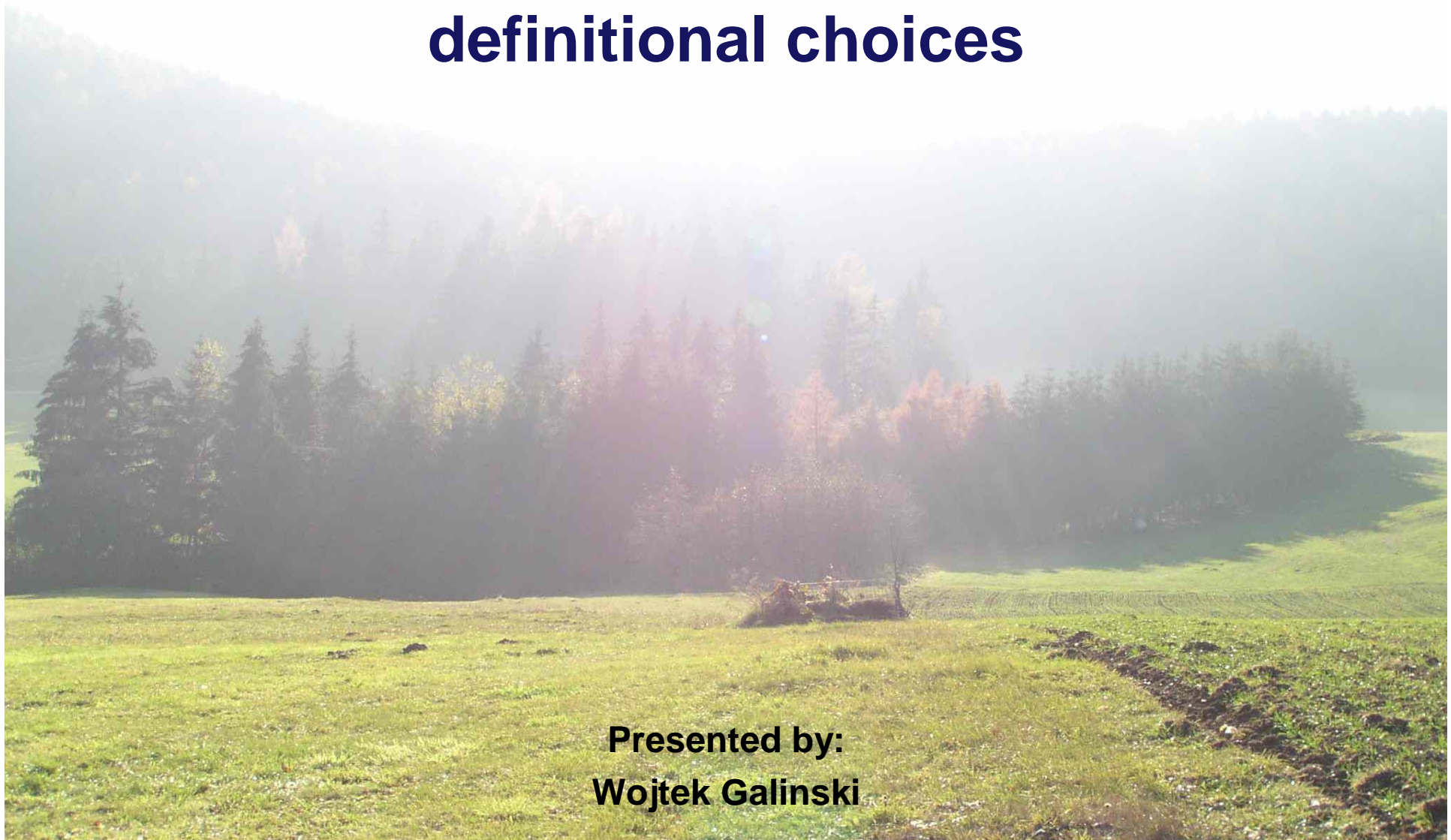


Detection of afforestation/deforestation through combination of remote sensing and NFI systems – relationship with definitional choices



**Presented by:
Wojtek Galinski**

Objectives

For NFI based on a net of sample plots:

- 1. Contrast forest and ARD events**
- 2. Analyse NFI as a tool for ARD detection in context of KP definitional choices**
- 3. Use NFI for D detection (method)**

***Afforestation/Reforestation* and *Deforestation*
are not stand alone ecological and legal conceptions**

**They are defined in relation to *Forest*
serving as the discriminatory filter**



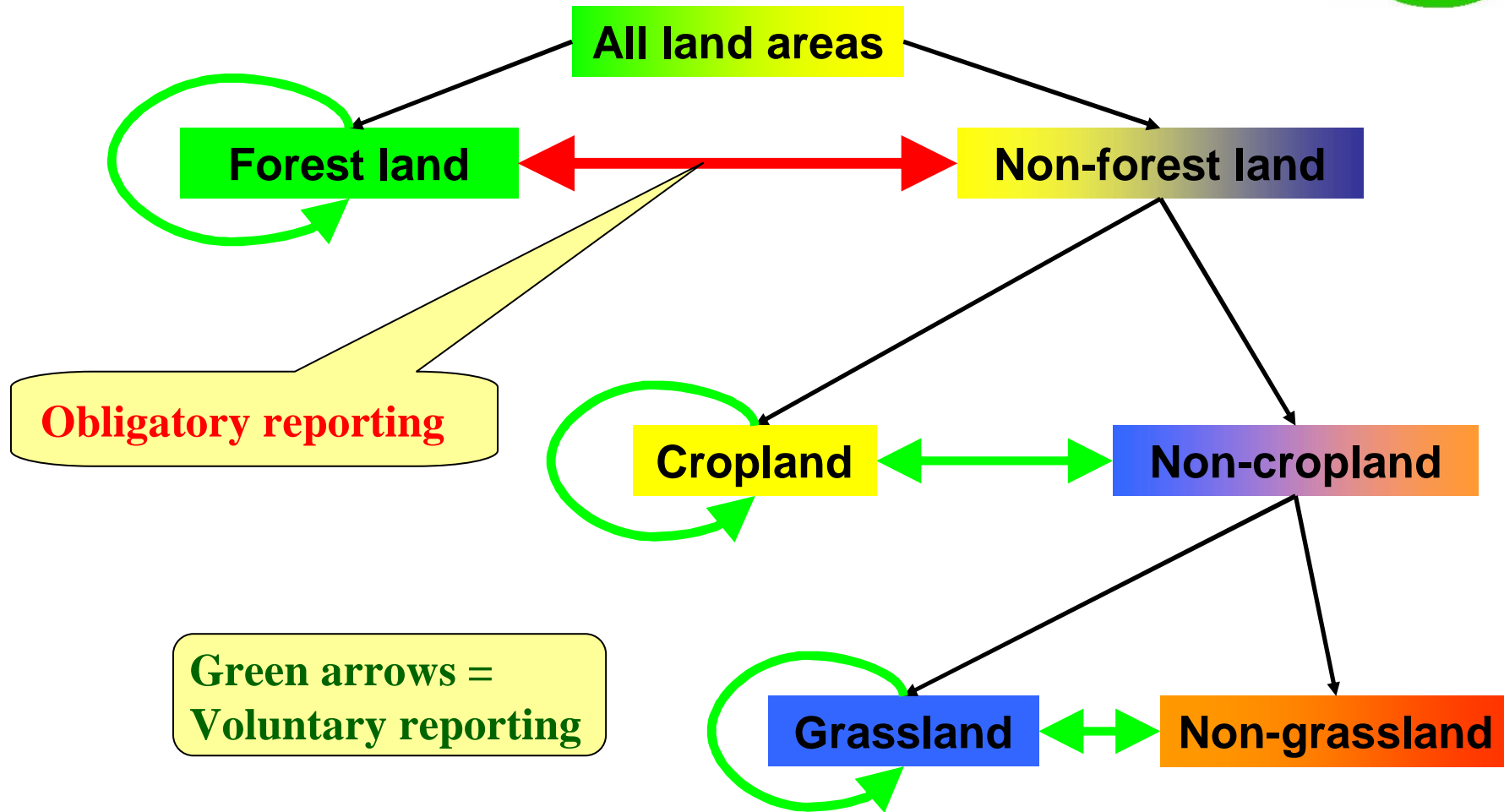
Some legal issues



„Forest“ as the discriminatory filter

- minimum area of land of 0.05-1.0 hectares covered with trees
- tree crown cover (or equivalent stocking level) of more than 10-30 per cent
- trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*
- closed forest formations
- areas temporarily unstocked (e.g. harvest, fire)

