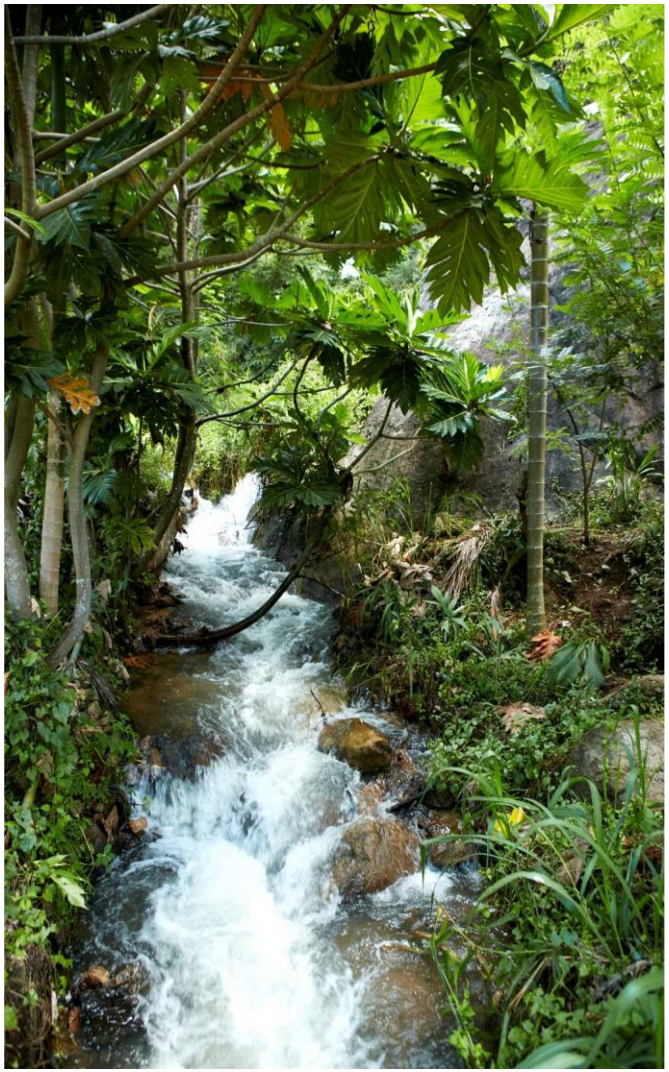

Spatial data: scales, limitations and validation

Barbara Pollini

23 April 2018 | Tubmanburg, Bomi county (Liberia)

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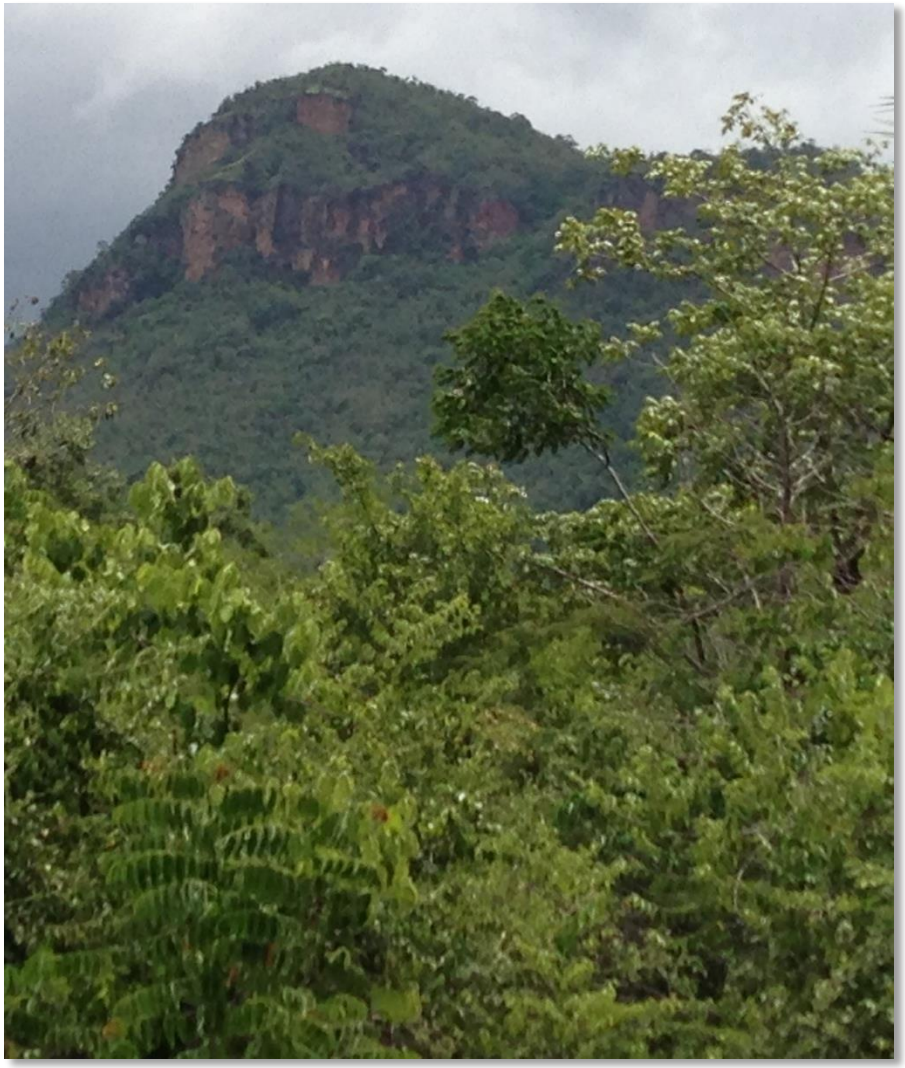
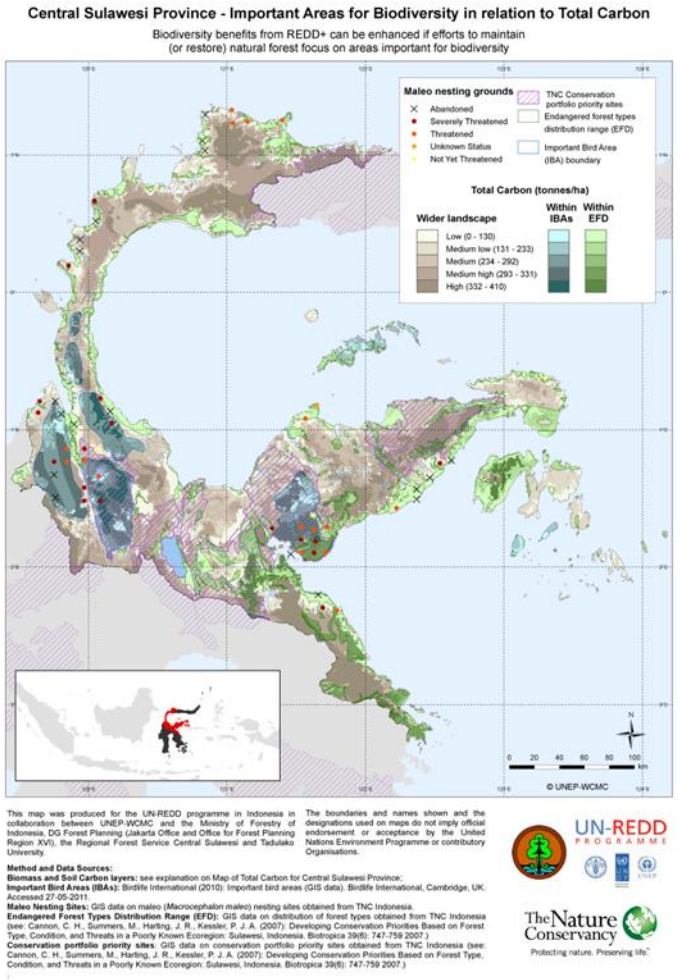
Outline

- Different types of spatial data
- Scale and resolution
- Use and limitations
- Field survey design
- Validation



Spatial data



- *"Any data that can be mapped"*
- *"Information about the locations and shapes of geographic features and the relationships between them, usually stored as coordinates and topology"*

