Smart Eco Path Finder for Mobile GIS Users

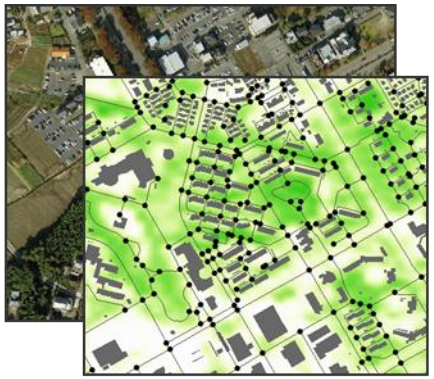
Ko Ko Lwin and Yuji Murayama

Division of Spatial Information Science
Graduate School of Life and Environmental Sciences
University of Tsukuba

SMART ECOPATH FINDER

OBJECTIVE

To develop **an integrated methodology** (Remote Sensing, GIS and Spatial Web Technology) to model **urban green space walkability**, which enables local residents to make spatial decision while their walking on the way.



ALOS-AVNR2
Building Footprints
Road Network
Public Facilities

Spatial Web Technology
GIS + Internet Technology
Urban Green Space Walkability Model

Local residents
decision making
Find eco-friendly living place
Find shortest or greenest paths

Division of Spatial Information Science, Graduate School of Life and Environmental Sciences, University of Tsukuba

SMART ECOPATH FINDER

URBAN GREEN SPACES (Improve Mental Health)

URBAN GREEN SPACES

Improve Mental Health

Studies on the relationship between nature and health

*Residents of neighborhoods with abundant **green spaces** tended, on average, to enjoy **better general health** (Maas et al., 2006)*

*More often one visits **green areas**, the less often one reports **sickness** from stress (Grahn and Stigsdotter, 2003)*

*Neighborhood greenness was more strongly associated with **mental health** than it was with physical health (Sugiyama, 2008)*

URBAN GREEN SPACES (Social Interaction and Cohesion)

URBAN GREEN SPACES

Social Interaction and Cohesion

Green spaces (especially parks) play important roles in ***social interactions and cohesion***

- *Children can play and build friendship*
- *People can meet and talk each other*
- *Do green exercises together*

Other Benefits

- *Reduce cooling and heating demands*
- *Improve air quality*
- *Reduce storm water runoff*
- *Enrichment of urban biodiversity*
- *Reduce urban heat island effect*
- *More ....*

SMART ECOPATH FINDER

ECO-CITY

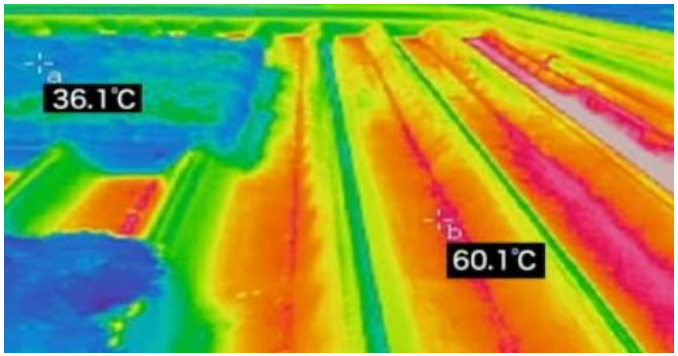
ECO-CITY

Many parts of the world, new or current urban planning activities are shifting to focus on eco-city (Dizdaroglu et. al., 2009)

Eco-yane (Roof)

In Japan, roof top greening by Daiwa Lease aims:

