Output 1: Lead contamination mechanisms and pathways from pollution source to soil surrounding the pollution source in Kabwe area

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Our final goals

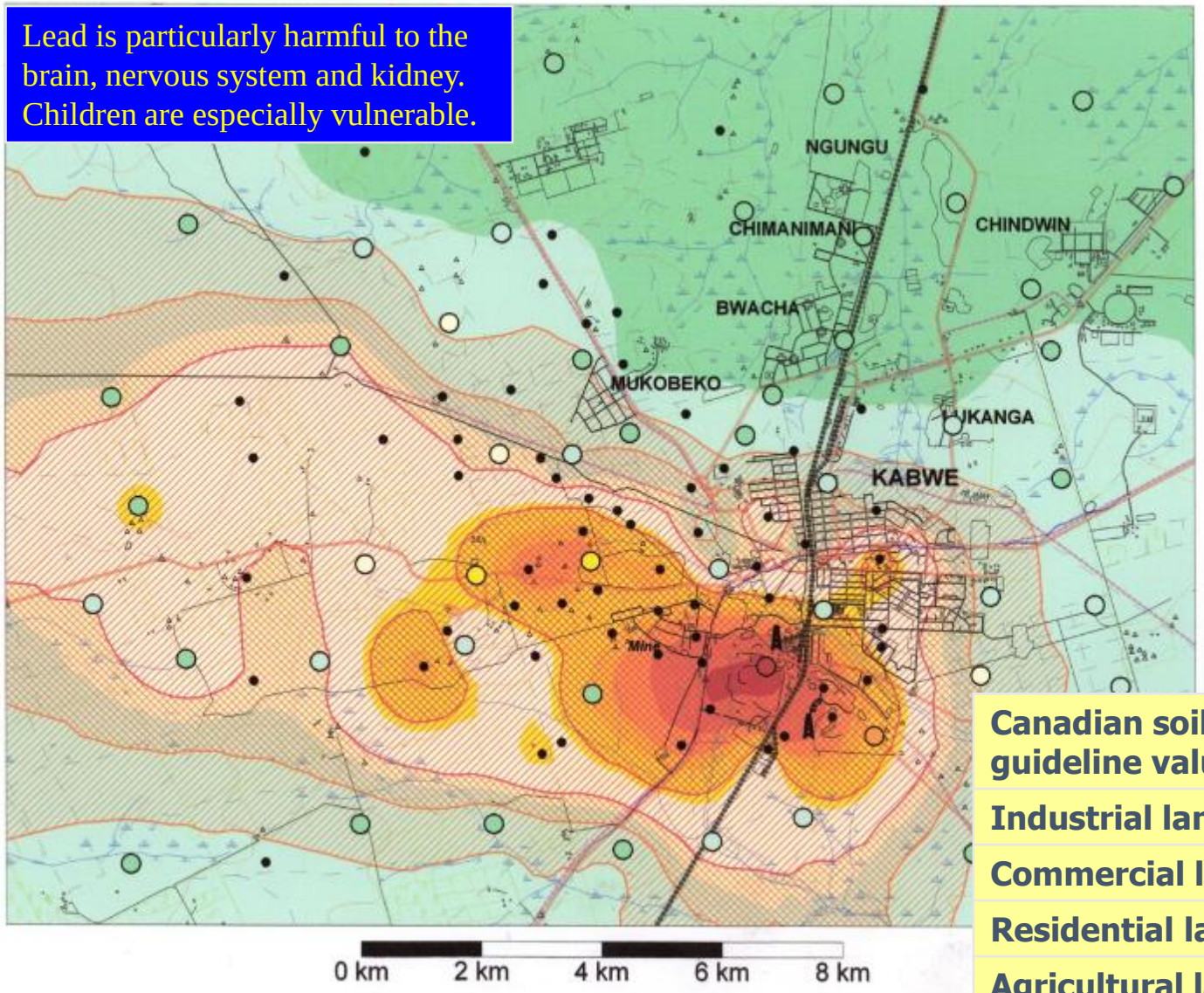
- To review currently available data and summarize them to find out what needs to be done.
- To provide critical information needed to achieve Output 2 & 3.