Obligatory and voluntary reporting



Obligatory reporting

Green arrows =
Voluntary reporting

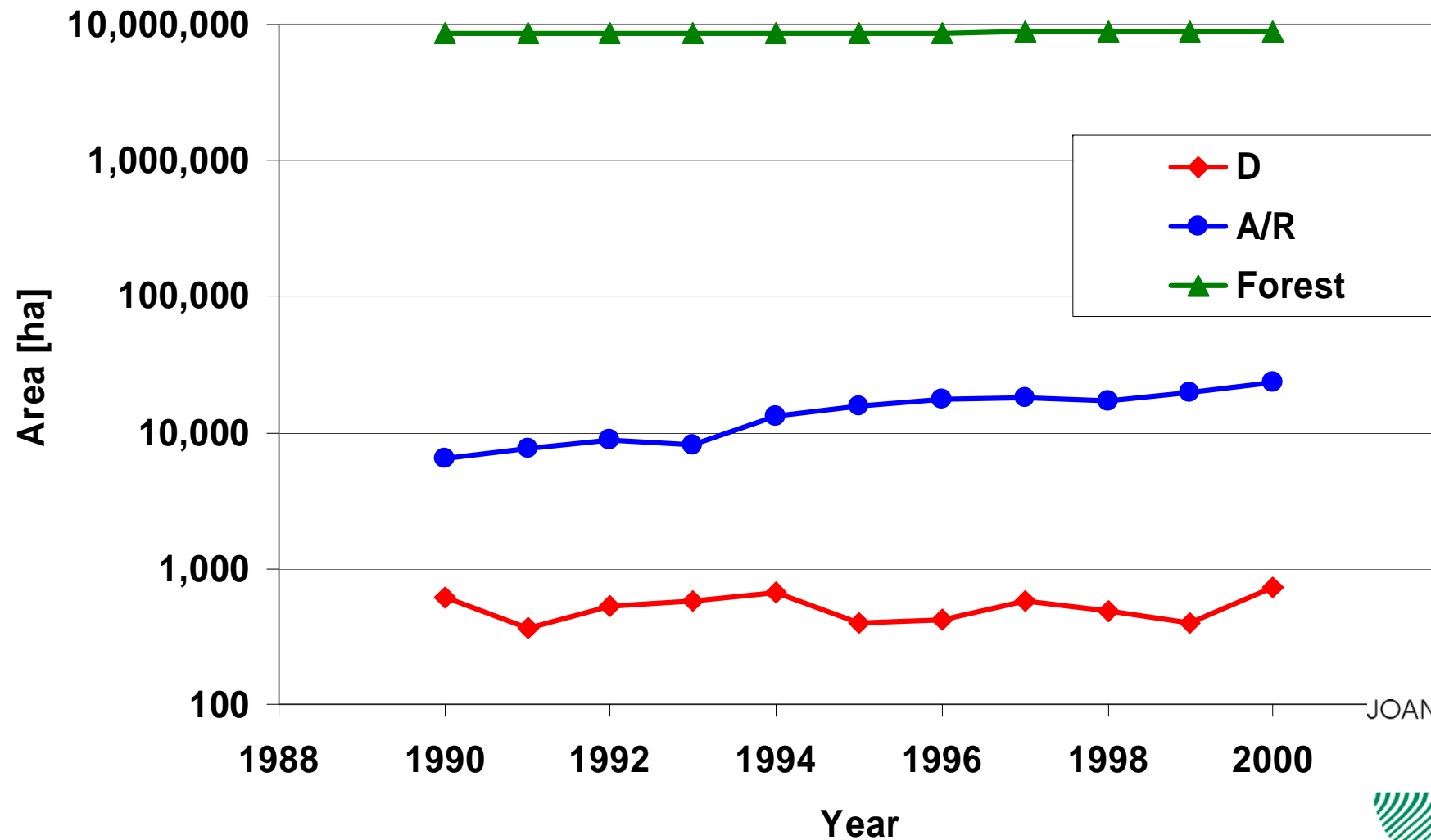
etc.



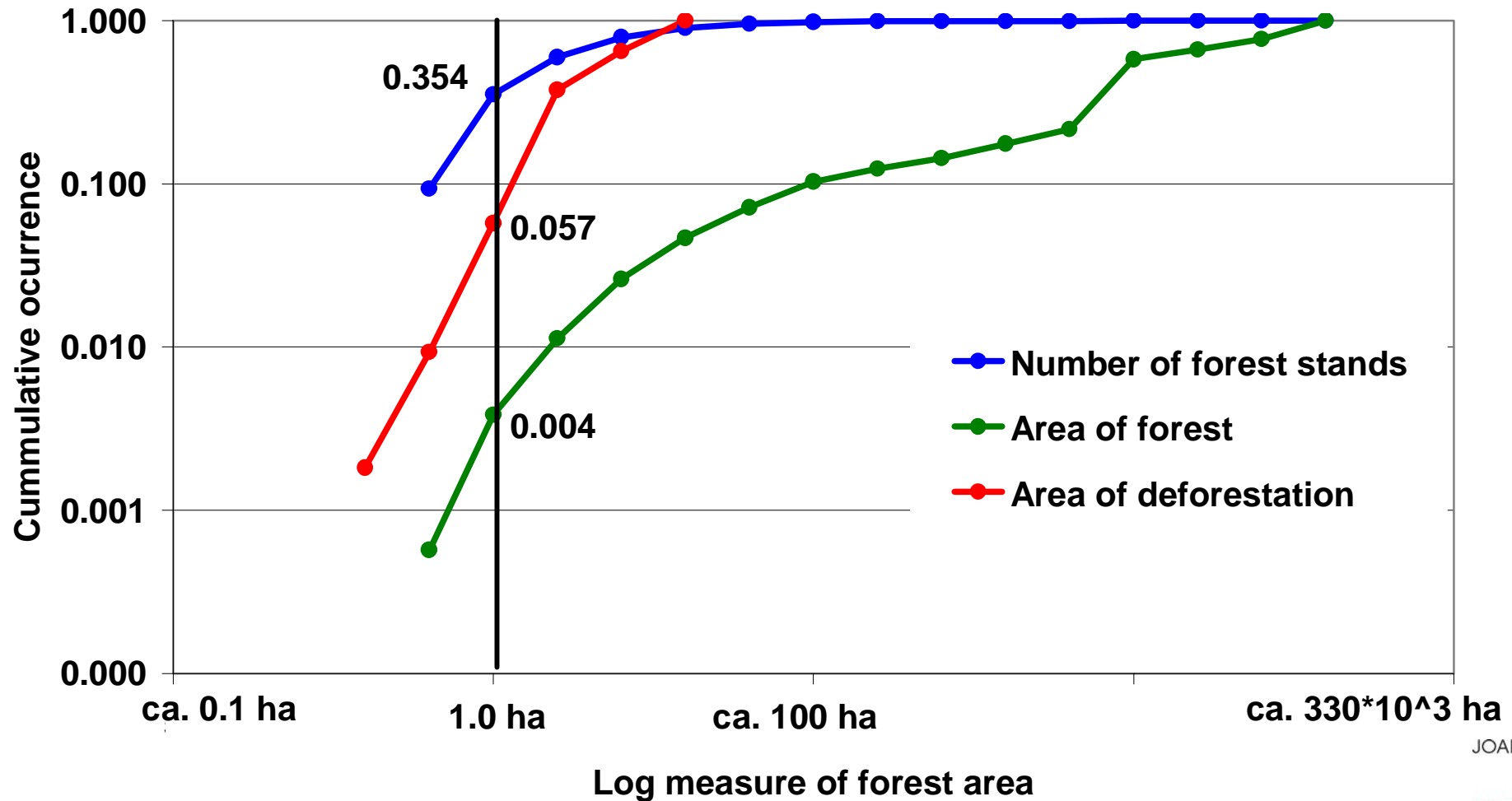
A bit of practice



Area of forest, A/R and D in Poland



Forest stands: number & area distributions Salzburg Test Area (Austria)



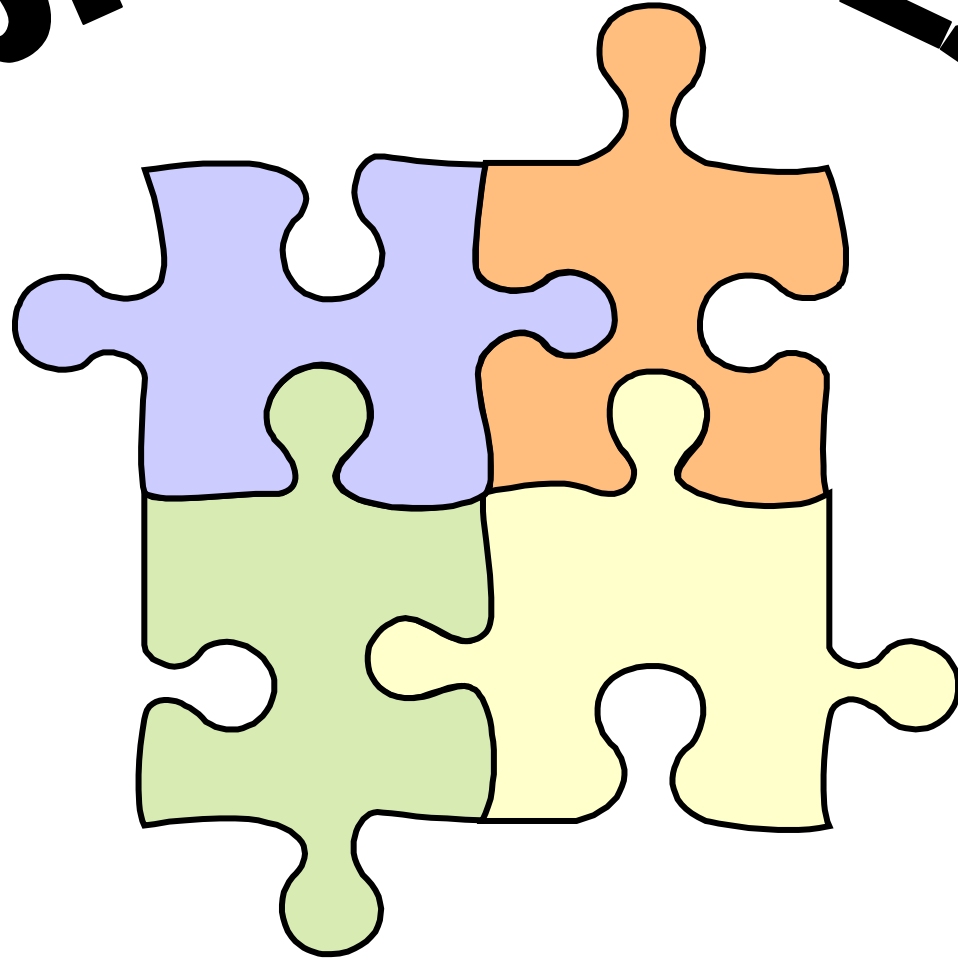
Annual Afforestation/Reforestation/Deforestation Rate

