Zambia SATREPS

6th Aug 2015 Meeting

- Soil, Water, Environment Team -


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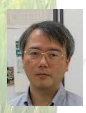
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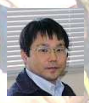
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Outline

- Currently available data/resource
- Current situation in Kabwe (Prof. Nyambe, UNZA)
- Future studies
  - Detailed map (land use, plant community, soil environment)
  - Sensing technologies
  - Field-level studies (remediation) and microbes

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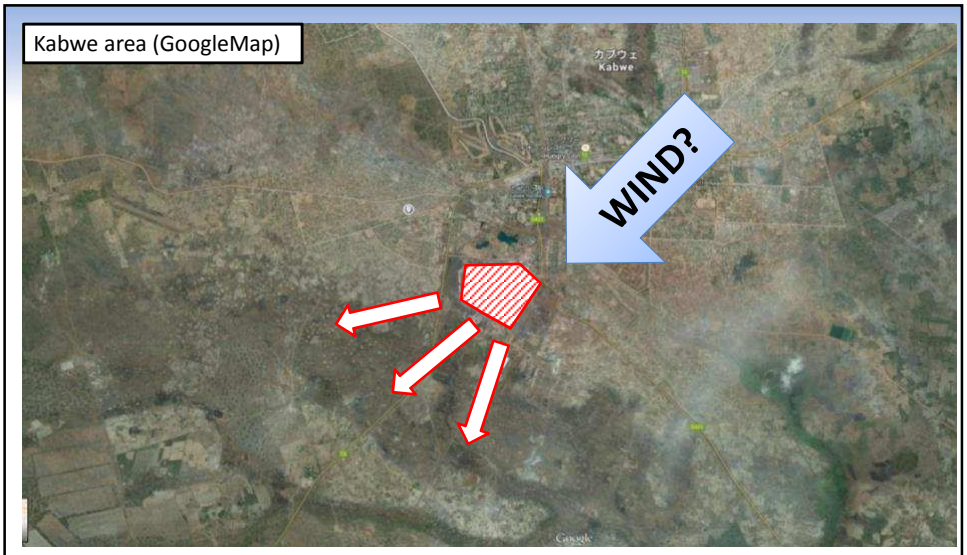

- Mixture of urban, agricultural and industrial area.
- Severe effects on plant communities?

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Available resources

- ZCCM-IH (Zambia Consolidated Copper Mines Investments Holdings) Kabwe Scoping and Design Study (2006-2009).
- Yoshinori Ikenaka (2009).
- Development Cooperation Programme of the Czech Republic (2008-2010).
- Follow up soil survey by Prof. Imasiku Nyambe's group (2013).

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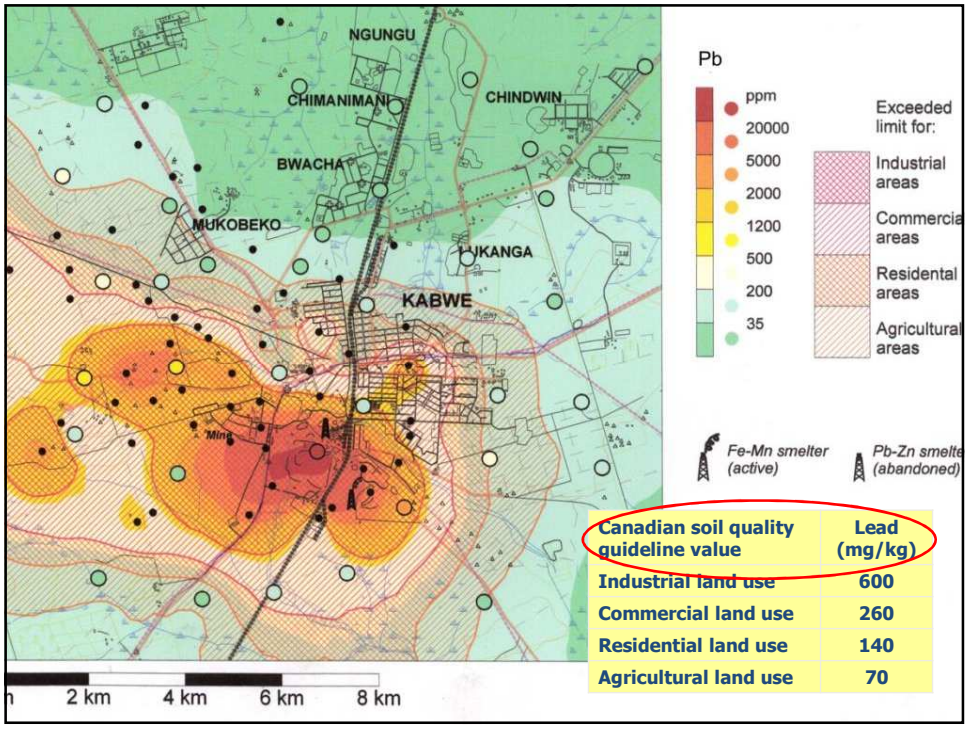