To achieve the final goals

- Create more detailed map of the site, using various approaches/techniques.
- Keywords: GIS / spectral data / land use / soil and plant types / dust / water etc...

Extent and magnitude of soil contamination in the Kabwe area

Lead is particularly harmful to the brain, nervous system and kidney. Children are especially vulnerable.



Soil contamination
Lead

Pb

ppm
20000
5000
2000
1200
500
200
35

Exceeded limit for:
Industrial areas
Commercial areas
Residental areas
Agricultural areas

Fe-Mn smelter (active)
Pb-Zn smelter (abandoned)

Canadian soil quality guideline value	Lead (mg/kg)
Industrial land use	600
Commercial land use	260
Residential land use	140
Agricultural land use	70

Heavy metal concentrations in soils
Changes from 2008 to 2013
(Personal Comm. With Prof. Nyambe)

- Pb – no big change.
- Cu – rise in some area.
- Fe – rise in some area.
- Mn – rise in some area.
- Zn – decreased in some area.

Iron-Mn Smelter in Kabwe (Photo given by Prof. Nyambe)


002-1


002-3


002-9


003-1


004-1


004-2


004-3


004-4


004-5


004-6

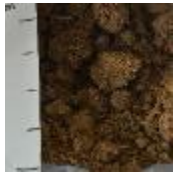

005-1


005-2


005-4


005-5


005-6


005-7


005-8


005-9


005-16


008-1


008-2


008-4


008-5


009-1


010-1


011-1


013-2


014-1

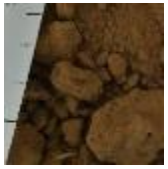

014-2


014-4


014-6


014-10-1


014-11


018-5


018-7

What is needed now?

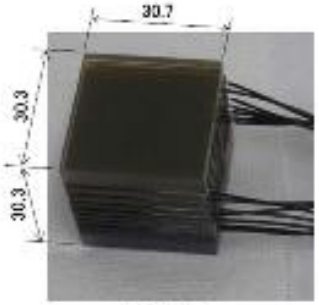
- Detailed land use -> Maps
  - Economical evaluation, application to another place.
- Prioritize on remediation, than data collection
- Soil conditioning – Effectiveness?
  - Liming
  - Hyper-accumulator
- Choosing the right crop – Education?
  - High risk = leafy crops, root crops
  - Lower risk = fruits

Liquid Crystal Tunable Filter camera

Airborne Multicolor Imager (AMI)

Multispectral Camera
- Wide FOV lens
- High-sensitive CCD
- Liquid Crystal Tunable Filter (LCTF) for Visible
- 190 x 100 x 100 mm
- 1.3 kg

Camera controller
- 100-240 V AC input
- USB 2.0 interface
- 300 x 200 x 60 mm
- 2.0 kg

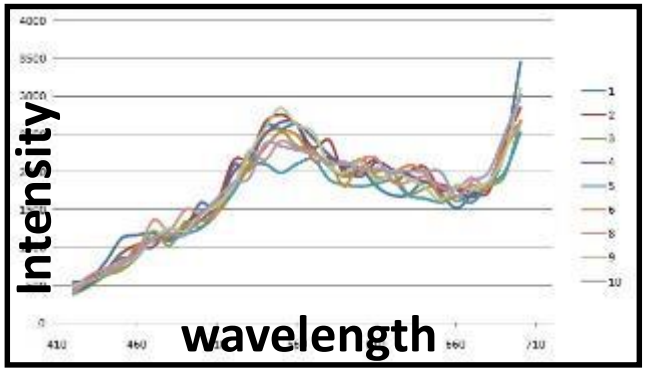


LCTF

Specifications	
Wavelength range	420 - 700 nm
Band width (FWHM)	8 - 25 nm
Response time	< 0.3 sec
Frame rate	> 1 frame /sec
Number of pixels	659 x 494
Field of view	92 degree