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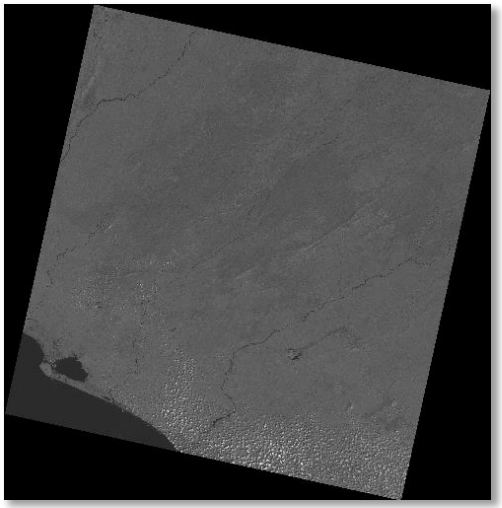
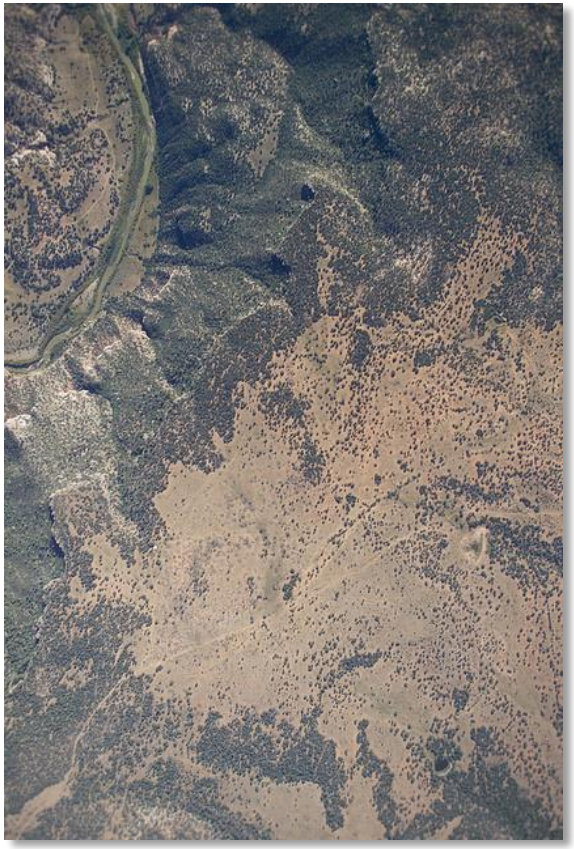
Types of spatial data: raw data