Canadian soil quality guideline value	Lead (mg/kg)
Industrial land use	600
Commercial land use	260
Residential land use	140
Agricultural land use	70

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)

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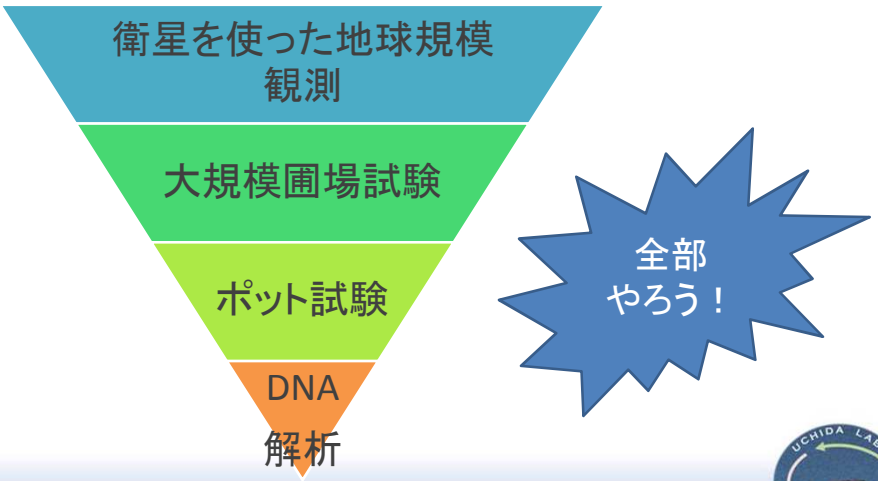
What is needed now?

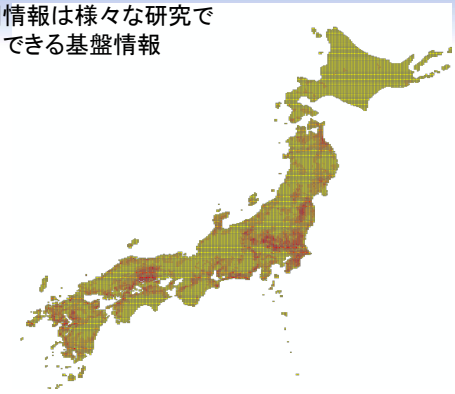
- Detailed land use -> Maps
  - Economical evaluation, application to another place.
- Prioritize on remediation, than data collection
- Soil conditioning – Effectiveness?
  - Liming
  - Hyper-accumulator
- Choosing the right crop – Education?
  - High risk = leafy crops, root crops
  - Lower risk =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

自然界における物質循環の謎を解く



技術紹介②：基盤地図整備と活用

地図情報は様々な研究で
利用できる基盤情報



1970-2005年までの
・総農地面積
・水田面積
・畑地面積
・樹園地面積
・放棄地面積

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

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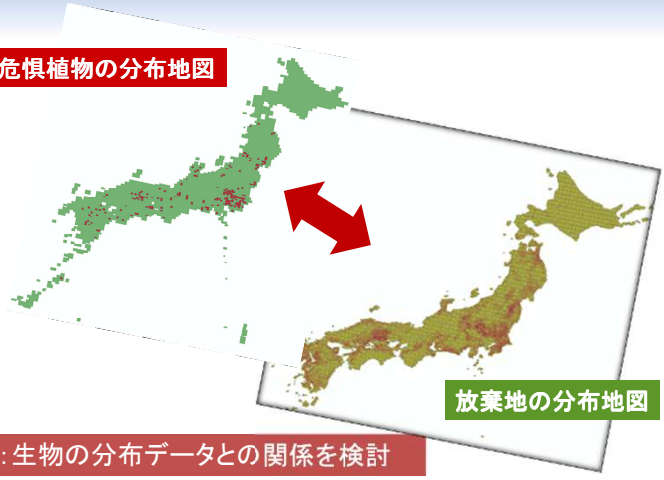
基盤地図整備と活用