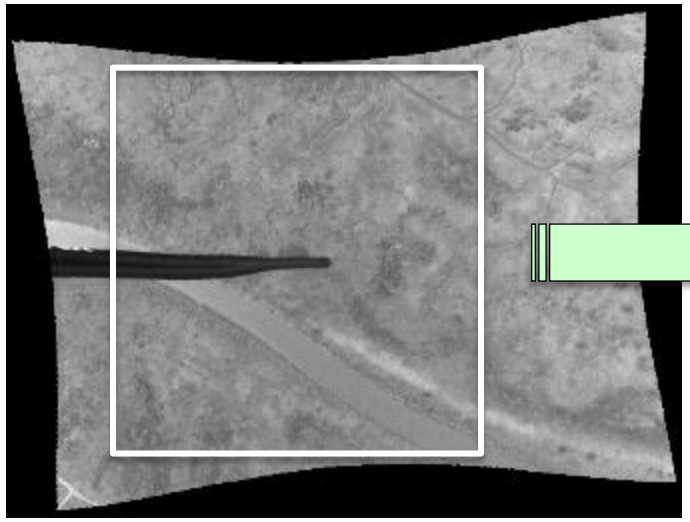
Aircraft (UAV) campaign with AMI in Java （2012/10/29-31）

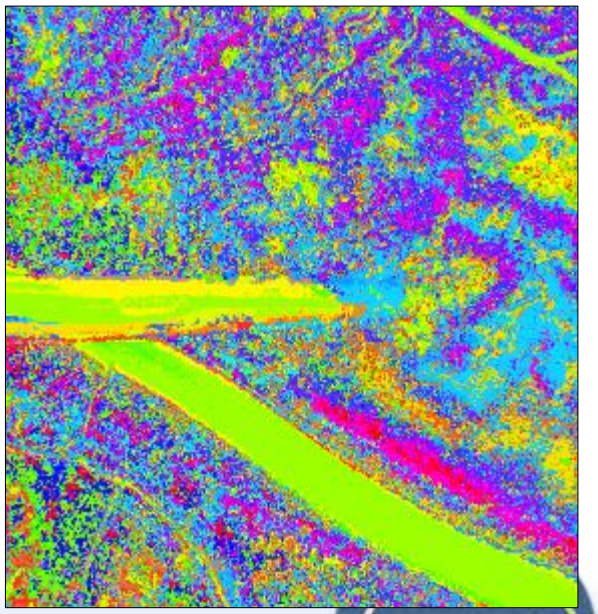
UAV developed and owned by **BPPT**



from 30 wavelengths

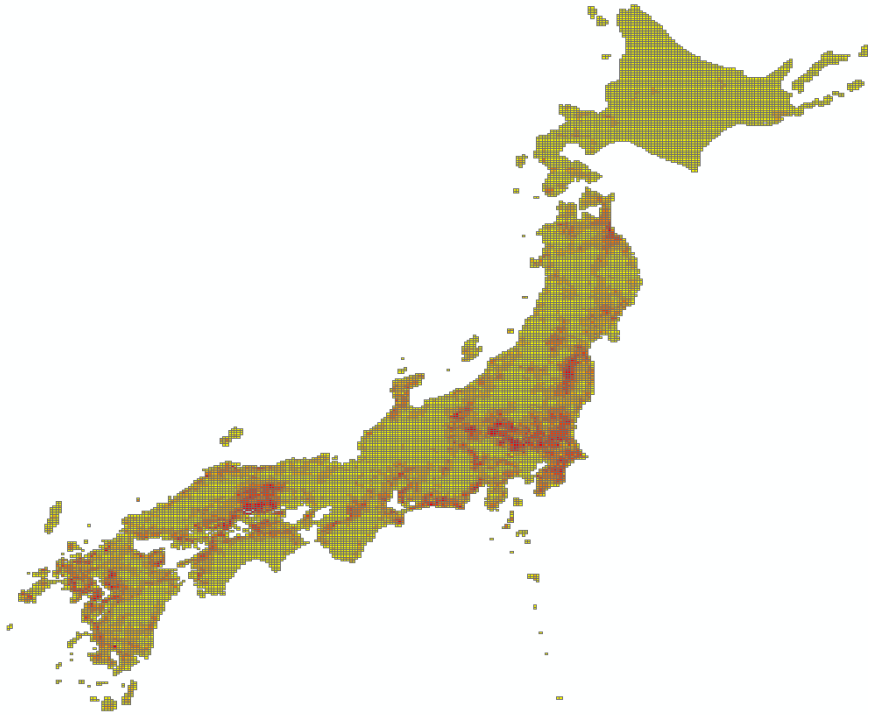
900 m





classification of species or monitoring condition for each tree...