**Deforestation rate =
Gross decrease in forest area
(annual)**

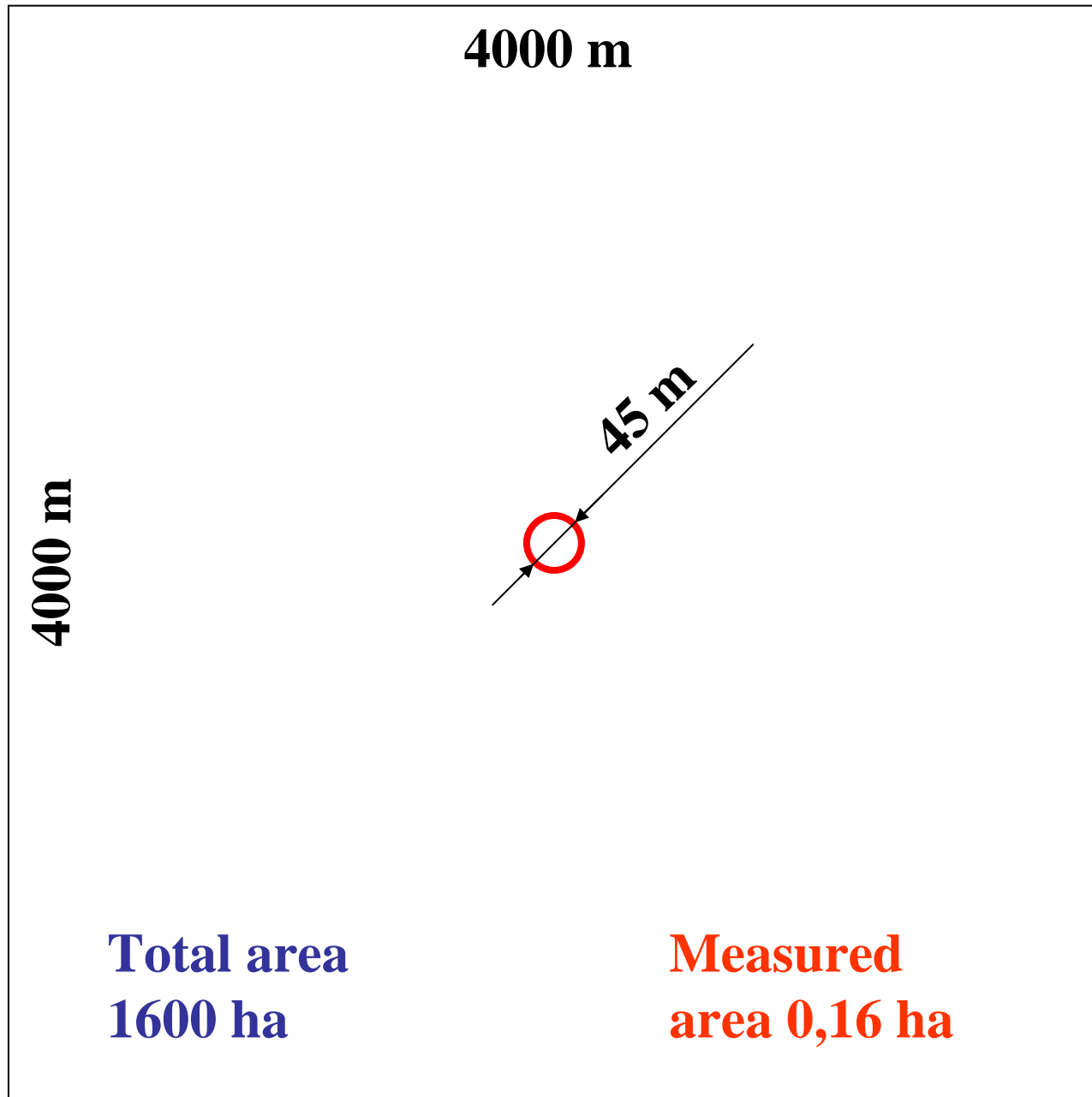
<< 0.1% of forest area

in majority of Annex I countries

A bit of puzzle



NFI for detection of ARD events



**Basic
measuring
unit of NFI**

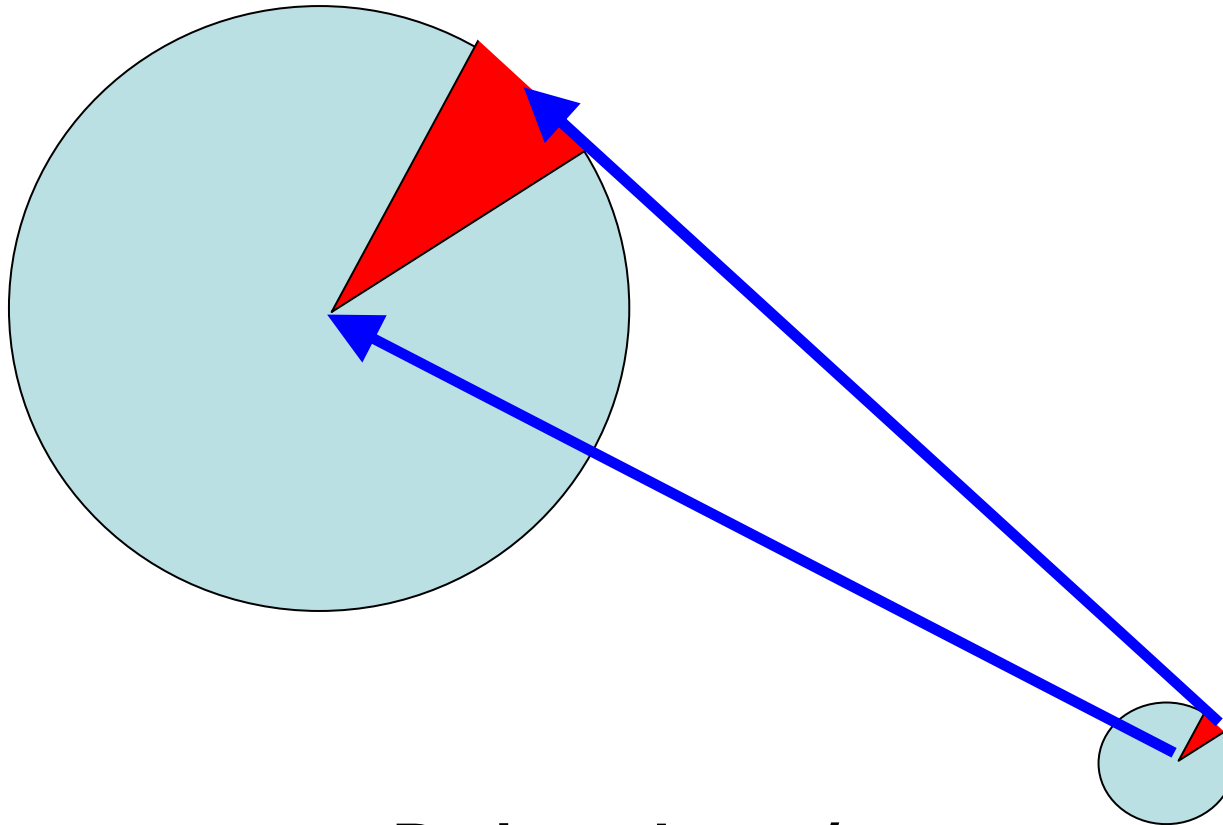
**Measured /
Total area = 10^{-4}**

Proportional representativeness rule



Stand

**Ratio red area/
stand plot area = m**

