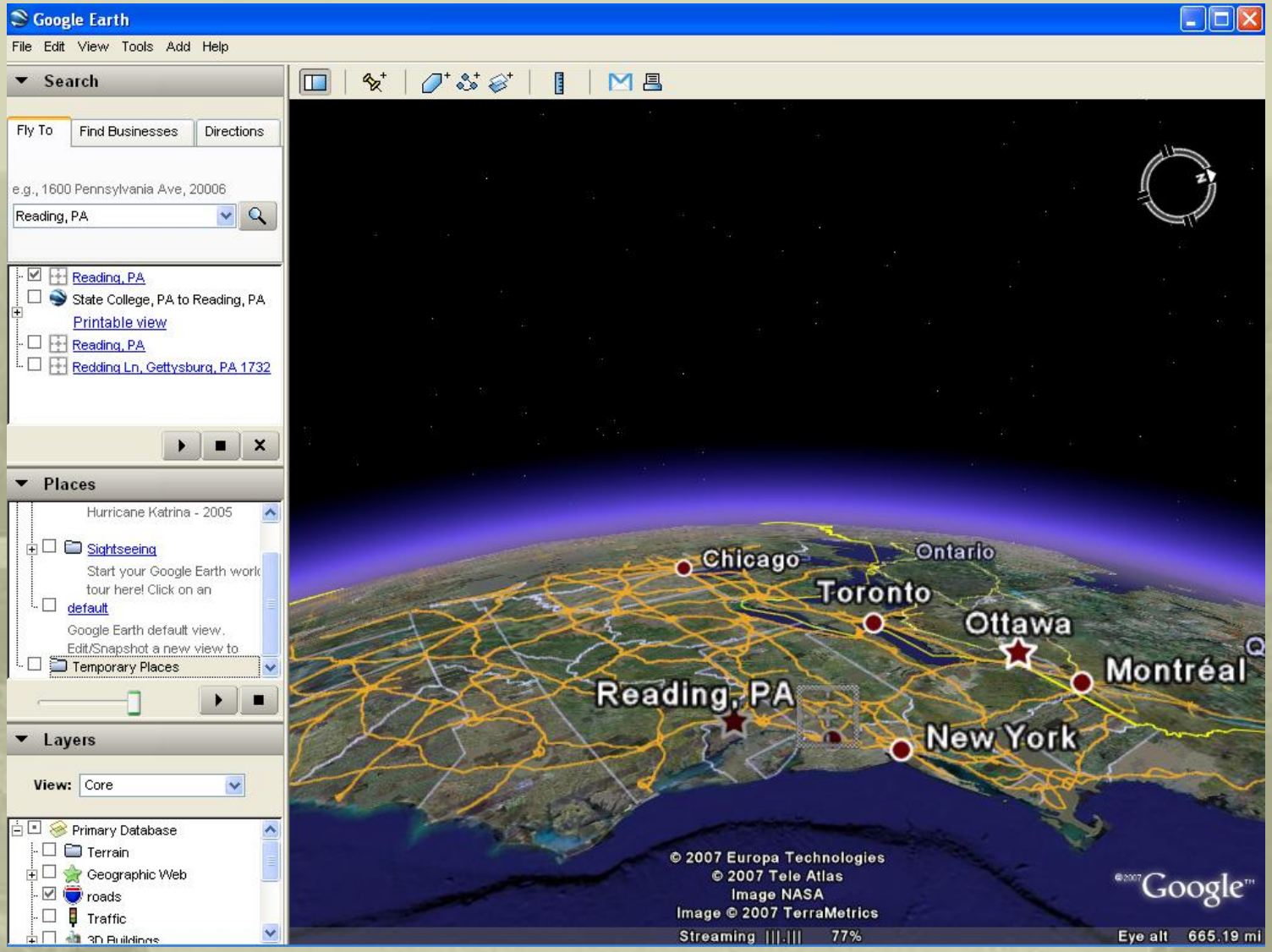
Introduction



the *Democratization* of GIScience

Introduction

A. Familiarizing Water Infiltration and the Chimney Pan Proxy

B. Assessing the Possibility of Remote Detection