Liberia :: Features total: 13105, filtered: 13105, selected: 0

	CCNAME	DNAME	CLNAME	LNAME	LCODE2	TOTAL	MALE	FEMALE	HH	X	Y	Xc	Y
0	Bomi	Suehn Mecca	Gbor	Alasala	5	677	308	369	86	308784	728021	10743'46.14"W	673500.0
1	Bomi	Senjeh	Upper Togay	Albert	13	37	20	17	9	289836	762289	10754'7.22"W	675333.
2	Bomi	Senjeh	Upper Togay	Alex Holmes	1	21	14	7	7	287290	765956	10755'30.62"W	675532.
3	Bomi	Senjeh	Manoah	Alfred	11	28	20	8	7	300135	756066	10748'31.03"W	675011.
4	Bomi	Dowein	Gbavon	Amadu	1	4	2	2	1	295802	721835	10750'47.96"W	673137.
5	Bomi	Klay	Kpo	Amadu	21	147	75	72	42	289452	740557	10754'16.94"W	674145.
6	Bomi	Klay	Tehr	Amos Quaye	8	9	5	4	4	302698	735471	10747'5.11"W	673918
7	Bomi	Senjeh	Manoah	Armah Konah	16	14	5	9	6	284999	754997	10756'43.79"W	674935.
8	Bomi	Klay	Tehr	Bai	3	36	17	19	13	298755	733667	10749'13.25"W	673826
9	Bomi	Dowein	Gbavon	Baimen	11	101	55	46	23	291586	724754	10753'5.52"W	673311.
10	Bomi	Klay	Manna	Bakana	2	11	9	2	5	304237	757058	10746'17.56"W	675044.
11	Bomi	Dowein	Lower Zor	Balala	12	6	2	4	2	307424	724396	10744'30.00"W	673319
12	Bomi	Suehn Mecca	Upper Mecca	Ballah	13	42	20	22	6	324907	750475	10735'3.66"W	674712.
13	Bomi	Senjeh	Manoah	Ballay	6	14	7	7	4	289941	757479	10754'3.18"W	675056.
14	Bomi	Senjeh	Upper Togay	Bamo	11	164	87	77	43	290162	764112	10753'56.84"W	675432.
15	Bomi	Klay	Manna	Banakor	8	75	37	38	25	304185	755188	10746'19.03"W	674943.
16	Bomi	Senjeh	LowerTogay	Banana	4	16	9	7	4	301228	761175	10747'56.06"W	675258.
17	Bomi	Dowein	Lower Zor	Banguay	18	55	21	34	11	304602	726120	10746'2.04"W	673357.
18	Bomi	Dowein	Gbavon	Bankor	14	65	33	32	29	297119	719452	10750'4.81"W	673019.
19	Bomi	Dowein	Lower Zor	Bapa	7	73	33	40	25	303218	722697	10746'46.70"W	673216.
20	Bomi	Senjeh	LowerTogay	Barclay	1	21	12	9	4	300810	761997	10748'9.77"W	675325.
21	Bomi	Klay	Manna	Barka	3	195	87	108	38	295765	746838	10750'52.19"W	674511.

Show All Features

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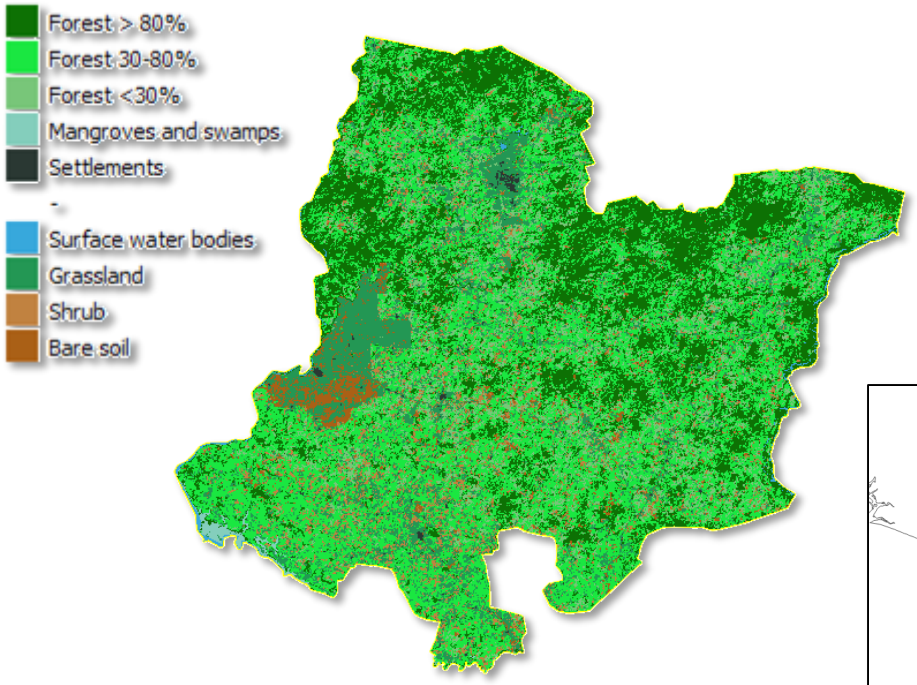
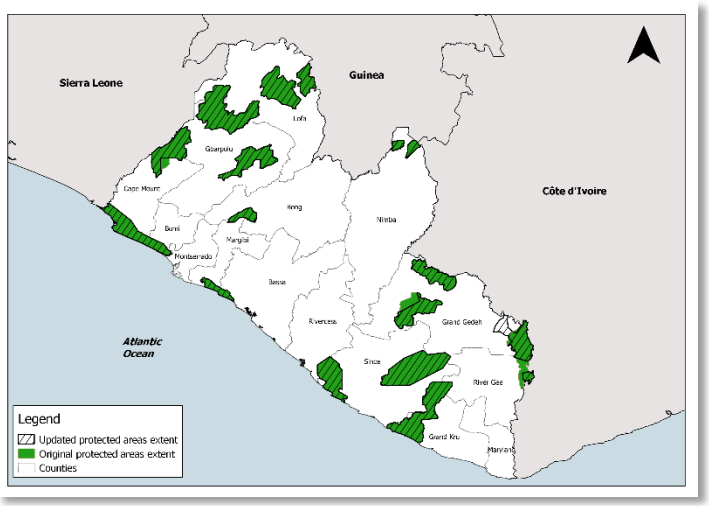
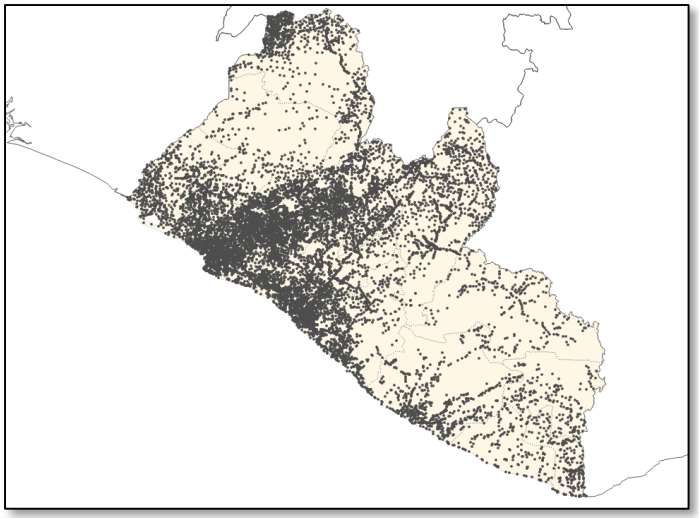
Types of spatial data: derived data