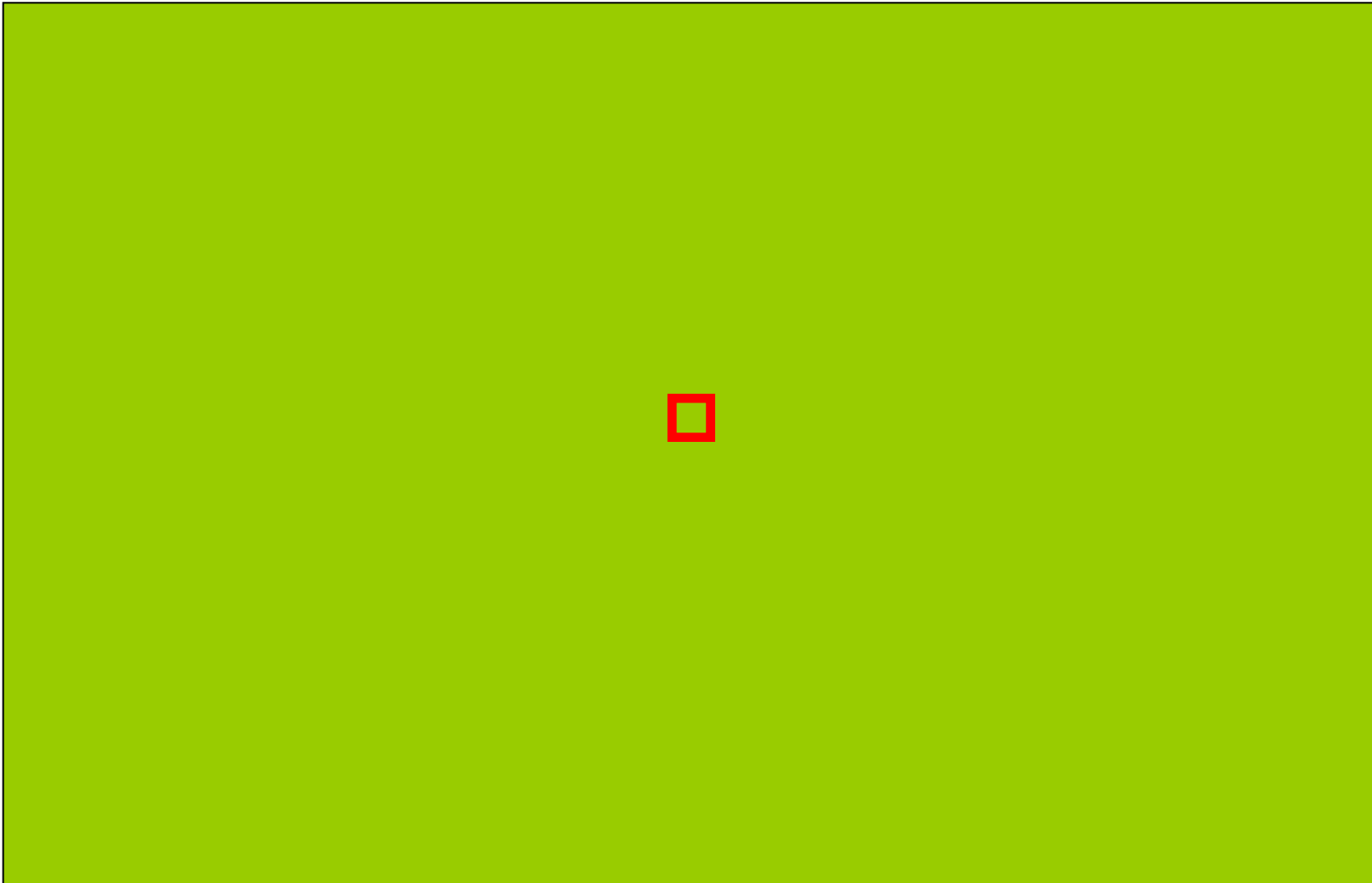


**Ratio red area/
sample plot area = m**

Sample plot

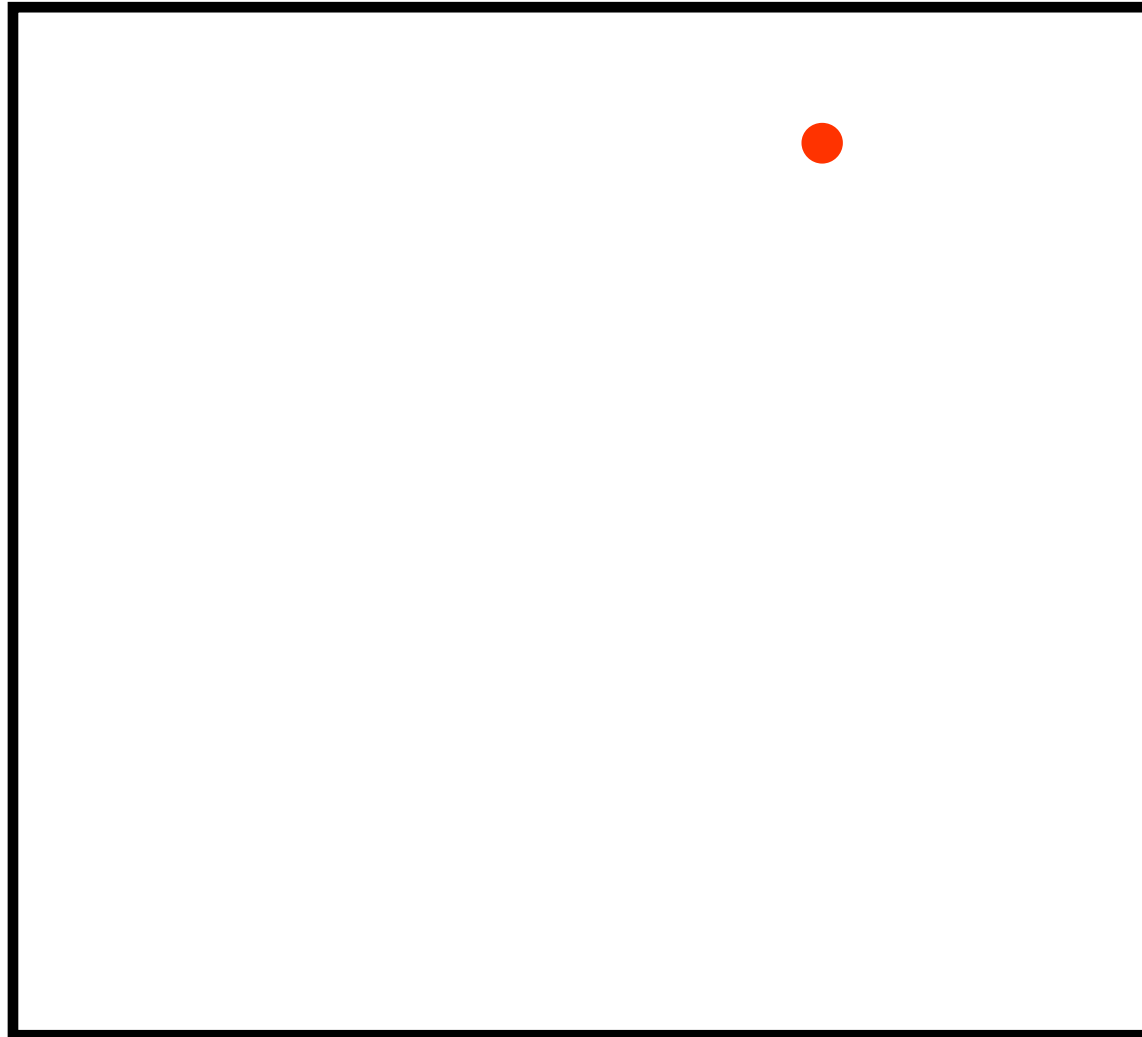
Location of D events in Salzburg test area

Forest area is much larger than the unit area



Location of D events in Salzburg test area

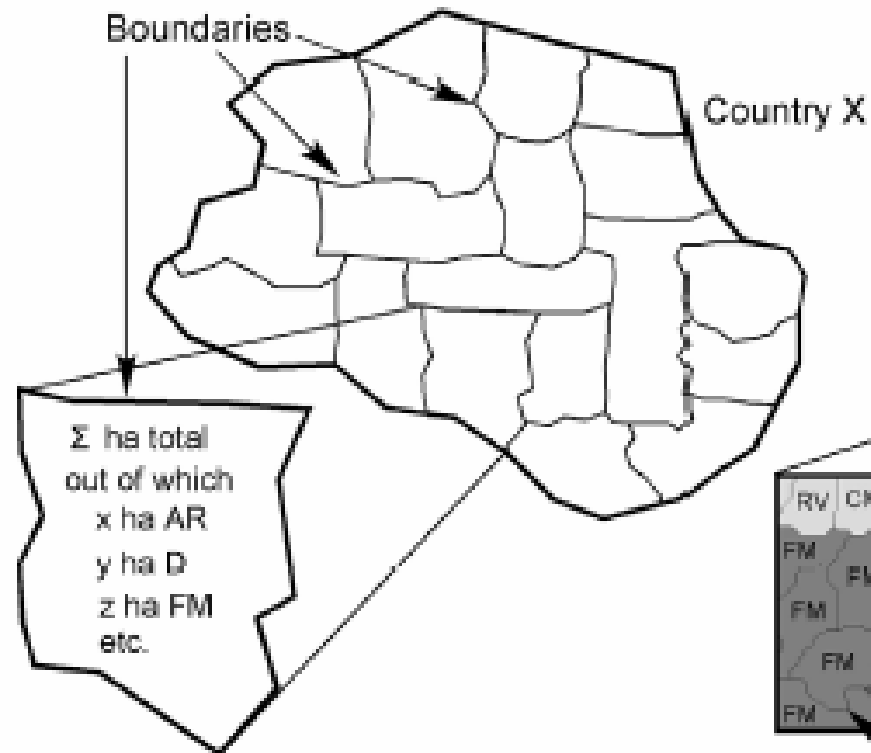
Deforestation area is much smaller than the unit area



How small the land area could be?