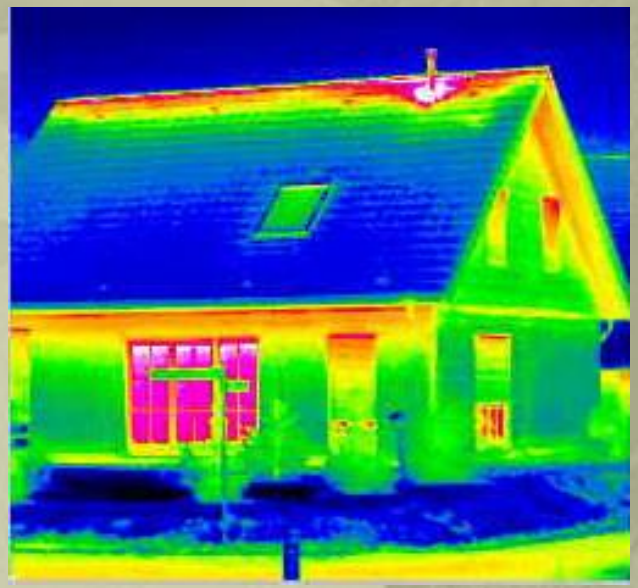
C. Assessing the Feasibility of Remote Detection

Familiarizing Water Infiltration and the Chimney Pan Proxy

building construction – the erection, maintenance, and removal of