Detailed “mesh-mapping” of the site

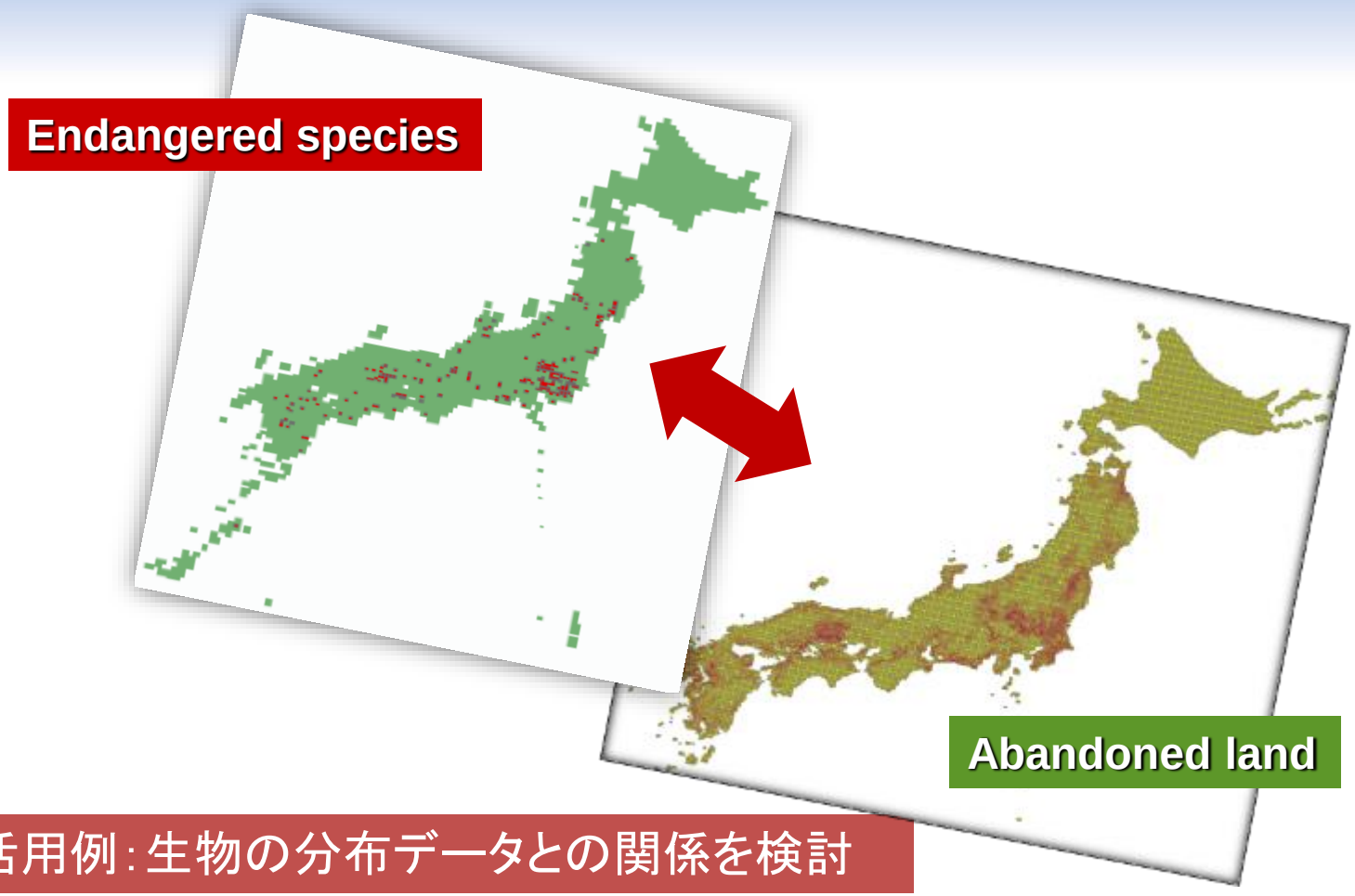


1970-2005
- Farmland area
- Maize area
- Abandoned site area

日本の農地利用に関するメッシュ（5km/10km）地図を論文（データペーパー）として公表

Osawa et al. (in press)
「Agricultural land use 5- and 10-km mesh datasets based on governmental statistics for 1970 - 2005」
Ecological Research

基盤地図整備と活用



活用例：生物の分布データとの関係を検討

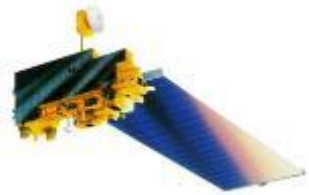
Osawa et al. (2013)
「Areas of increasing agricultural abandonment overlap the distribution of previously common, currently threatened plant species」