- *To reduce room temperature*
- *To cut-off heating demands*



Source: NHK Eco Channel, 2008

Drop 2C inside the room temperature **2C**

SMART ECOPATH FINDER

SPATIAL WEB TECHNOLOGY

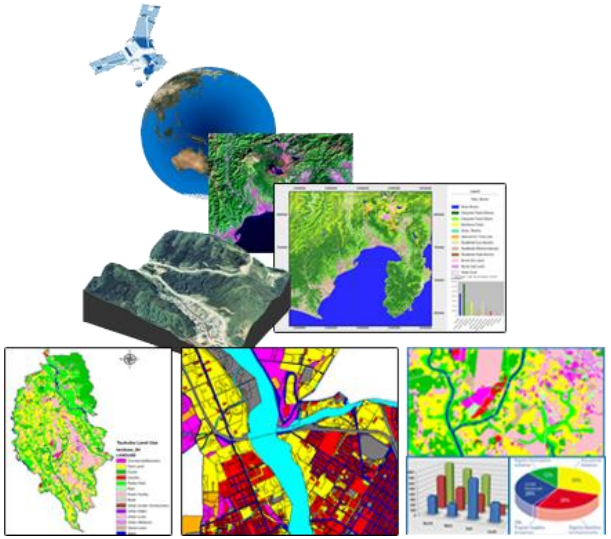
GIS → GIScience → GIST (Geographical Information Science and Technology)

Provide theory and concept
Enhance spatial analysis
Improve spatial modeling
Adequate decision making

GIS
GIScience

Communication & Hardware Development

Emergence of Internet
Development of communication technology
ISDN > ADSL > Wi-Fi access
Development of Hardware
Desktop > Laptop > Netbook > Smartphone



Mobile GIS

GIS is more accessible ….
GIS goes professional to public
Part of our daily lives
Finding closet facility, driving routes, …
Geospatially enabled society

SMART ECOPATH FINDER

SMART ECO-PATH FINDER

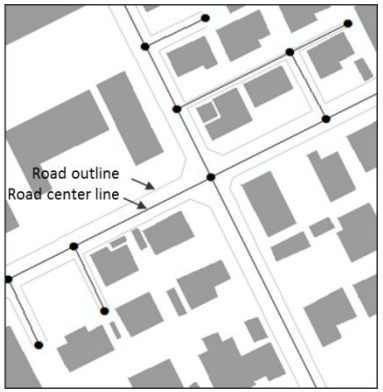
Focused on:

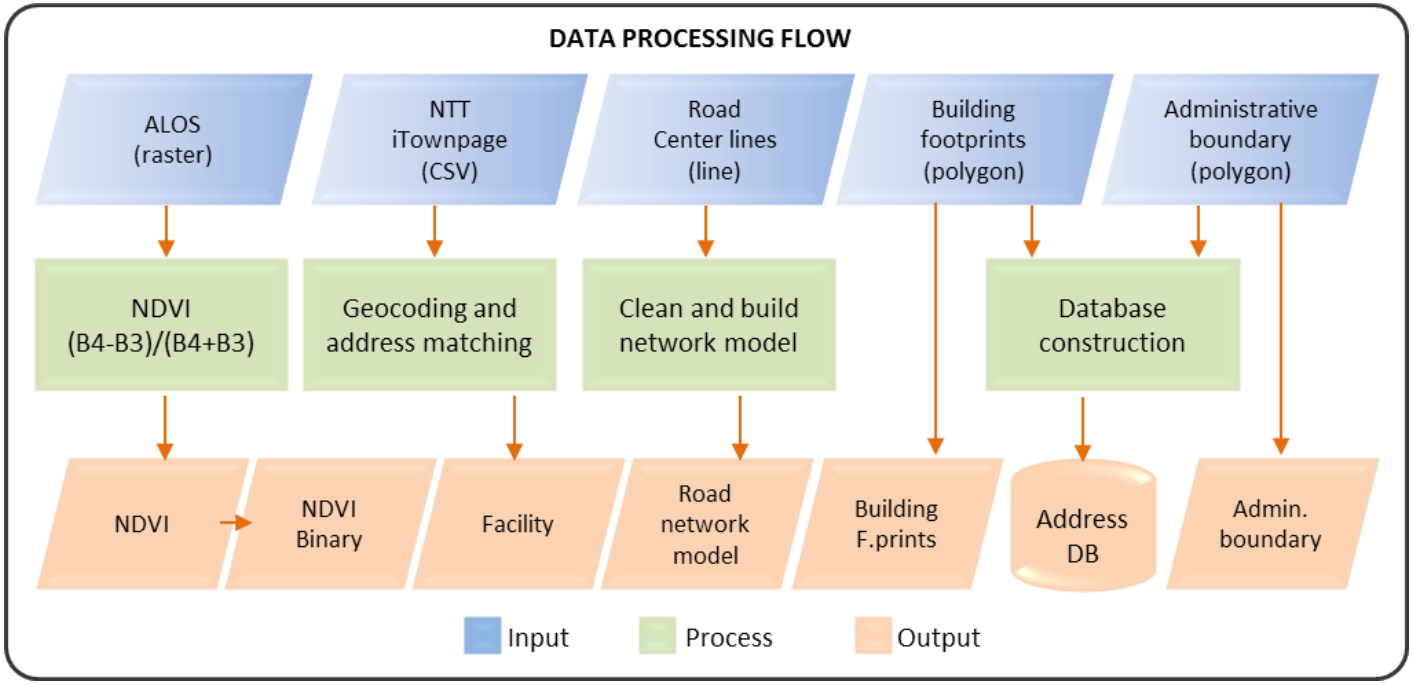
How to utilize urban green spaces with GIST (GIScience & Technology)?
How to evaluate neighborhood environmental quality with GIST?
How to find shortest paths for shopping with GIST?
How to find greenest paths for walking with GIST?