絶滅危惧植物の分布地図



放棄地の分布地図

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

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基盤地図整備と活用

・基盤地図の整備は時間も手間がかかるので、
優先度は高く設定し、ある程度はエフォートを割きたい

・利用幅が広い基盤地図を整備しておくことで、後ほど新しい
アイディアが出た場合にも活用できる

・PJ終了後には基盤地図を公開することで、業績にもなるし、
後の研究で同じことをする手間が省ける

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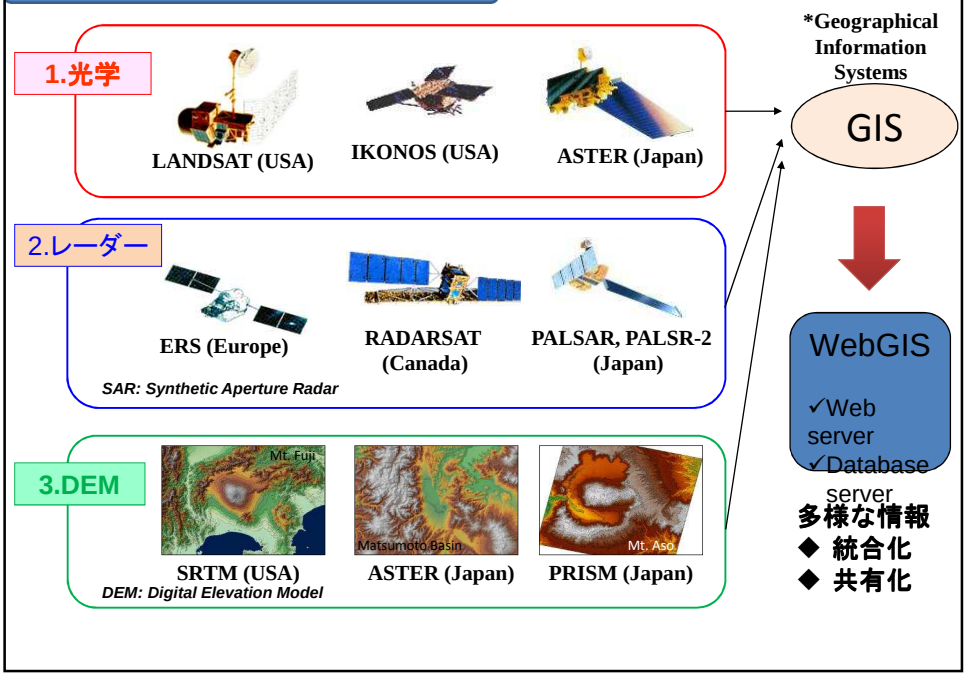
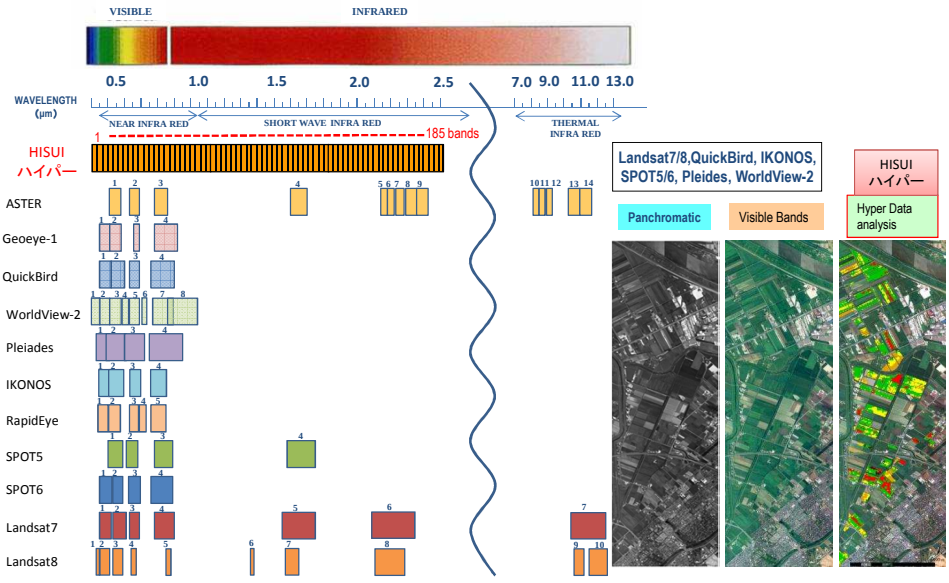
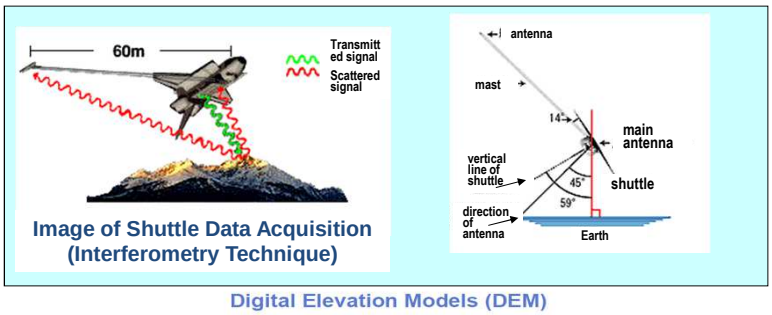
技術紹介③：情報の公開と共有