residential, commercial, and industrial structures

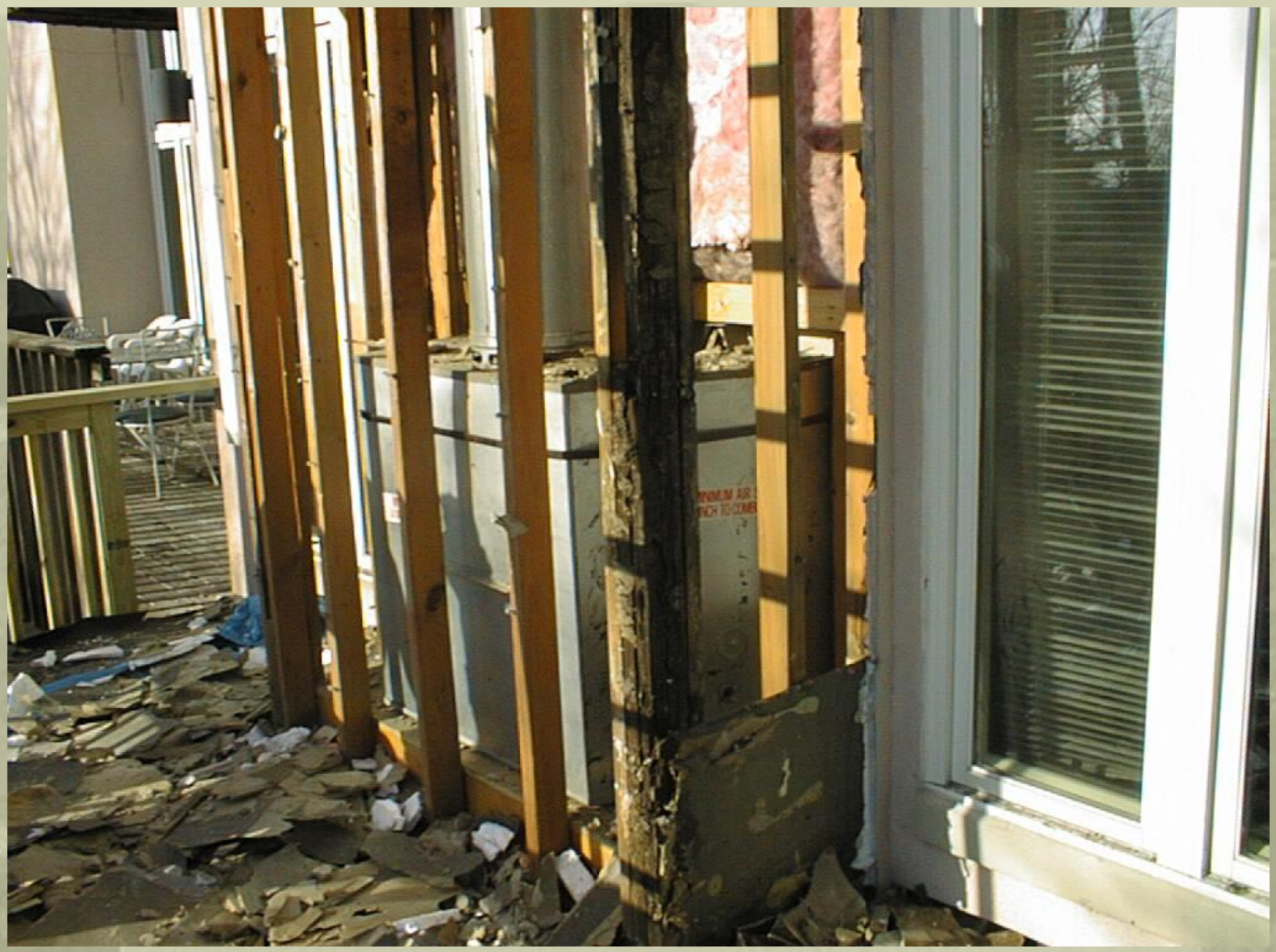
building diagnostics – identification and maintenance of potential structural issues before they become fatal to the building

