



# **SATREPS Zambia Group 1 Activity Report & Future Plan**

**Kaampwe Muzandu, 16<sup>th</sup> Oct 2017**

# Group core member list...



Dr. Kaampwe Muzandu	Dr. Yoshitaka Uchida
Dr. Benson Chishala	Dr. Ikabongo Mukumbuta
Mr. Kabenuka Munthali	Dr. Kazuyo Hirose
Mr. Mukuka Mwansa	Dr. Eiji Nishihara
Prof. Imasiku A Nyambe	Dr. Tsubo Mitsuru
Dr. Kawawa Banda	Mr. Shinsaku Nakamura
Dr. Meki Chirwa	Mr. Toru Hamamoto
Ms. Charity Nalweya	Ms. Akane Chiba

# Outline

- Goals
  1. **Satellite image** systems – Kabwe area history should be analysed as well as near-real time monitoring will be achieved.
  2. **Weather stations** will be up and running.
  3. Some results for **plant** growth / **soil** microbes / soil animals within Kabwe or Pb contaminated soils will be published.
  4. We will launch '**Gairoju (街路樹)**' project. We target a small area within Kabwe city and will perform some re-vegetation trials.

## Overall goals towards future (above the current project, final goals)

- **To minimize “future” Pb related risks.**
  - Better understanding of;
    - Climate
    - Water movement
    - Soil/plant types -> Land use types
- **To mitigate “already contaminated” area.**
  - Individual ~ community scale measures
  - Practical advices for the government

# 1. Satellite image systems



1973 Landsat

1980 Landsat

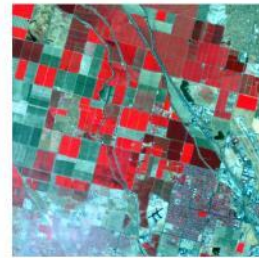
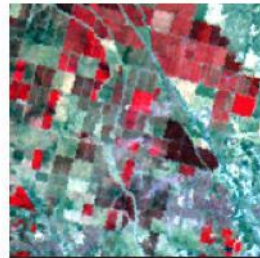
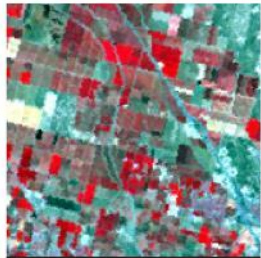
1986 Landsat

1992 Landsat

2000 Landsat

2005 Landsat

2010 Landsat



1973 LULC

1980 LULC

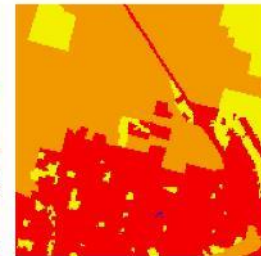
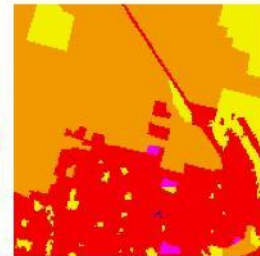
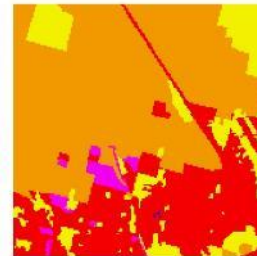
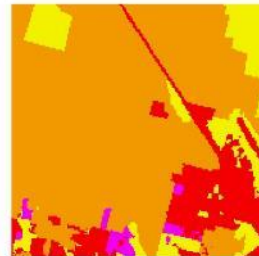
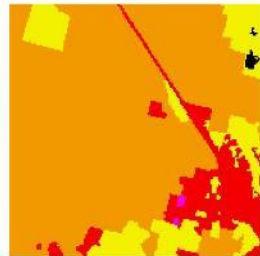
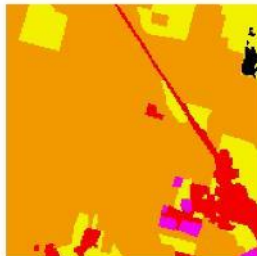
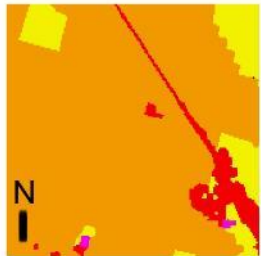
1986 LULC