PLoS ONE 8(11): e79978

Data sharing / accessibility

1.光学

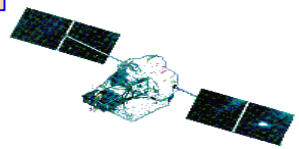
LANDSAT (USA)

IKONOS (USA)

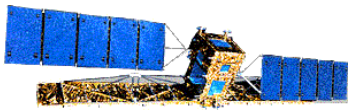


ASTER (Japan)

2.レーダー



ERS (Europe)

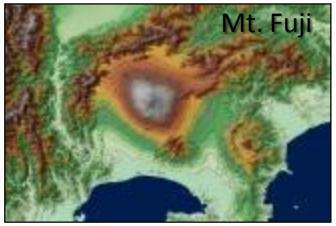


RADARSAT (Canada)

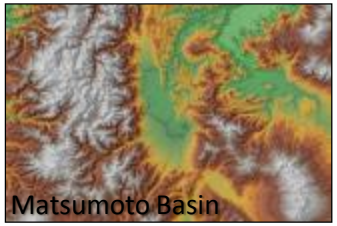
PALSAR, PALSR-2 (Japan)

SAR: Synthetic Aperture Radar

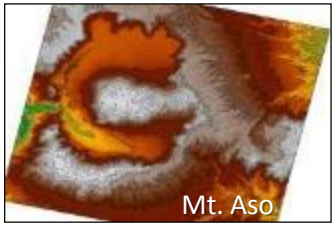
3.DEM



SRTM (USA)



ASTER (Japan)



PRISM (Japan)