LIST OF DATA and DATA PROCESSING FLOW

List of Data

- ALOS-AVNR2
- Building Footprint
- Administrative Boundary
- Road Center Line
- NTT iTownpage

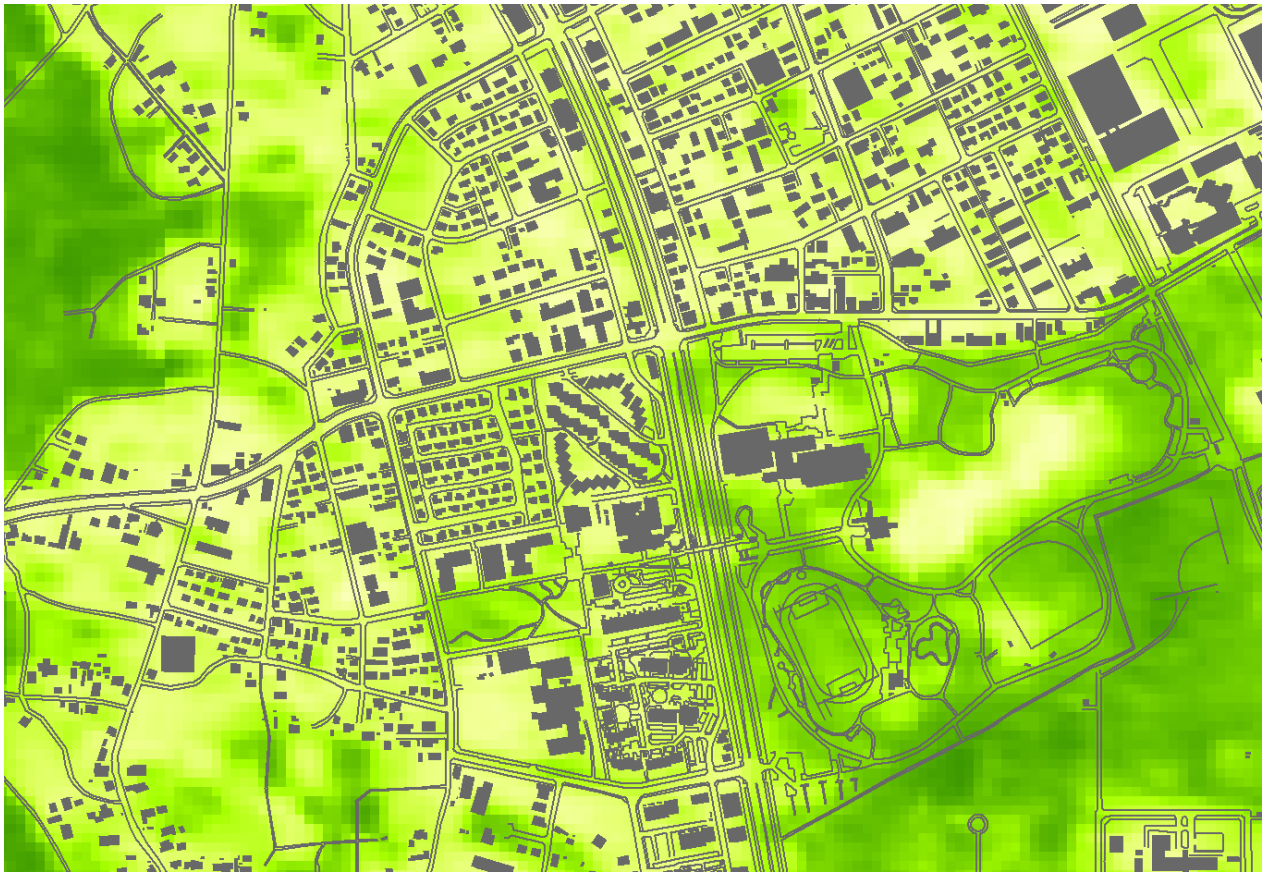




NDVI binary image: Greenness score calculation
iTownpage: Allocation of facility point
Road center line: Find shortest and greenest path