1992 LULC

2000 LULC

2005 LULC

2010 LULC



Water  
Developed

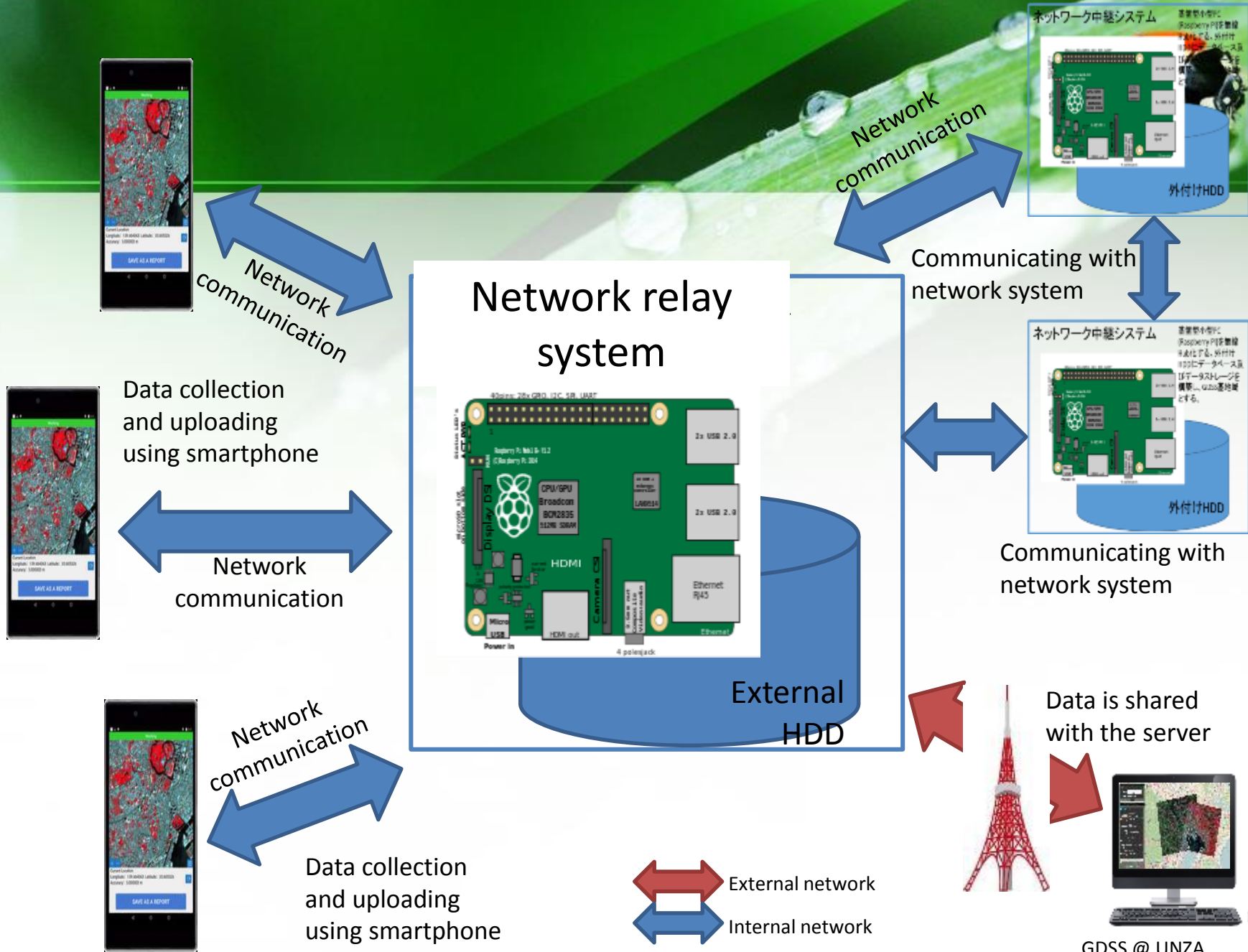
Wetlands  
Mining

Barren  
Forest

Grass/shrub  
Agriculture

Mech. Dist.  
Nonmech. Dist.