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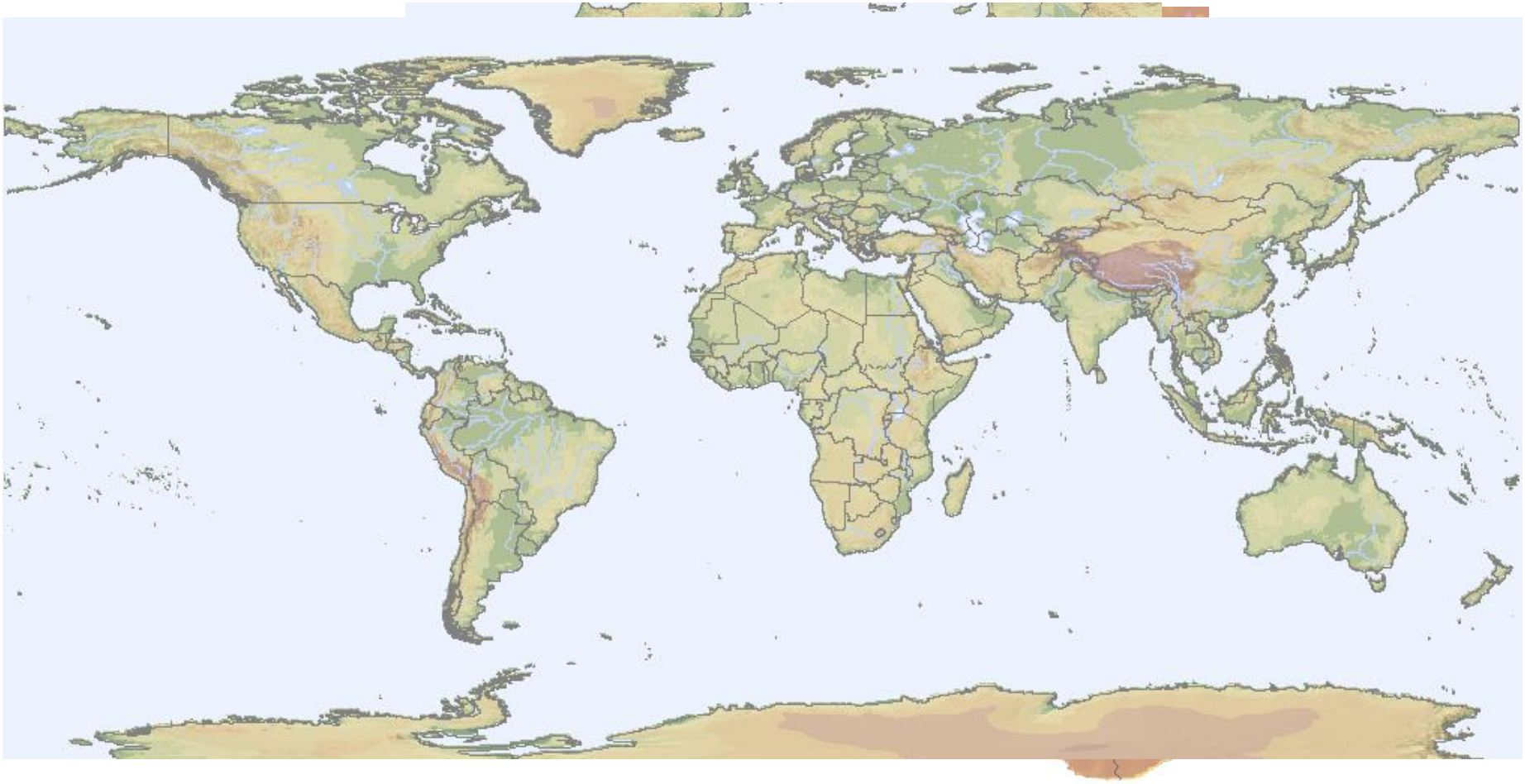
Scale and resolution