Building Footprint + **Admin. Boundary**: Construct address database

SMART ECOPATH FINDER

NDVI INTENSITY IMAGE

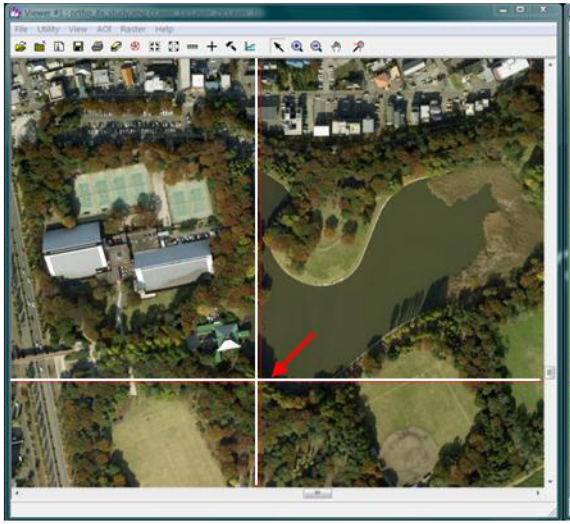


NDVI intensity image (DN = 0 – 255) at 10m spatial resolution

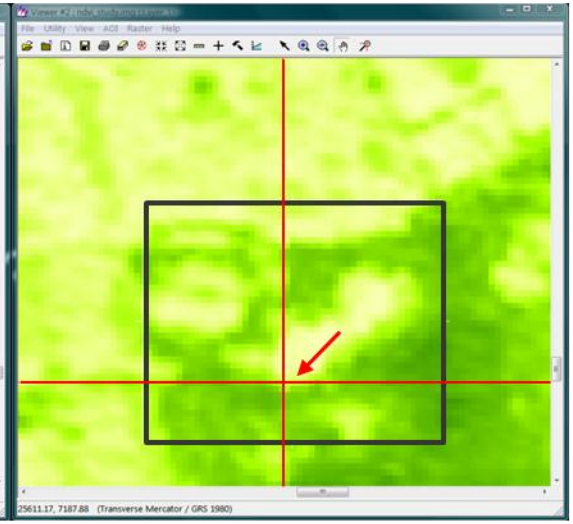
SMART ECOPATH FINDER

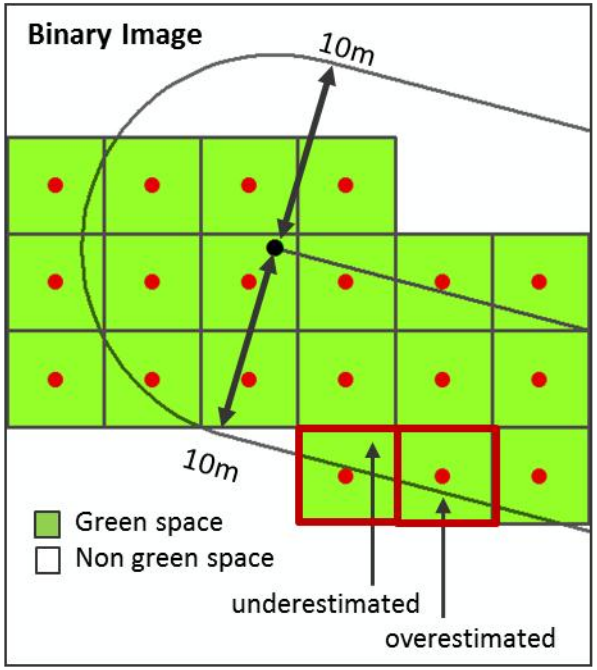
NDVI BINARY IMAGE

RGB True Color Ortho-image (67cm)