- Basic online analyses can be done here in Japan (1 student).
- After the analyses, the student can visit the site to confirm some of the highlighted (important) area.
- Is Pb contamination related to the recent (the last 20 years) development of the city?
  - May link to economists' survey??



Network communication

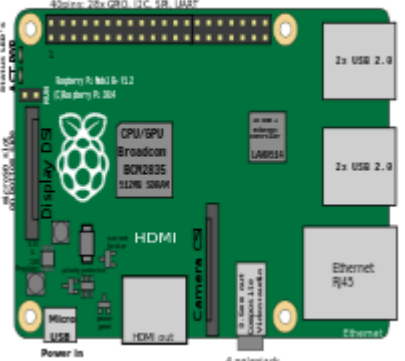
Data collection and uploading using smartphone

Network communication

Network communication

Data collection and uploading using smartphone

### Network relay system



External HDD

Network communication

Communicating with network system

Communicating with network system

Data is shared with the server

External network  
Internal network

GDSS @ UNZA  
Data is shared with Japanese side

# Kabwe Data Sharing Map

表示回数 110 回

すべての変更が Google ドライブに保存されました

レイヤを追加 共有 プレビュー

Geological Data Sharing\_AnimalH...

Geological Data Sharing\_SoilPlant

Geological Data Sharing\_AnimalH... ⋮

▼ スタイル: Sample\_type

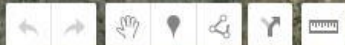
 Blood (12)

Geological Data Sharing\_SoilPlant ⋮

▼ 均一スタイル

 すべてのアイテム (78)

基本地図



## Haruya\_Kasanda\_Dog

Number	1
Team	2
Name	Haruya
sample number	27
Sampling_date	2016/6/30
Sample_type	Blood
Area	Kasanda
Coordinates_Lat	-14.45523
Coordinates_Lon	28.42626
Pb_conc	52.49
Units	ug/dL
Measurement_method	ICP-MS
Other_measurements_t...	NEPTUNE
Note	値なし
Status	Analyzed

 -14.45523, 28.42625



Haruya\_Kasanda\_Chicken  
Haruya\_Kasanda\_Dog

Haruya Mutue Wansofu D...

カブウェ  
Kabwe

ガーナ・アベニュー  
ハングリリー  
レストラン  
Hungry Lion

Shoprite Kabwe  
Munkoyo St

レイルウェイ  
RAILWAY

## 2 Weather station

# POTEKA – Weather Station Service

NETIS registration number:KT-160077-A(Registered in October 2016)

**Meisei Denki Ltd.**

Weather information contributes Safety &  
Security of the community

# POTEKA



Meisei Denki Ltd. Is authorized by Japanese Meteorological Department



## Real-time monitoring of weather data

### Real-time weather

- Data is uploaded every minute
- Can be connected to email alert system
- SIM card is inserted to weather station
- Smart-phone application is available