infrared thermography of buildings – the planimetric (from above) or oblique (from the side) remote detection of failures in the insulation of the home with the goal of preventing energy waste



Familiarizing Water Infiltration and the Chimney Pan Proxy

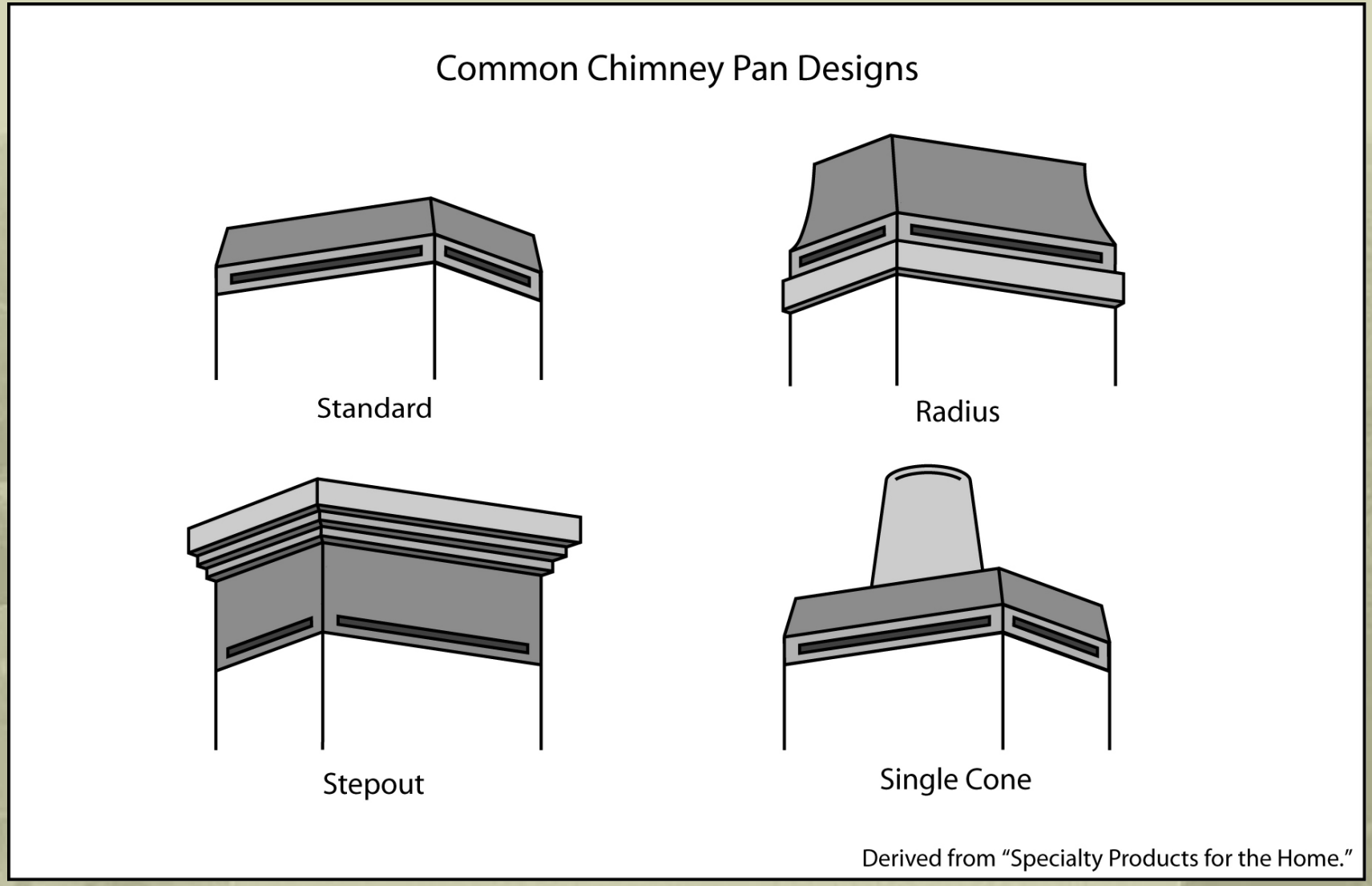
detrimental effects of water infiltration:
1) jeopardizing of the structural integrity of the home