DEM: Digital Elevation Model

*Geographical Information Systems

GIS

WebGIS

✓Web server
✓Database server

多様な情報
- **統合化**
- **共有化**

3. DEM（デジタル標高値）： 地形解析、水系抽出ができる

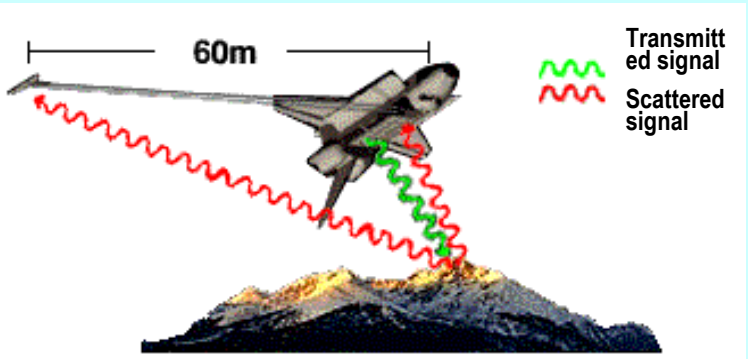
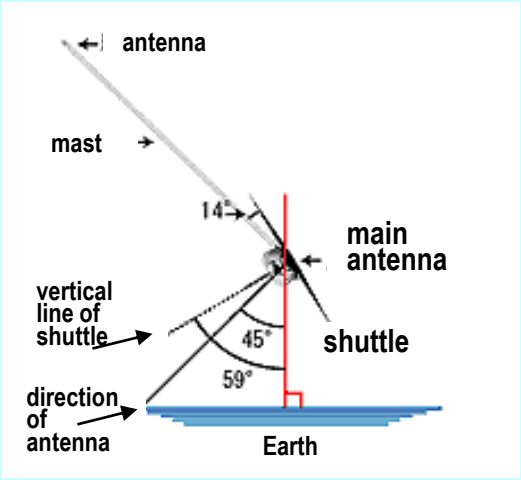
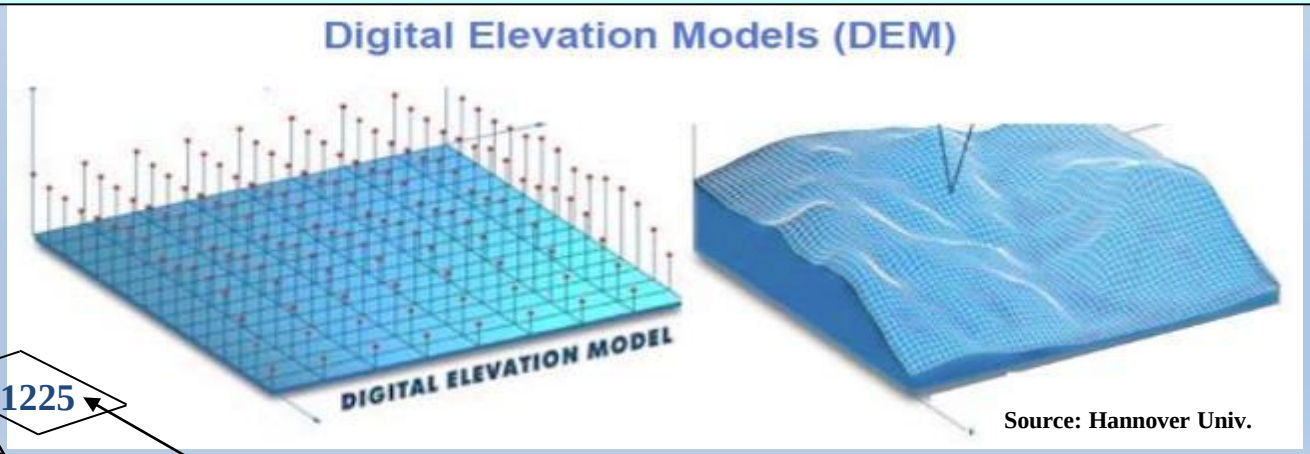


Image of Shuttle Data Acquisition
(Interferometry Technique)