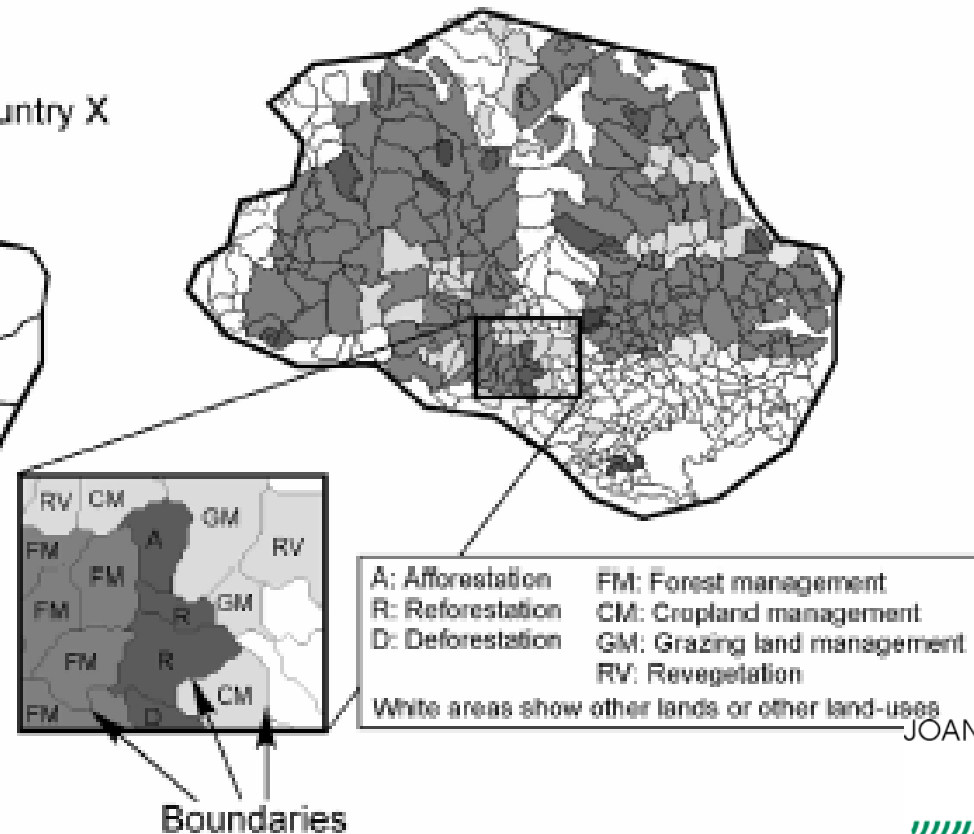
Reporting Method 1

A geographic boundary encompasses units of land or land subject to multiple activities.



Reporting Method 2

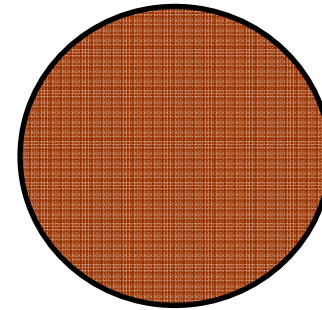
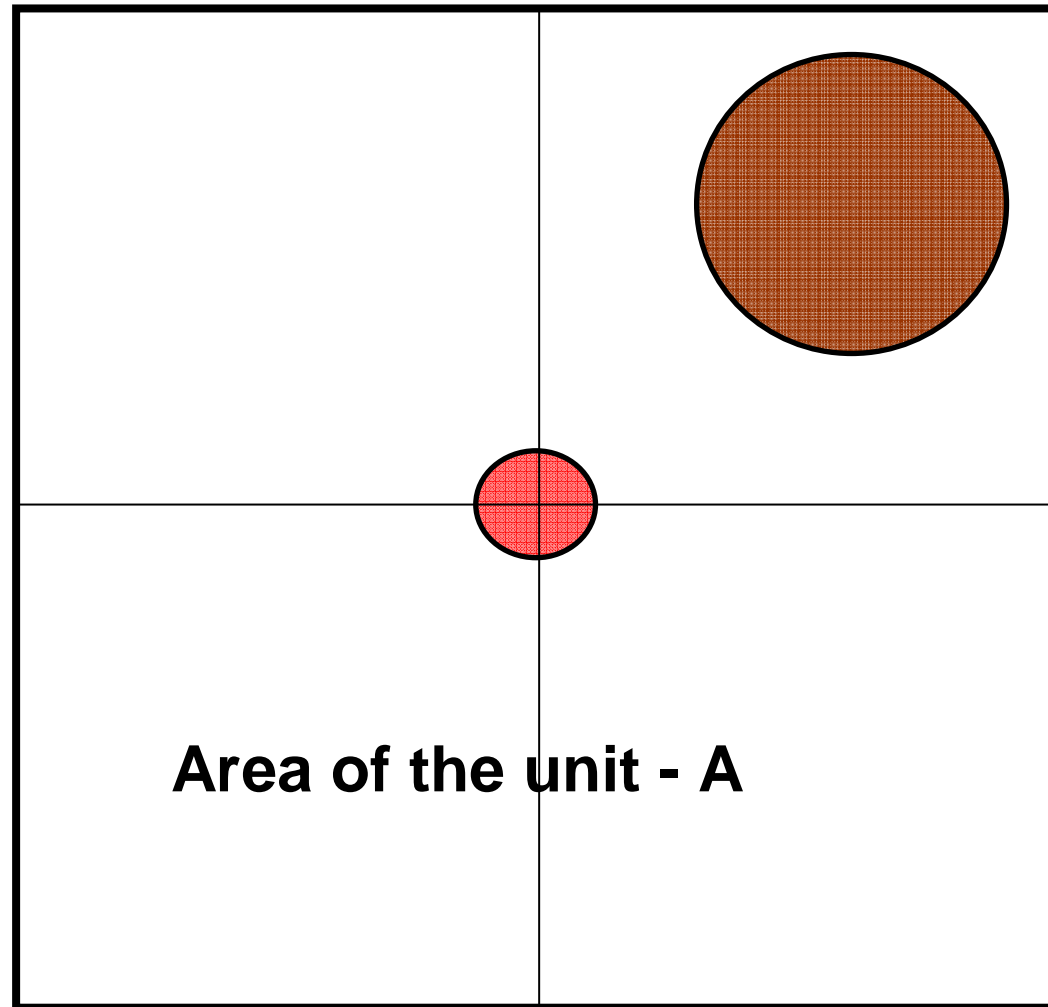
A geographic boundary encompasses units of land or land only subject to a single activity.



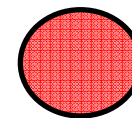
Details



Detection of D events in the NFI (1)