Familiarizing Water Infiltration and the Chimney Pan Proxy

detrimental effects of water infiltration:
2) encroachment of unwanted creatures

Familiarizing Water Infiltration and the Chimney Pan Proxy



the *chimney pan* proxy

Familiarizing Water Infiltration and the Chimney Pan Proxy

the *chimney pan* proxy

The Possibility of Remote Detection

remote detection of the chimney pan proxy hinges upon differences in physical characteristics between:

1) smooth metal (a functional pan)

2) rust (a failed pan)

these two material types can be extracted from remotely sensed orthophotography in one of two methods

1) examining each material's spectral reflectance

2) examining each material's spectral radiance

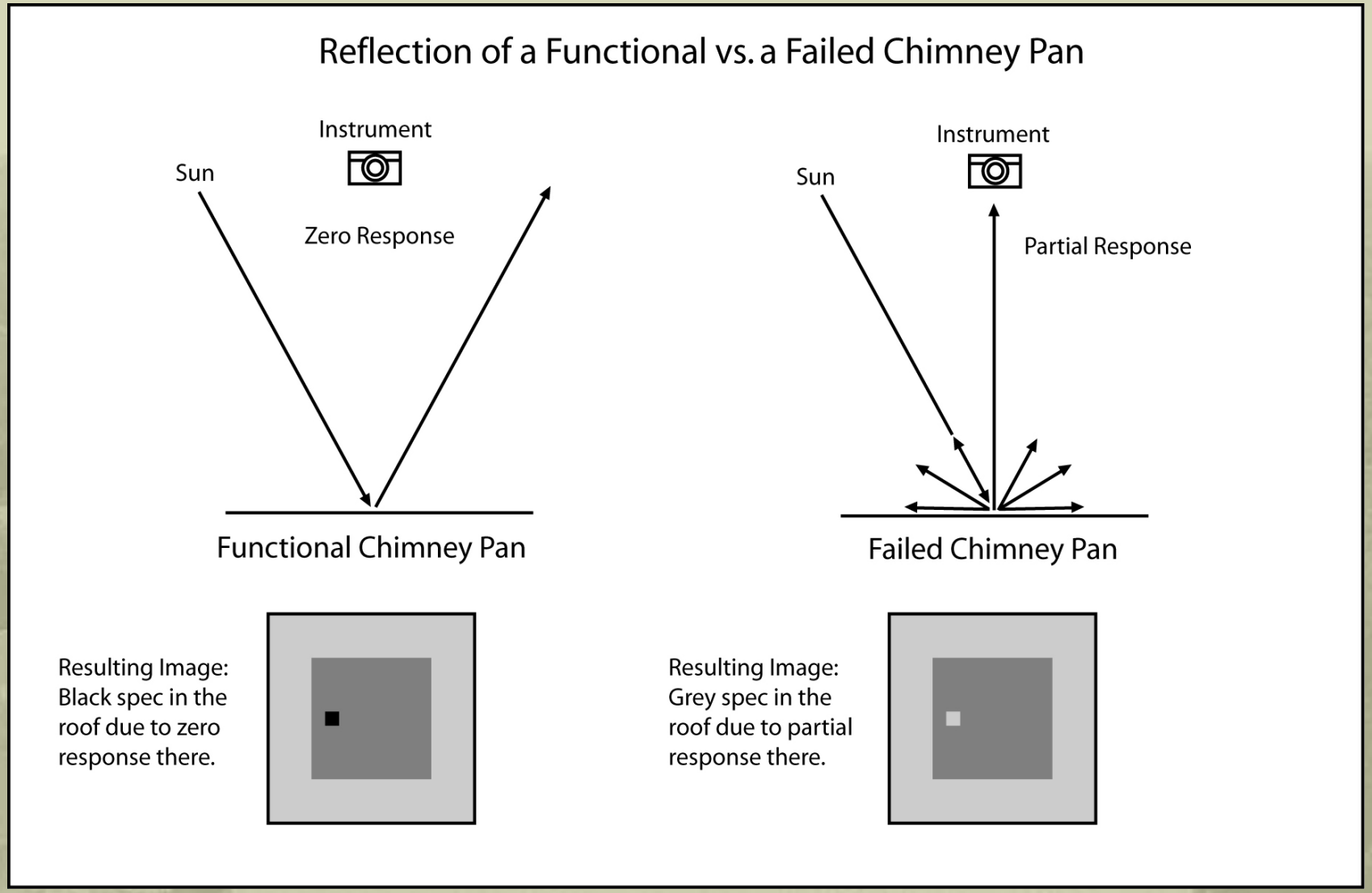
The Possibility of Remote Detection

$$E_I(\lambda) = E_R(\lambda) + E_A(\lambda) + E_T(\lambda)$$

where:

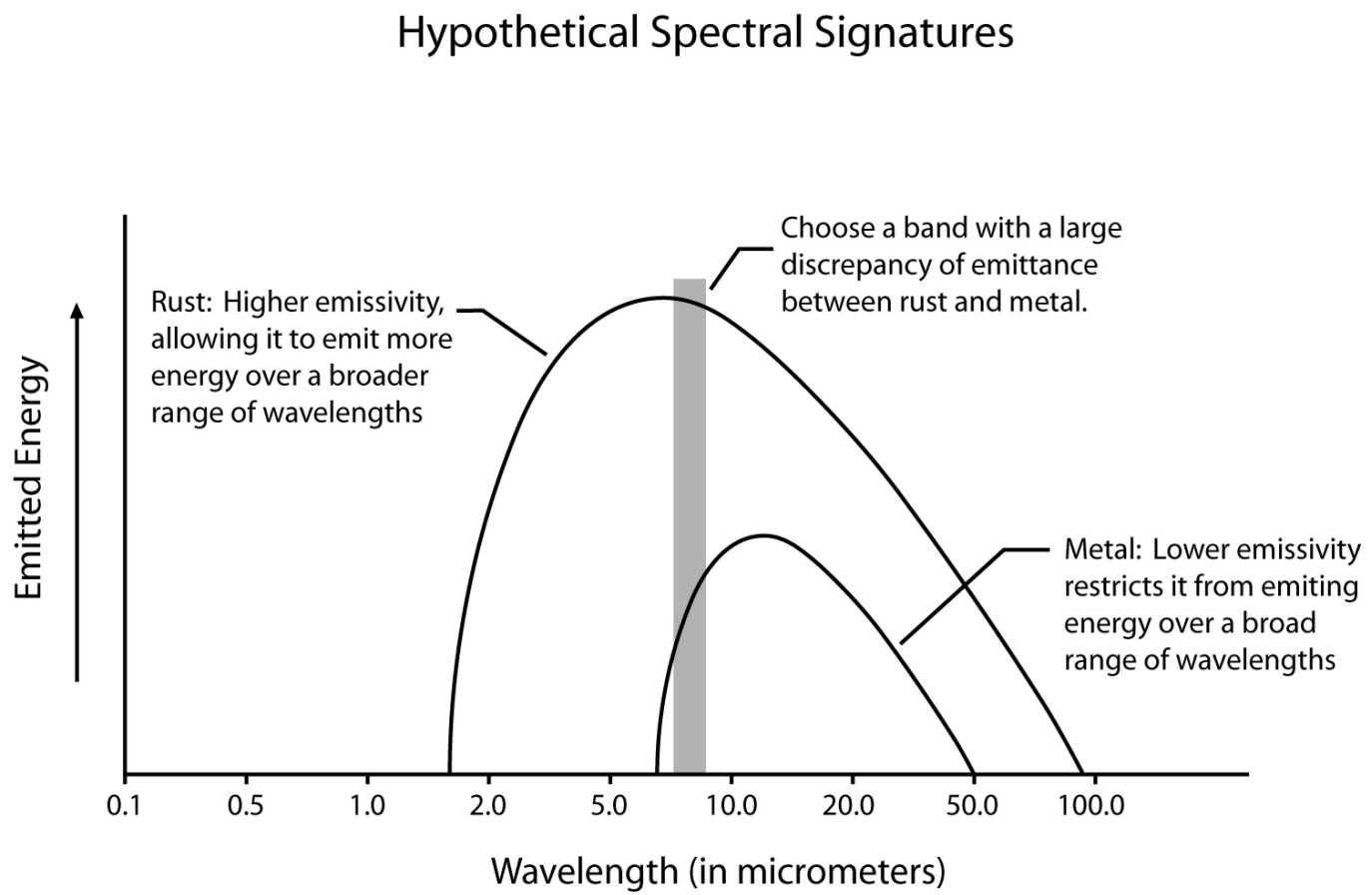
$E_I(\lambda)$ = incident energy at a given wavelength
$E_R(\lambda)$ = reflected energy at a given wavelength
$E_A(\lambda)$ = absorbed energy at a given wavelength
$E_T(\lambda)$ = transmitted energy at a given wavelength