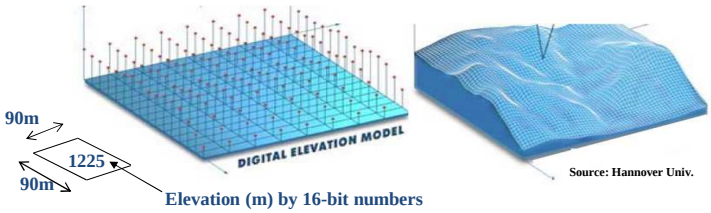
1. 光学： 多様なスペクトル情報を取得できる



3. DEM（デジタル標高値）： 地形解析、水系抽出ができる

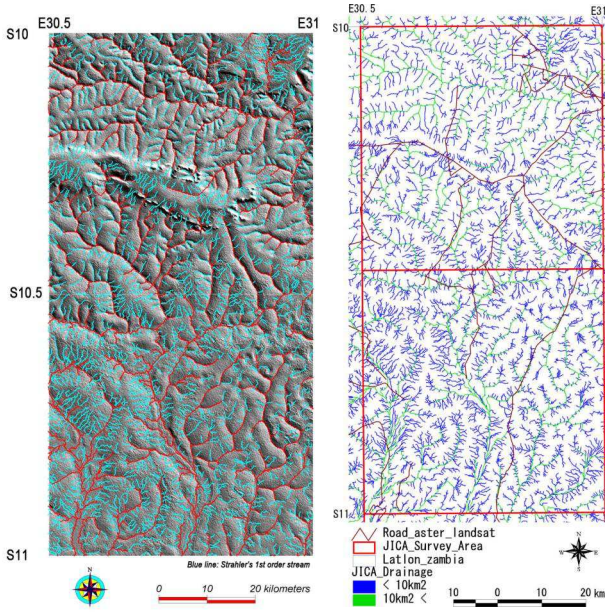


Digital Elevation Models (DEM)

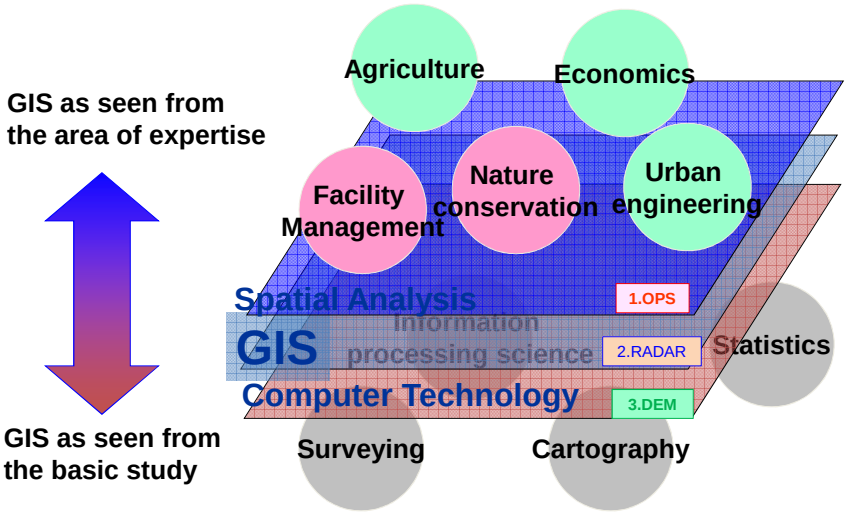


Elevation (m) by 16-bit numbers

- 標高値から水系網が抽出でき、汚染物質の経路を検討できる。
- 右の2つの図は、ザンビア北部Kasama西方の事例（2007年JICA案件）
  - 右側の図は、集水面積が10km2で色分け
  - 左側の図は、水系網とSRTM/DEM（背景）
- ただし、起伏が小さい平坦地での適用は難しい。