### Weather forecast

- Accurate weather forecast maybe possible
- Data available for anyone

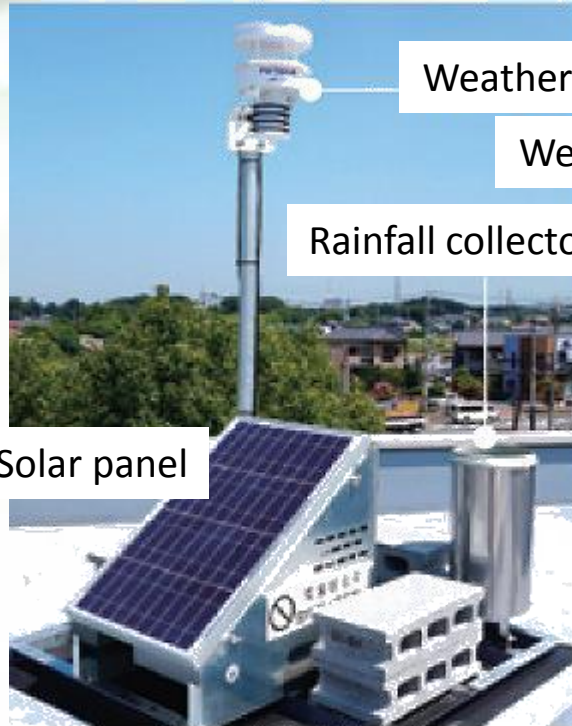
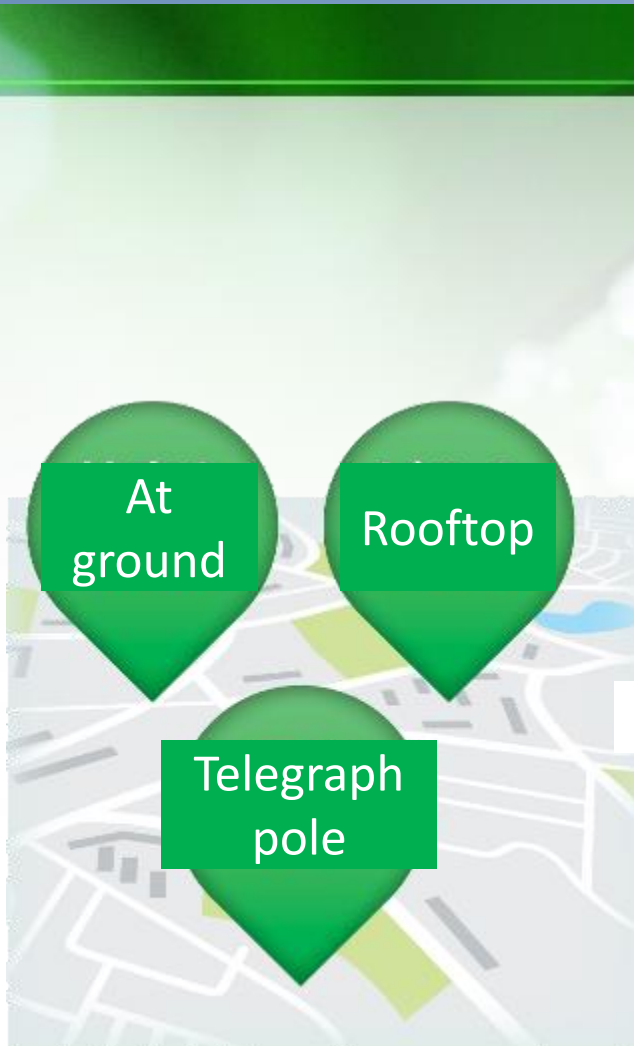


Easy to be placed.