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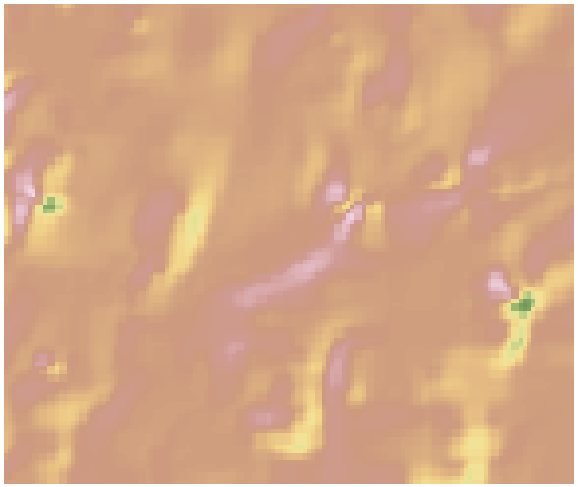
Scale and resolution

1 km resolution

Local

Landscape



National

Use and limitations

- Local
- Landscape
- National
- Regional
- Global

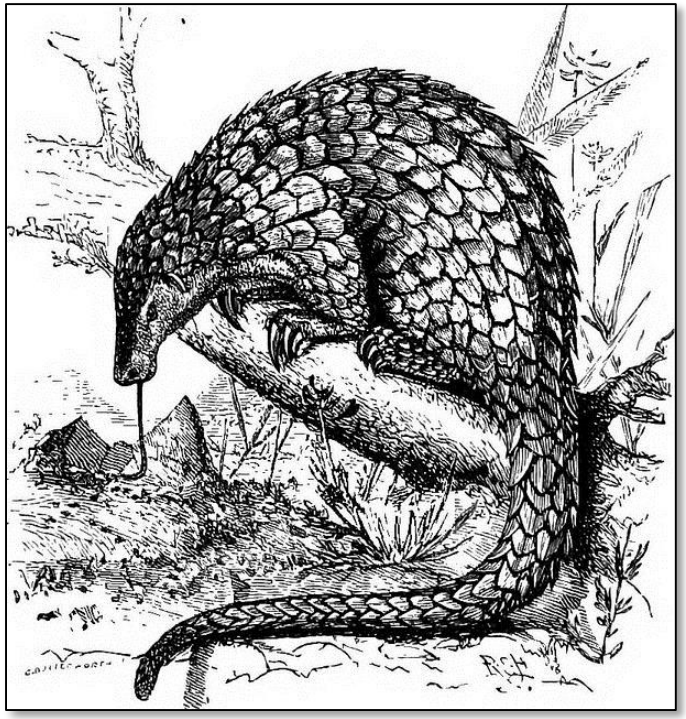
- Environmental impact assessment, wildlife studies
- Environmental impact assessment, wildlife studies
- Forest Inventory, Demographic
- Transboundary infrastructure development, protected areas
- Protected areas, Global natural forest assessment