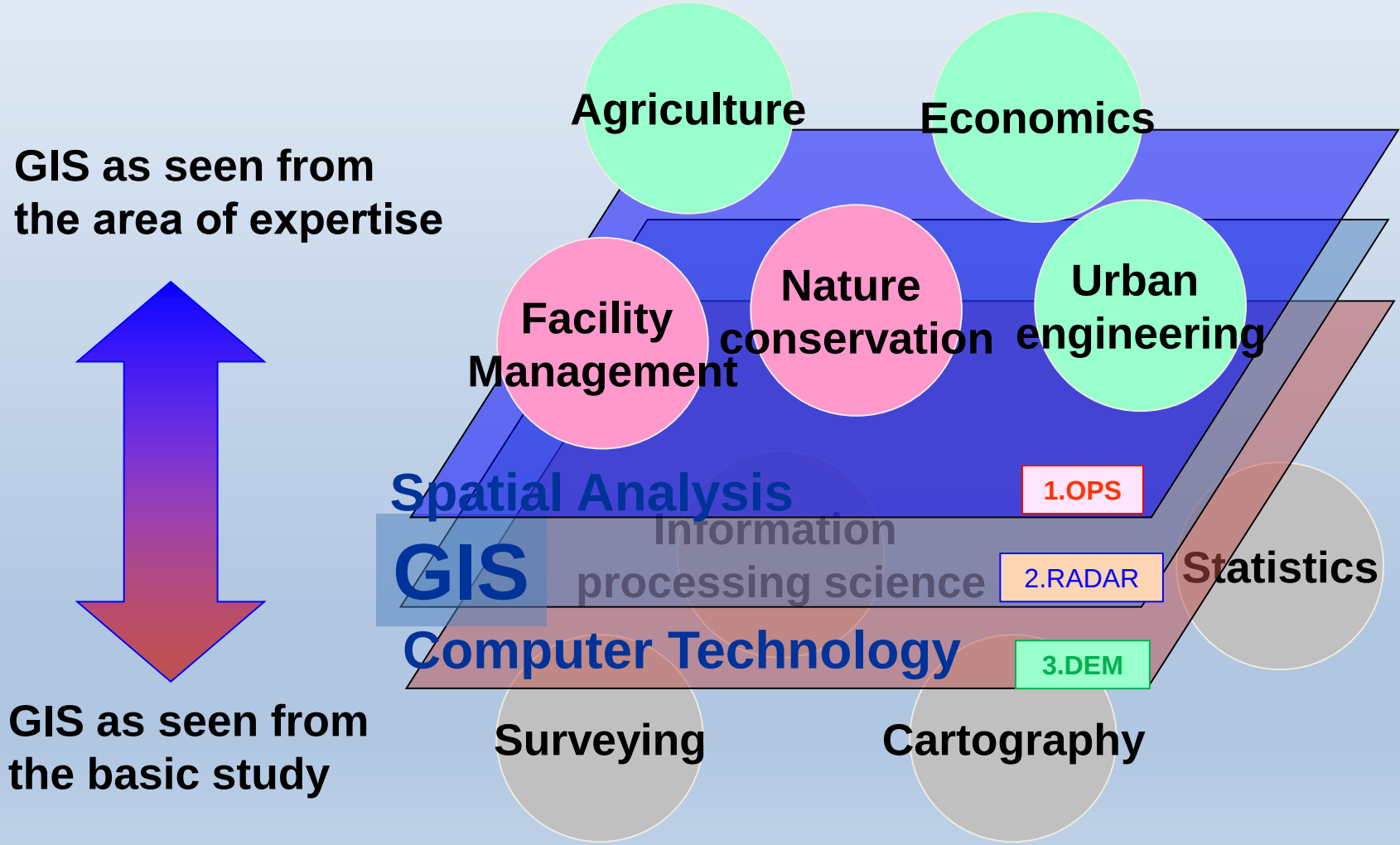




90m
1225
90m

Elevation (m) by 16-bit numbers

GISを用いた情報統合化



Our team (Output 1: Key people)

Zambian side

- Schools of Mines, Agriculture (UNZA)
- GSD
- ZEMA

Japanese side

- Faculty of Agr, Sci, Eng, Informatics
- Japan Space Systems
- Nat. Inst. for Agro-Env. Sci.
- Tottori Uni
- Free State Uni