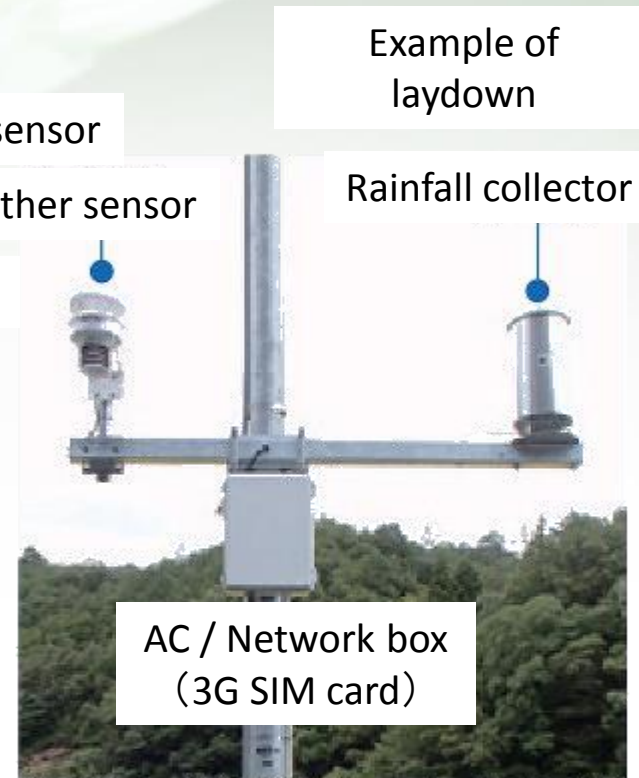


PC, smart-phone, e-mail can be used to see the data

# Low energy cost, save space



Size: W 1m D 1m H 1.5m  
Weight: 130 kg

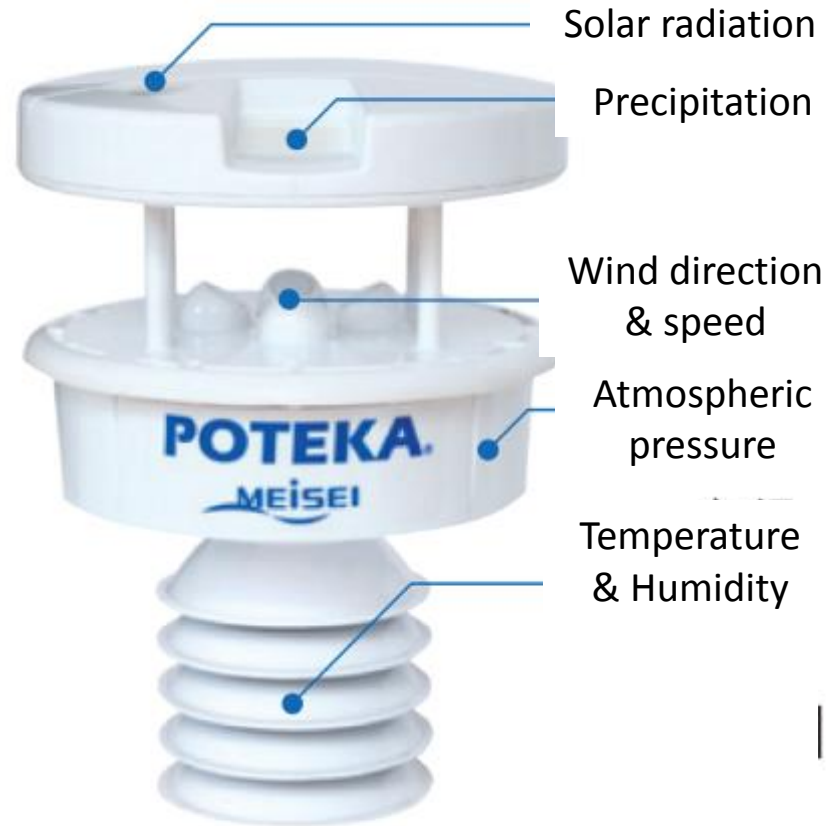


Telegraph pole type  
Weight: 20 kg

# Compact weather monitor

- Seven types of sensors  
(Temperature, Atmospheric pressure, Humidity, Solar radiation, Wind, Precipitation, Rainfall)
- Compact, Light, Power saving  
Easy to install
- Network system
- Authorized by Japanese  
Meteorological Department