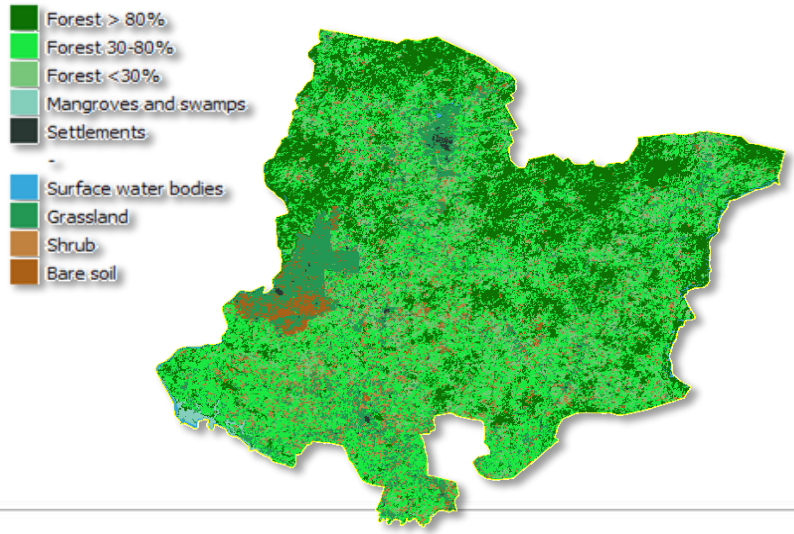
Use and limitations

- Coarse resolution data cannot be used to perform local analyses
- To collect higher resolution data = higher costs and effort
- Bias in inference from few points to national analyses

Field surveys

- To collect baseline data and get information on a population
- To monitor
- To validate





Survey design: steps

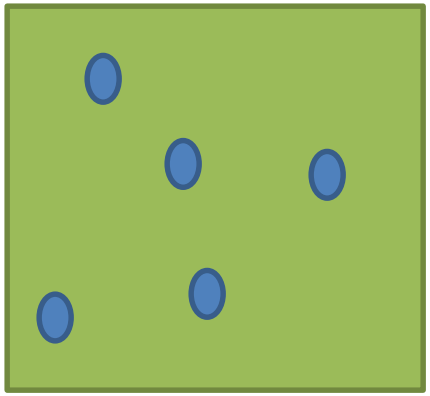
Step 1	• Define objectives – What is the question you want to answer?
Step 2	• Review other studies
Step 3	• Specify your assumptions and constraints (e.g. study area, scale of inference, etc.)
Step 4	• Specify parameters to be estimated and how will be analysed – What we want to measure and how will we analyse the data?
Step 5	• Identify potential bias (e.g. due to accessibility, observers experience, etc.)
Step 6	• Identify limits for statistical significance (e.g. confidence interval, number of sample units, etc.)
Step 7	• Data collection protocol (sampling design, number of samples, time of sampling, sampling methods, statistical analyses, etc.)
Step 8	• Evaluate ability to achieve the objectives (power analyses, pilot study)