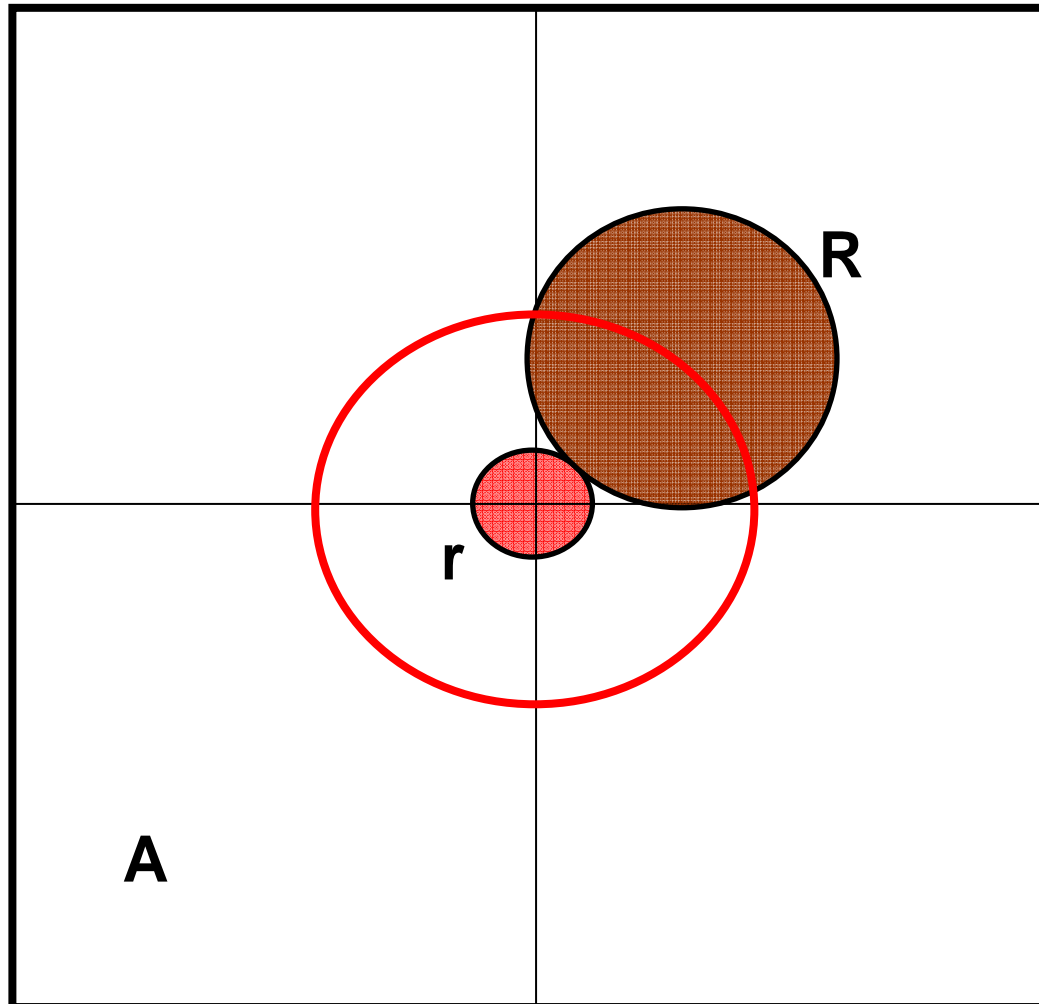


**Circular D event –
radius R**



**Circular sample
plot – radius r**

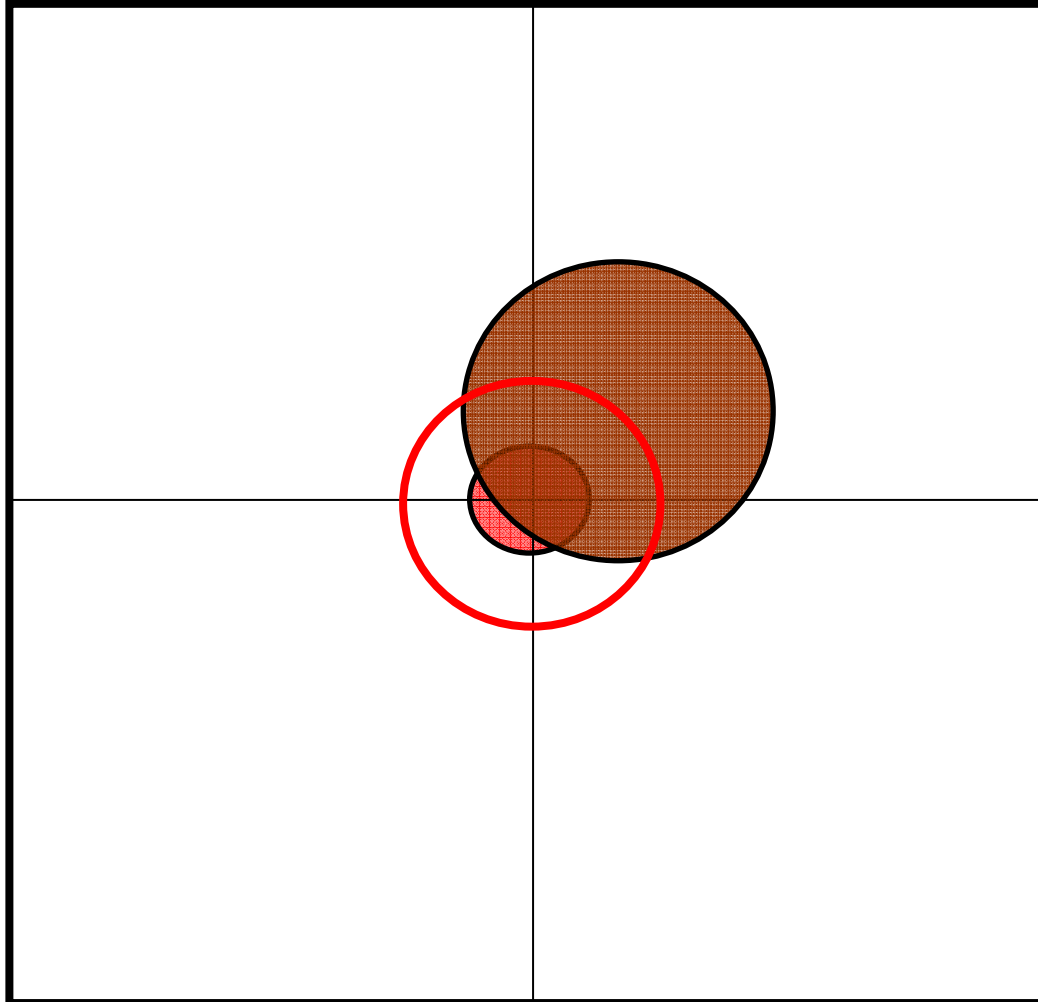
Detection of D events in the NFI (2)



Probability
that D event
is reported =

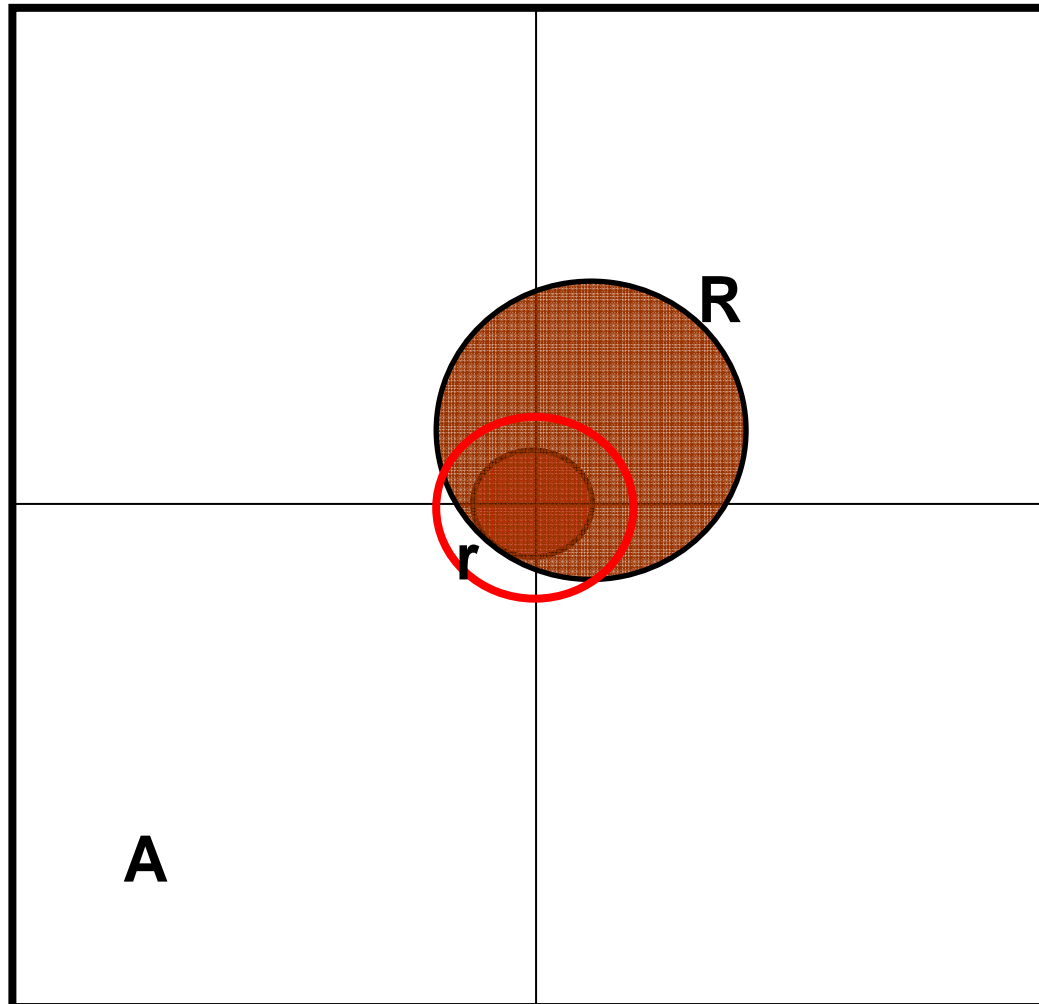
$$\pi^*(R+r)^2/A$$

Detection of D events in the NFI (3)