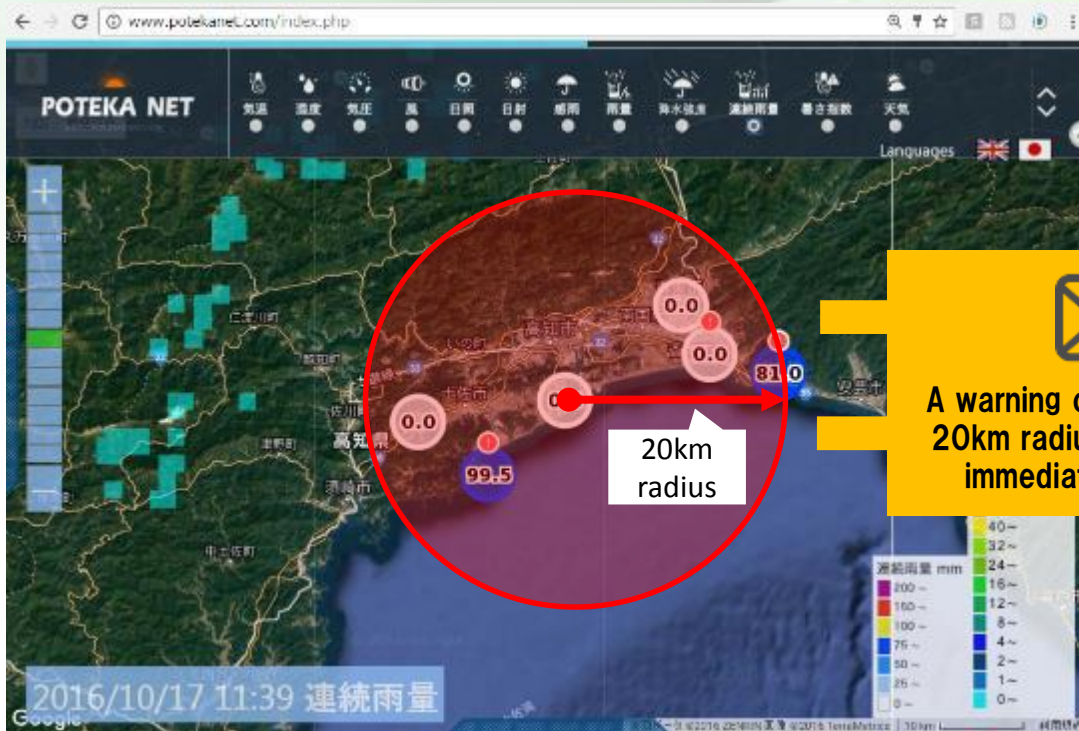
⇒ **Best and compact weather monitor**



Size: Diameter 20 cm, Height 27.1 cm  
Weight: 1.35 kg

# Application of weather station in Kabwe

## Aiming for Alert system



A warning occurred at around 20km radius will be reported immediately to members

Field



Office



Example

Strong wind : > 15m/s

Heavy rain : > 20mm/h

Dramatic change of weather

Weather warnings around 20km radius are detected and reported immediately!

# 3 Plants and soil microbes

- Some 'soil conditioning' and re-vegetation experiments have started at UNZA (School of Ag).
- Soil respiration / decomposition / microbial community data are obtained here in Hokkaido.
- Also Pb concentration and vegetable experiments are being performed at Tottori University.



# Potential plants can be used on site



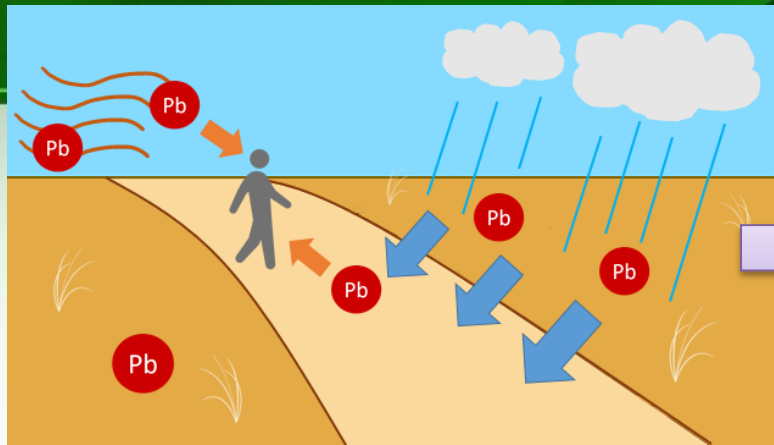
- Vetivar
- Lemongrass
- Tithonia
- Moringa



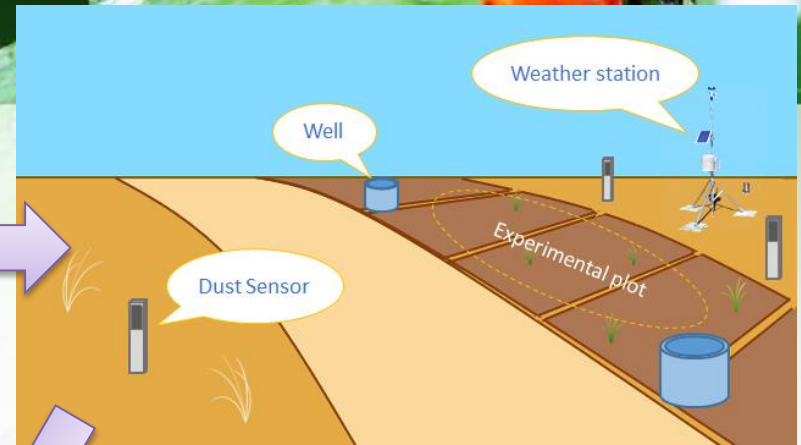
# 4 Re-vegetation plans



# Our work plan



① Select a site with severe contamination with little vegetation.