The Possibility of Remote Detection: Spectral Reflectance



***specular* versus *diffuse/Lambertian* reflectors**

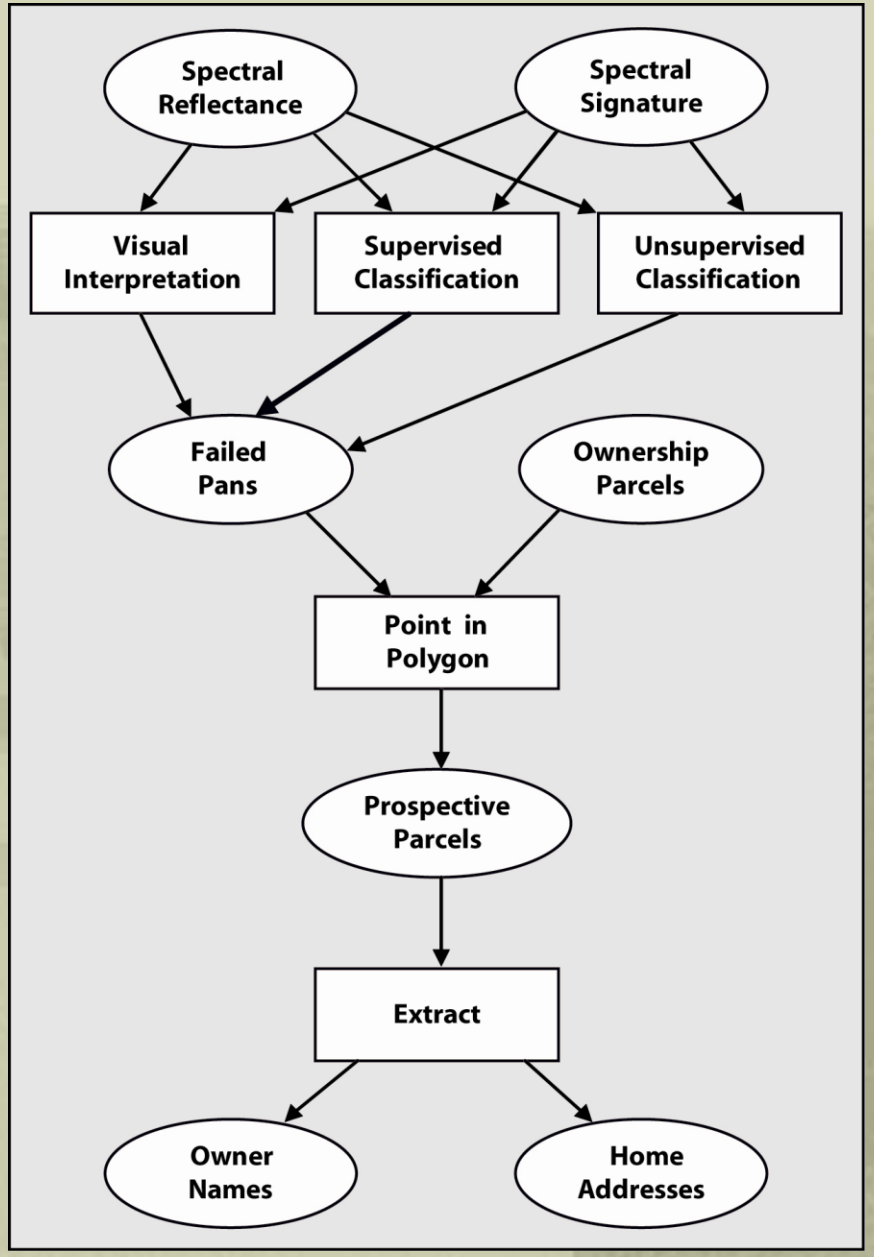
The Possibility of Remote Detection: Spectral Radiance



spectral signatures* of each material's *emissivity

The Possibility of Remote Detection

GIS model for automation



The Feasibility of Remote Detection

technical concerns

1) non-uniform incident energy source

2) atmospheric effects

3) ambiguous radiance responses

4) sensor limitations

*spatial resolution
*spectral resolution
*radiometric resolution

The Feasibility of Remote Detection

"The Subdivision Effect" – because homes of a subdivision are often built all at once, it is likely that most of the pans within that subdivision will fail at relatively the same time

* Selecting subdivisions that are 7-10 years old should increase the success rate of our marketing