An intermediate situation

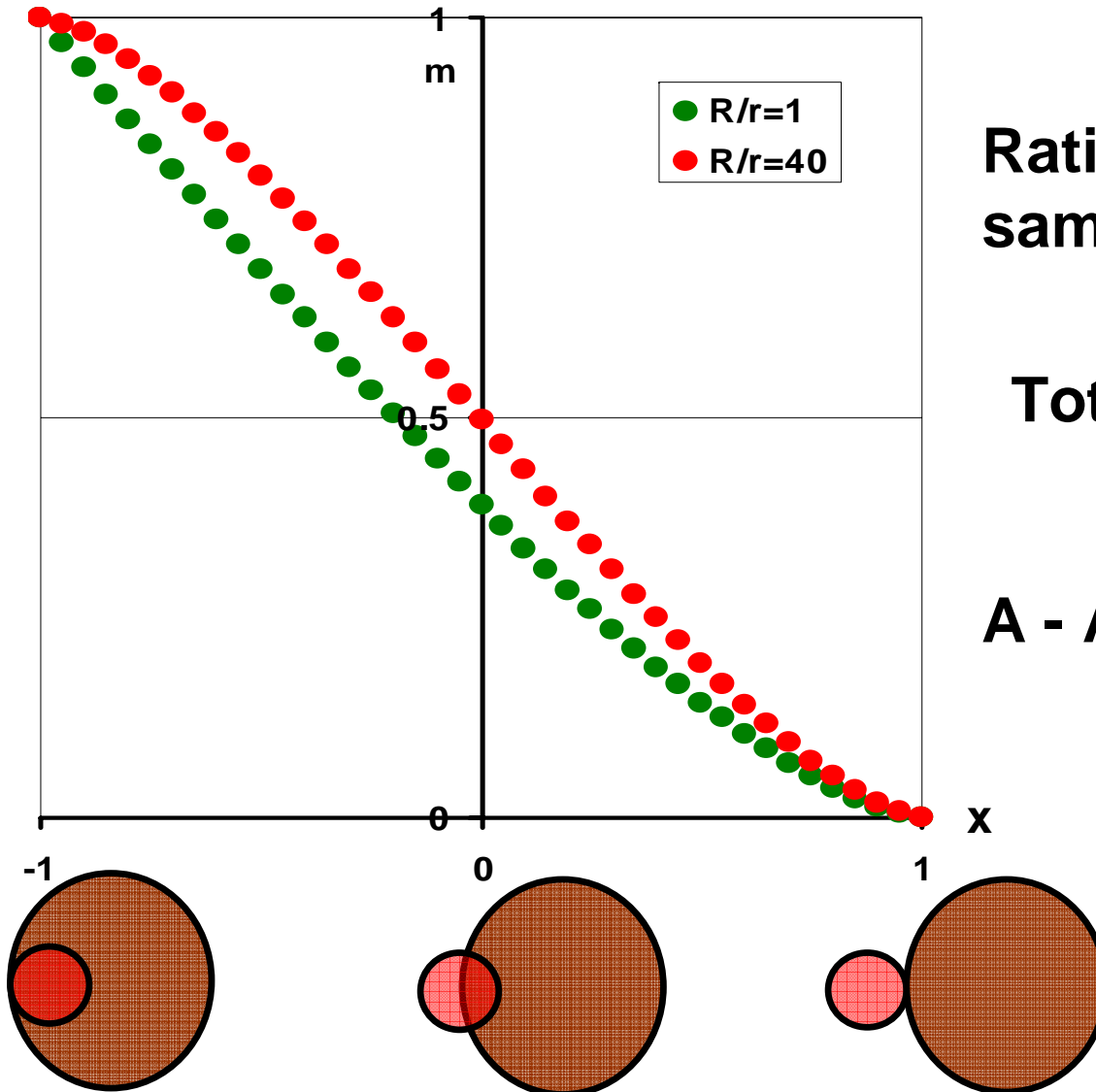
Detection of D events in the NFI (4)



Probability that
whole sample
plot is cut =

$$\pi^*(R-r)^2/A$$

Detection of D events in the NFI (5)



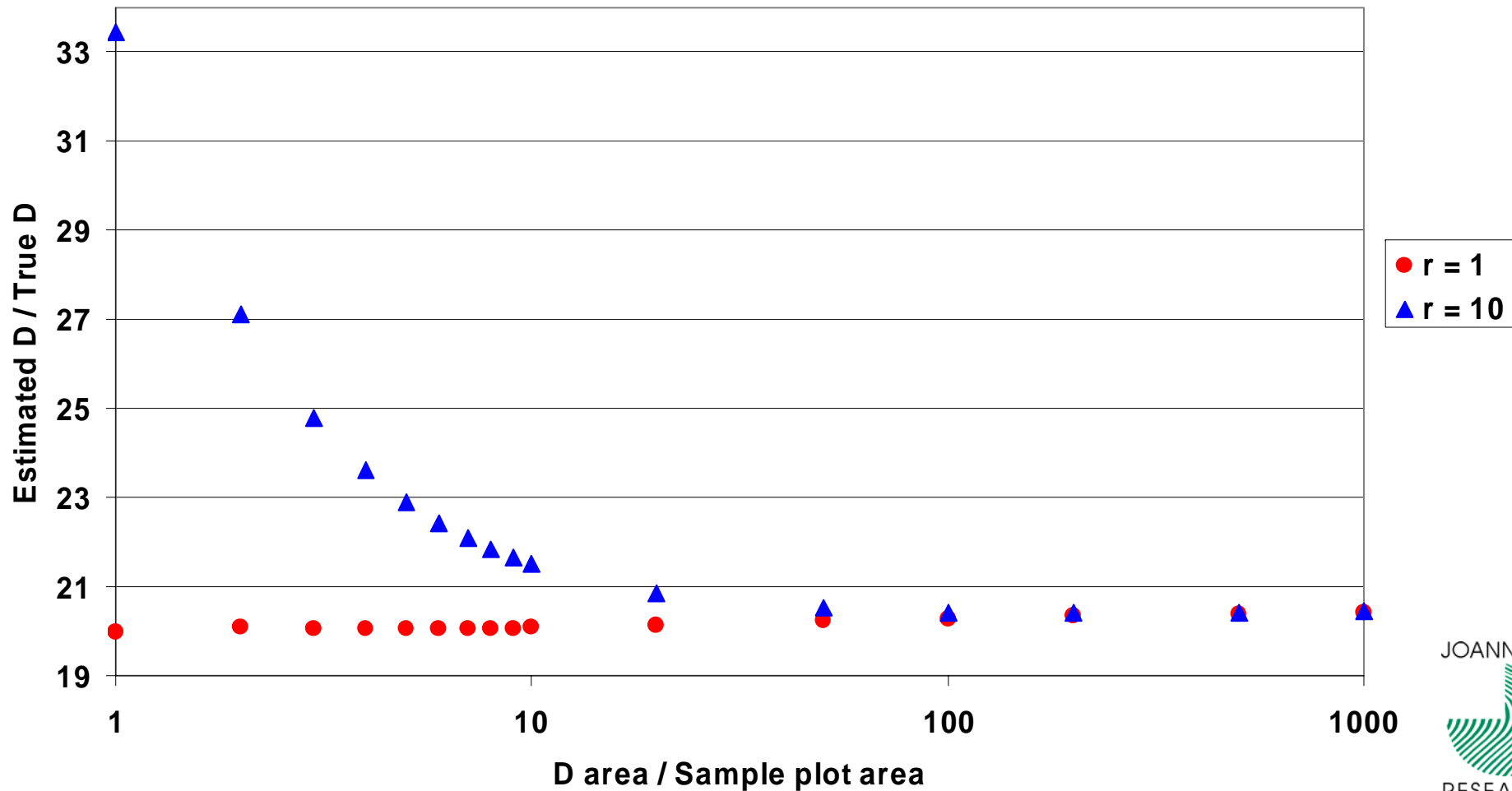
Ratio mutual area/
sample plot area = m

$$\text{Total D} = m * A$$

A - Area of the unit

Expected value of the ratio estimated D / True D

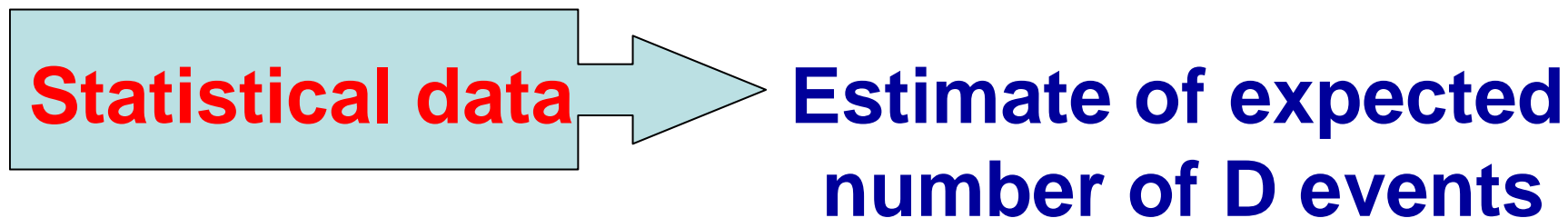
$$\frac{\int_{-1}^{+1} m(x) * p(x)}{\pi * R^2} = \frac{\pi * \int_{-1}^{+1} m(x) * (R^2 + r^2 + 2 * r * x) dx}{\pi * R^2} > 1$$



A blue-tinted photograph of a snow-capped mountain range. The text "A bit of vision" is overlaid in a bold, black, sans-serif font, slanted upwards from left to right across the middle of the image.