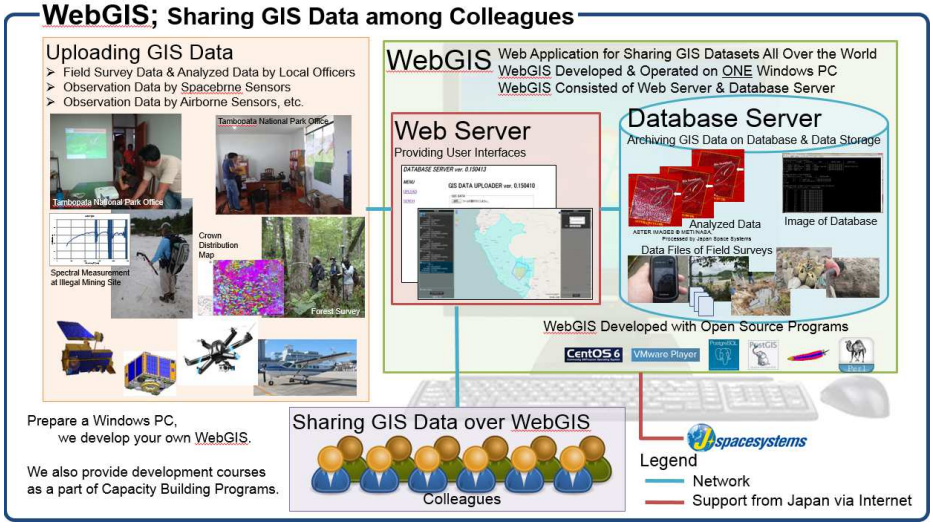


GISを用いた情報統合化



WebGISを活用した情報共有化

- Build a small web GIS application through at least 1-week training.
- Prepare a Windows PC, we do with open sources, which means free to Build!



技術紹介④：大規模フィールド試験

Large scale field trial

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Evaluation of:
- Different plants
- Different inoculants
- Fertilizers

At the field level.

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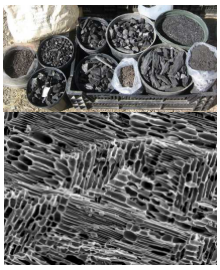
Vegetation Contamination

Data from Prof. Nyambe's project (UNZA)

	Zinc ppm	Lead ppm	Copper ppm	Local.
Blurush	5550.20	2771.85	2084.78	P4
Resp. Rhizosphere Soil	10,000	10,000	560.70	P4
Lemon Grass	>10,000	1075.68	176.07	P4
Resp. Rhizosphere Soil	1783.10	1596.20	46.11	P4

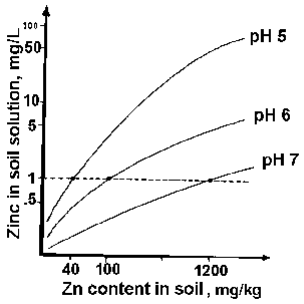
Lemon grass has a higher photo-remediation potential to clean Kabwe of heavy metals.

Soil conditioners and heavy metals



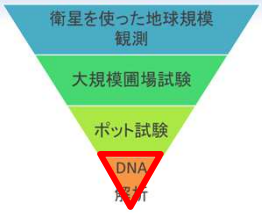
Charcoal

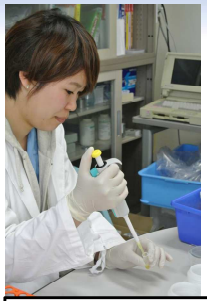
Manure to stabilize soils



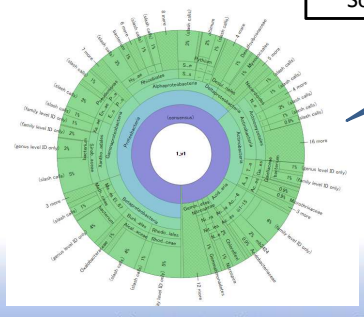
Soil pH and heavy metal availability
[Hue NV (University of Hawaii)]

技術紹介⑤:土壌微生物の調査





Soil DNA analyses using a next-generation sequencer



Bioinfomatics

Contents of proposed PDM (Summary)

1. Using the available satellite data, changes in land cover situation in Kabwe area can be grasped from 1980s to date.
2. Methods to evaluate soil characteristics and to survey vegetation, using techniques such as GIS and/or spectrometry, are established. The manuals for the methods are available and the capacity building for the methods has done.
3. Maps usable on-site are created, particularly focusing on agriculture, based on techniques such as field survey, digital elevation models (DEM), and aerial photo images.
4. For 1 and 3, the dataset is published and it can freely be accessed by anyone.
5. An information sharing system is constructed based on database made utilizing open source software.