The Feasibility of Remote Detection

ethical concerns: privacy

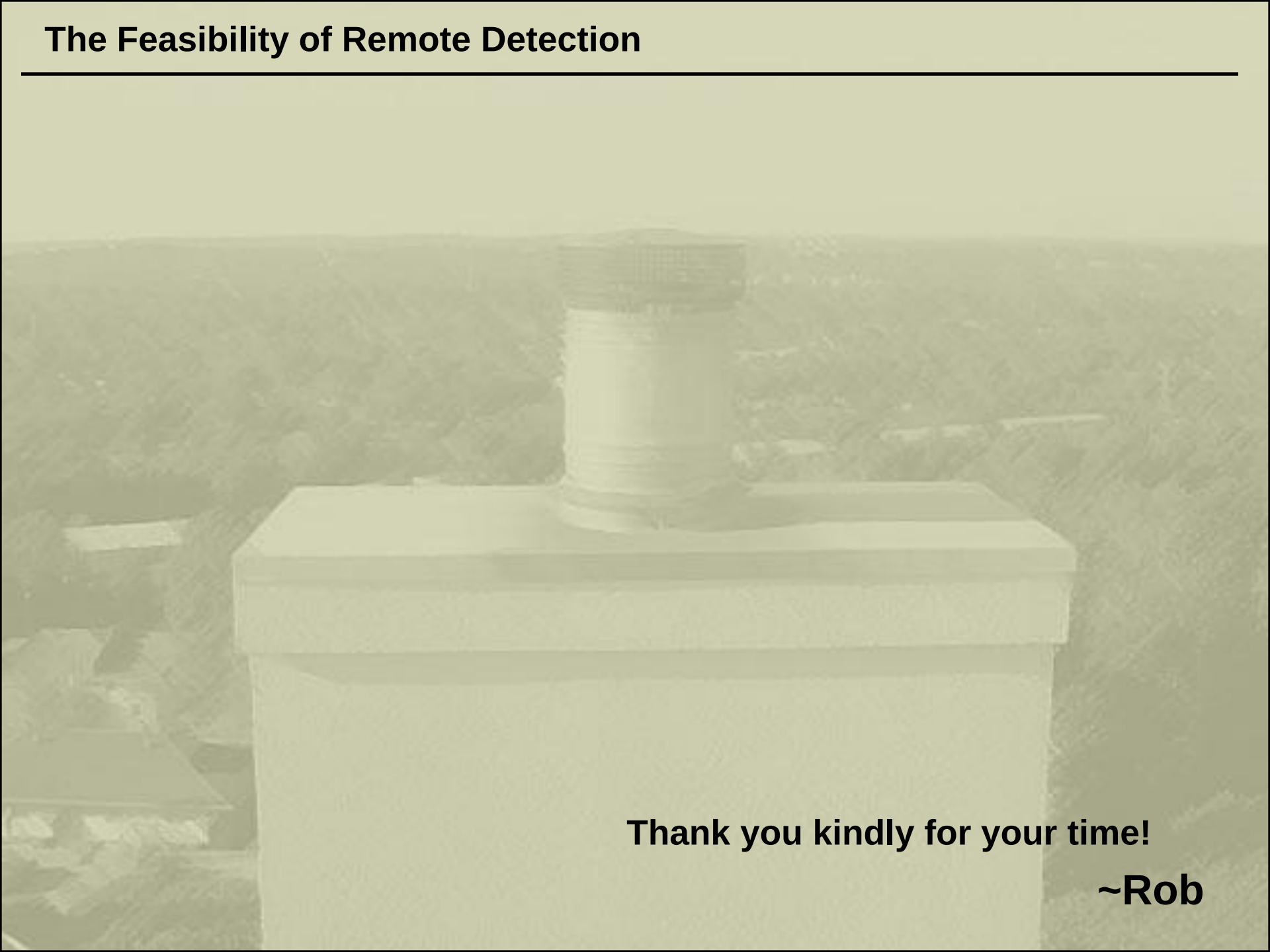
privacy of the home covered by Fourth Amendment

* confirmed by *Griswold v. Connecticut* in 1965
* later expanded upon in the Privacy Act of 1974

the issue of the legality in remote sensing addressed in *Dow Chemical Company v. United States*

***open field doctrine*:** “whatever can be seen from above is fair game for official and unofficial snooping” (Monmonier 2002)

The Feasibility of Remote Detection



Thank you kindly for your time!

~Rob