A bit of vision

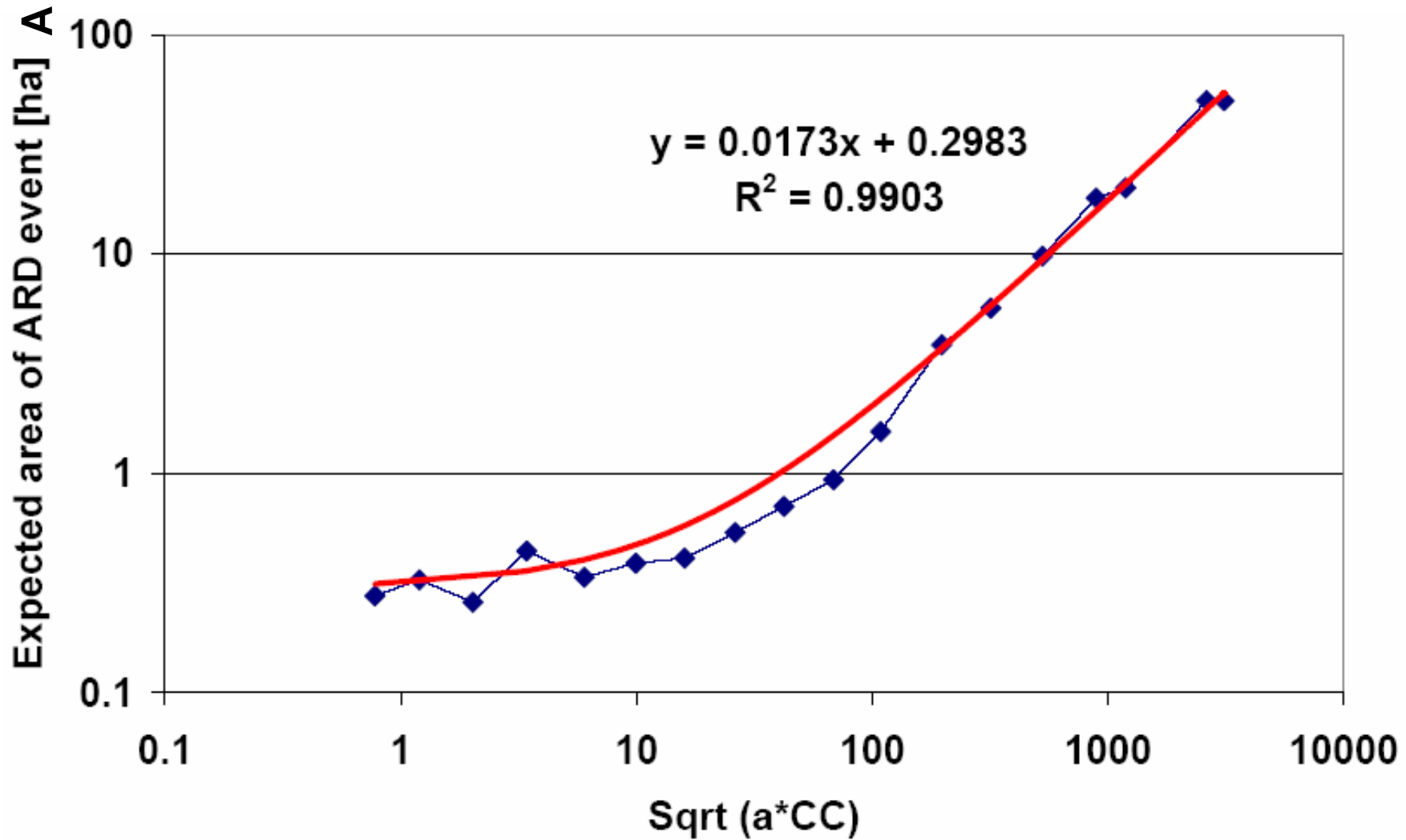
Approach:



Estimate of deforestation =

average area of D event * expected number of D events

Expected area of DE event



Expected number of D events



Conservative approach

Assumption: none of N DEs is observed on circular plots

Probability that the assumption holds:

$$\left(\int_0^U \frac{U-s}{U} * f(s) ds \right)^N = 1 - P$$

U – area of the NFI unit

s – area of D event

$f(s)$ – PDF of DE area

P - probability that DE is observed

Expected number of DE events



$$N = \frac{\ln(1 - P)}{\ln\left(1 - \frac{E(s)}{U}\right)}$$

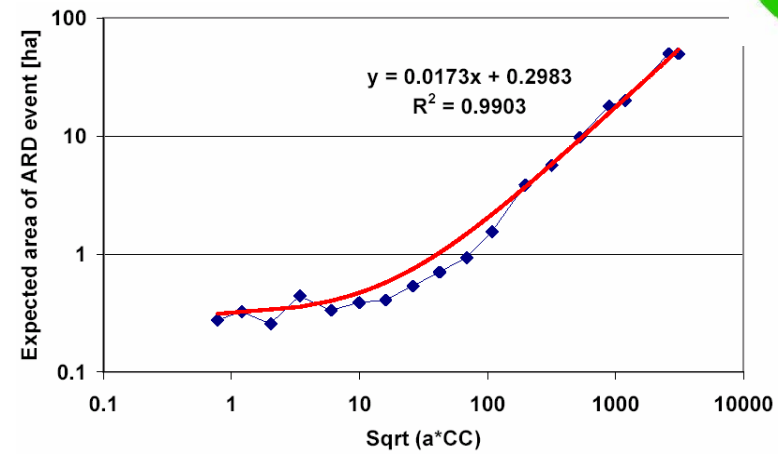
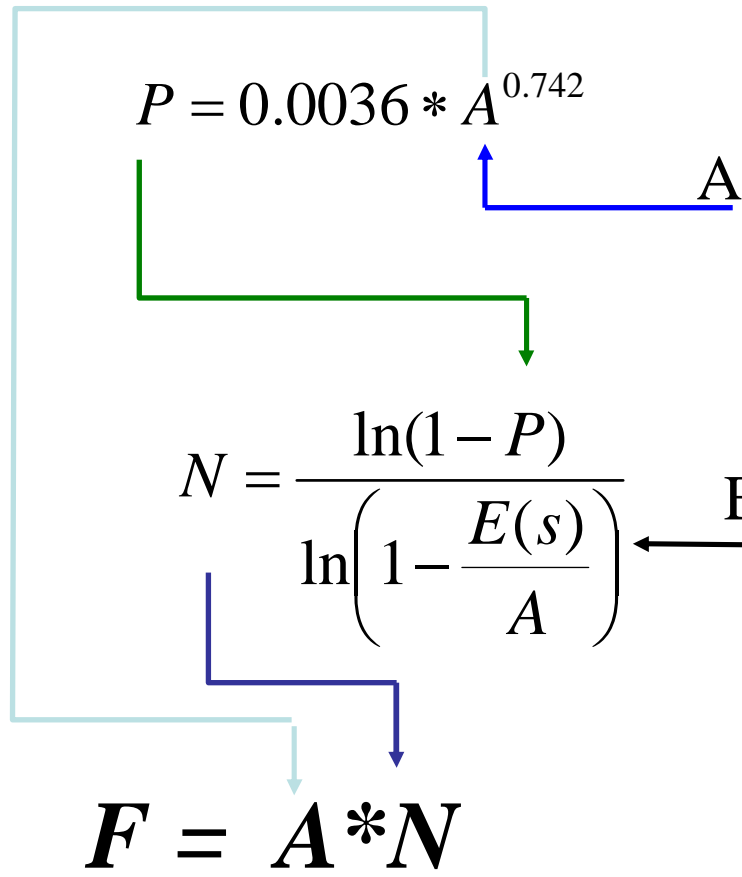
$$P = 0.0036 * A^{0.742}$$

$E(s)$ – Expected value of DE area (based on EO data)

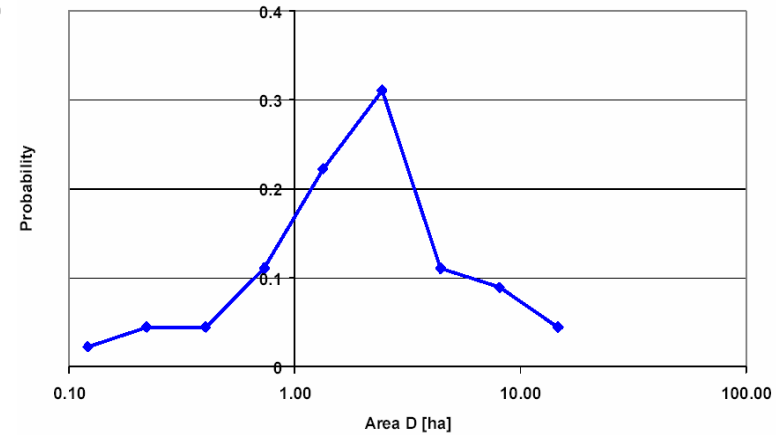
P - probability that DE is observed

U – area of the NFI unit

a – locally specific average area of DE based on the NFI data



based on data from the NFI



based on data from the EO

Estimation of D in Salzburg test area

Numerical results



D (estimated) = 193 ha

D (true) = 105 ha

True deforestation according to EO data based on Spot scenes

Conclusions



- **NFI is the most economic source of data applicable for conservative reporting under Kyoto Protocol**
- **Direct application of NFI to estimate D results in biased estimates if D is small compared to the size of the NFI unit**
- **Definition of forest is crucial for NFI role in reporting under Kyoto Protocol**



Thank you