Data collection protocol

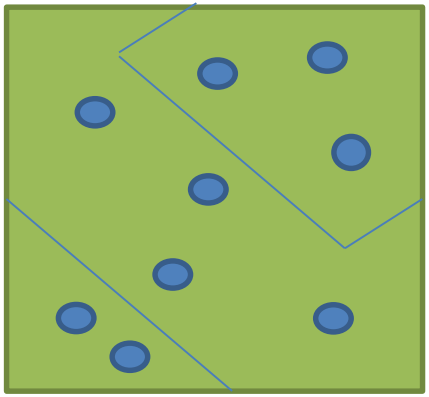
- Sampling design:
  a. Objectives of study
  b. Statistical analyses to analyse data
  c. Cost-effectiveness
  d. Patterns and variability of the variable you want to study
  e. Spatial and temporal consideration
  f. Practical consideration (resources, accessibility, safety, etc.)

Data collection protocol

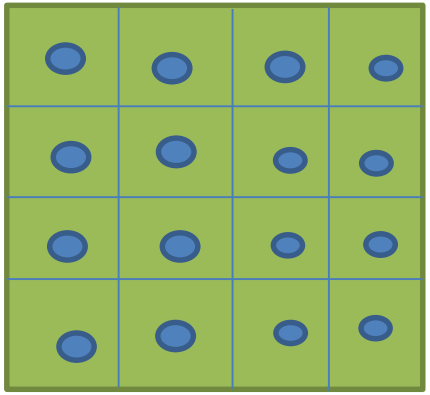
Probabilistic sampling



Simple random sampling



Stratified random sampling



Systematic sampling

Data collection protocol

- **How many samples to be statistically significant?**

More samples are collected the higher is the reliability of the results, **but** at a certain number of samples the level of reliability which is gained by additional samples is negligible.

Field survey is expensive therefore it is desired to find the optimal number of samples as a compromise between the required level of reliability and available resources!

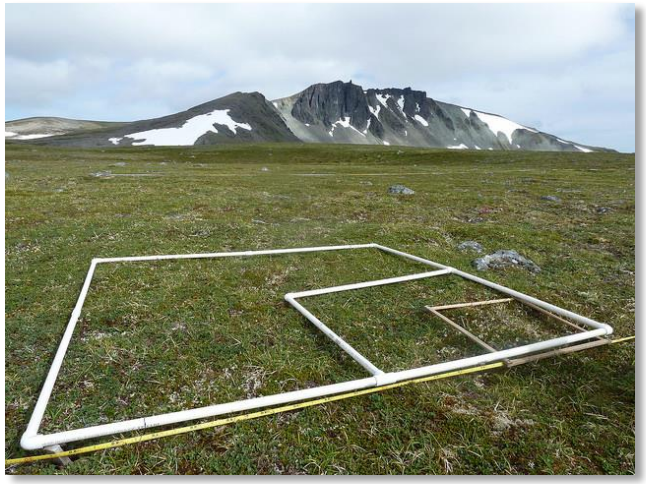
Power analyses: *to determine the sample sizes necessary to achieve acceptably high power, or to determine the probability that an effect size of interest will be detected with a certain sample size*

Several Softwares online

Data collection protocol

Which field methods?

- *Transects*
- *Camera trapping*
- *Quadrats/plots*



Survey design to validate land cover

- **Definition of the sampling unit:** the area unit which is observed in the field. It has to be comparable with the land cover map.
- **Sampling design**
- **Sample selection:** approach proposed by Congalton & Green (2009) who defines a number of samples per map class or strata according to the number of classes and the size of the test site.

Land cover map classes and area of test site	Samples per class
< 12 classes and < 1 million acres (≈ 4000 km²)	50
> 12 classes or > 1 million acres (≈ 4000 km²)	75-100

Source: EFTAS & FAO, 2015

Survey design to validate national land cover

- Predefined sample selection
- Probability sampling
- Good spatial distribution of samples
- Appropriate sample size
- Samples covering all land cover classes

Survey design to validate national land cover

- **Survey guidelines:** collect precise and complete field observations, transparently document the observation, consider logistical aspects
- **Data processing and documentation**

Thank you!

Barbara Pollini | *Barbara.Pollini@unep-wcmc.org*

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