② Set up a trial to test different plants/fertilizers/mulch treatments.



③ We monitor changes in dust as plants grow.



④ After the trial, this area can be a natural reserve for local plants.



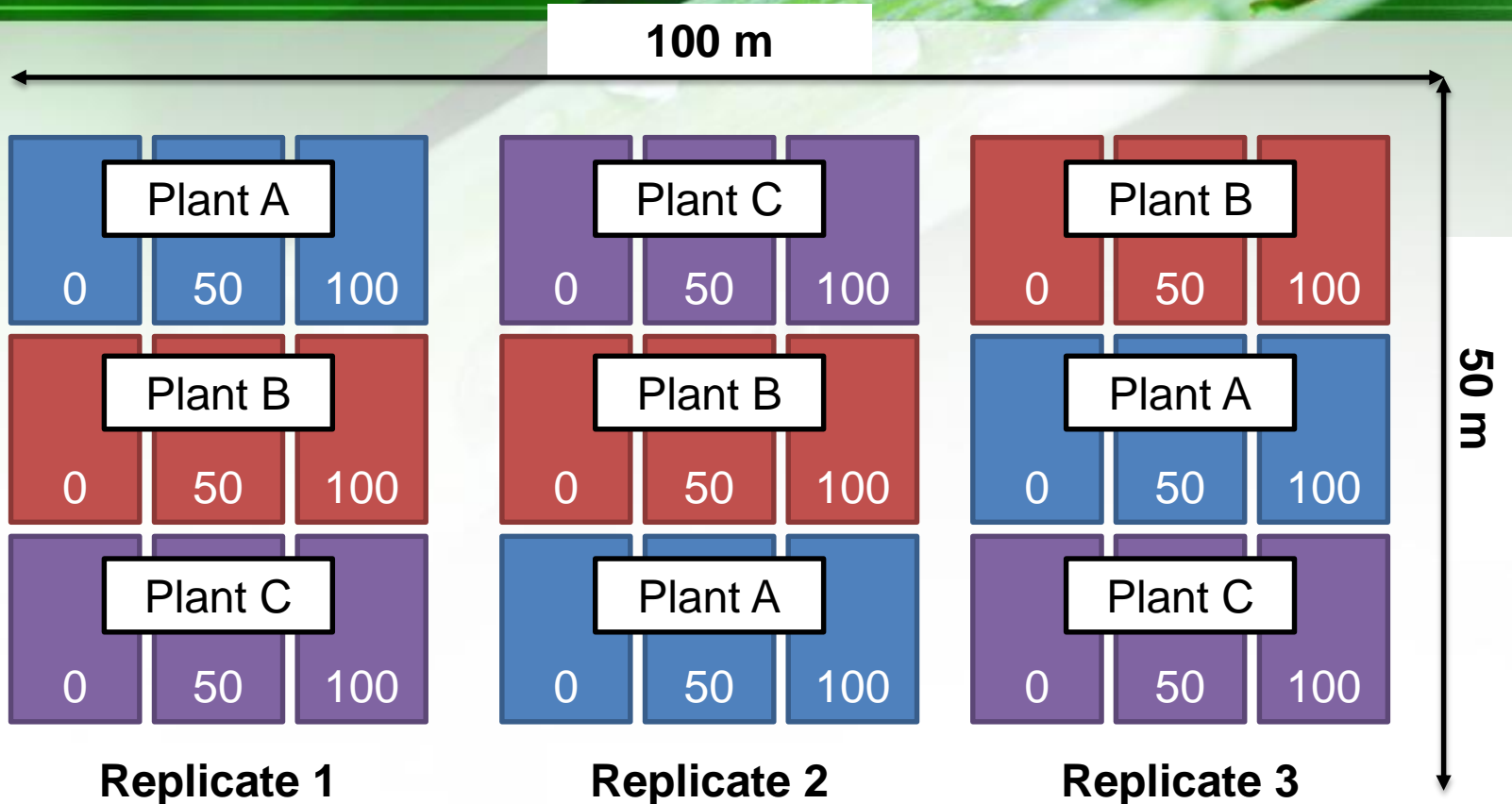
# Some examples in Japan

- In our city (Sapporo), roadside trees or ‘Gairoju’ are very popular.
- They buffer sunshine, wind, and drought. They also improve the quality of air.
- They nurture a lot of lives (e.g. birds) too.



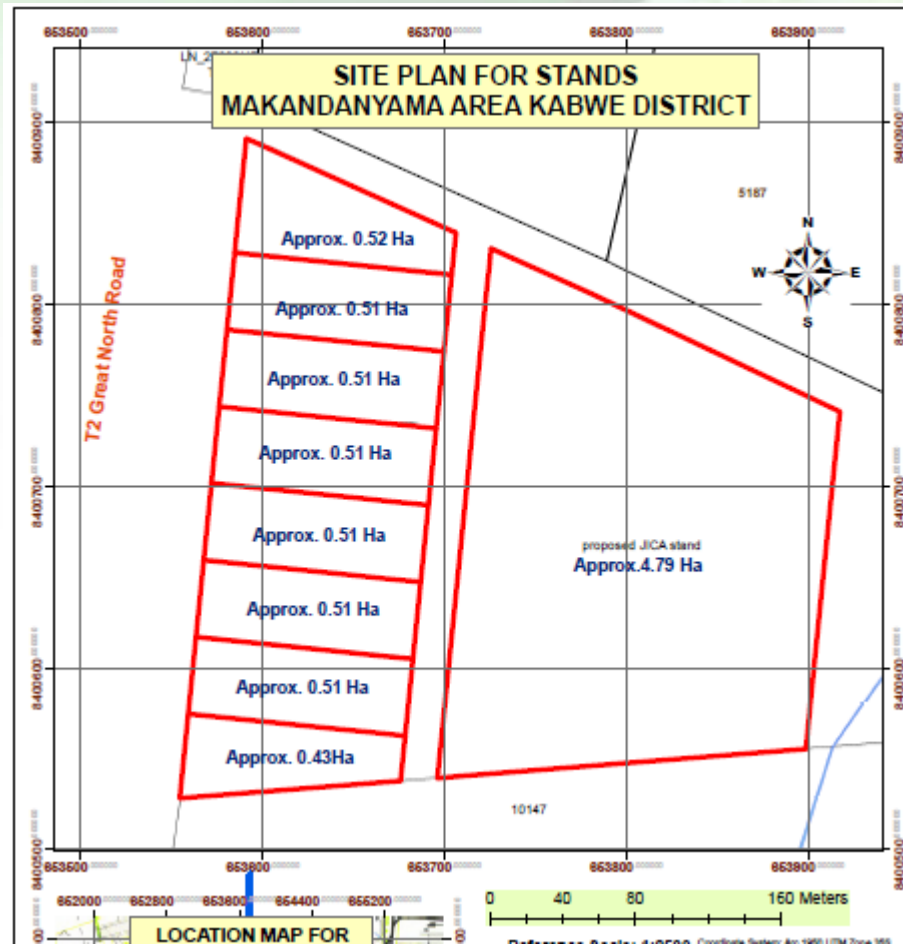
# Tentative plot trial plan

## - Split-plot design



- Numbers indicate **fertilizer application rates**.
- Plant A, B, and C mean **different plant species**.
- Plant growth and changes in soil properties (biology, chemistry, and physics) are recorded.
- **Weather stations** and **dust sensors** monitor atmospheric conditions, continuously.

# Trial site has been discussed with Kabwe council



- Possible 'Gairoju' site is just at the South of EPL land.
- The trial should be carried out slowly, starting from fences and boreholes.
- Local plants should be used.
- The site should be open to the public, eventually.
- Maybe 'botanical garden'?

# Conclusions

- Mitigation will be extremely difficult unless we ‘fundamentally’ change the whole city in many ways.
- Probably soil water holding capacity and stability are very important.
  - Soils should be stable enough to cope with heavy rain and strong wind...
- To achieve it, the role of plants has to be recognized.
- Citizens should realize the concept of this study.
  - Their cooperation is necessary to achieve something significant.