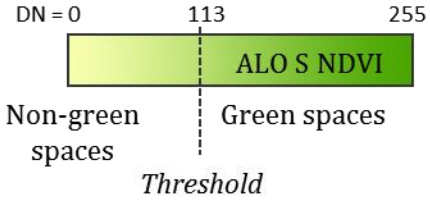
ALOS AVNIR-2 NDVI (5m)





Green spaces
Forest, paddy fields and grass lands

Non-Green Spaces
Bare lands, water surface, roads and building footprints

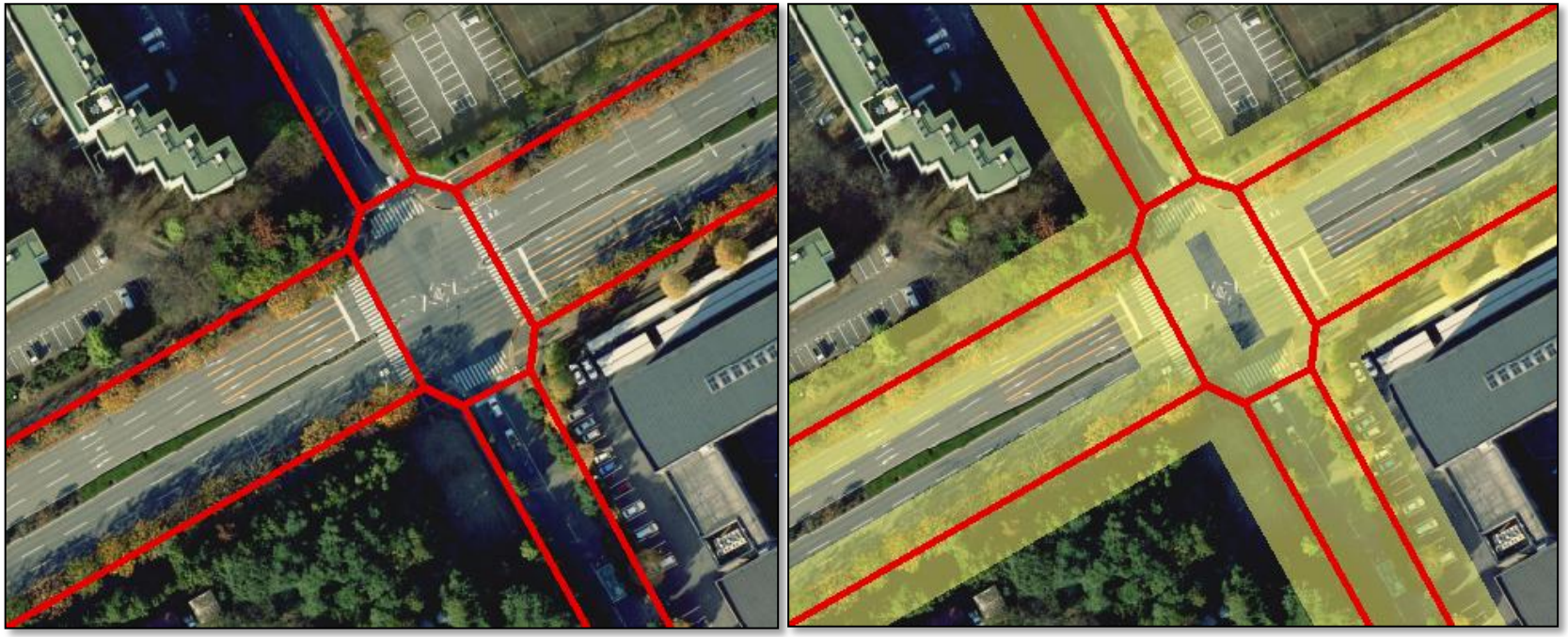


Resampled to 5m
To improve between raster and vector analysis

Convert to binary image (DN = 0 – 1)

SMART ECOPATH FINDER

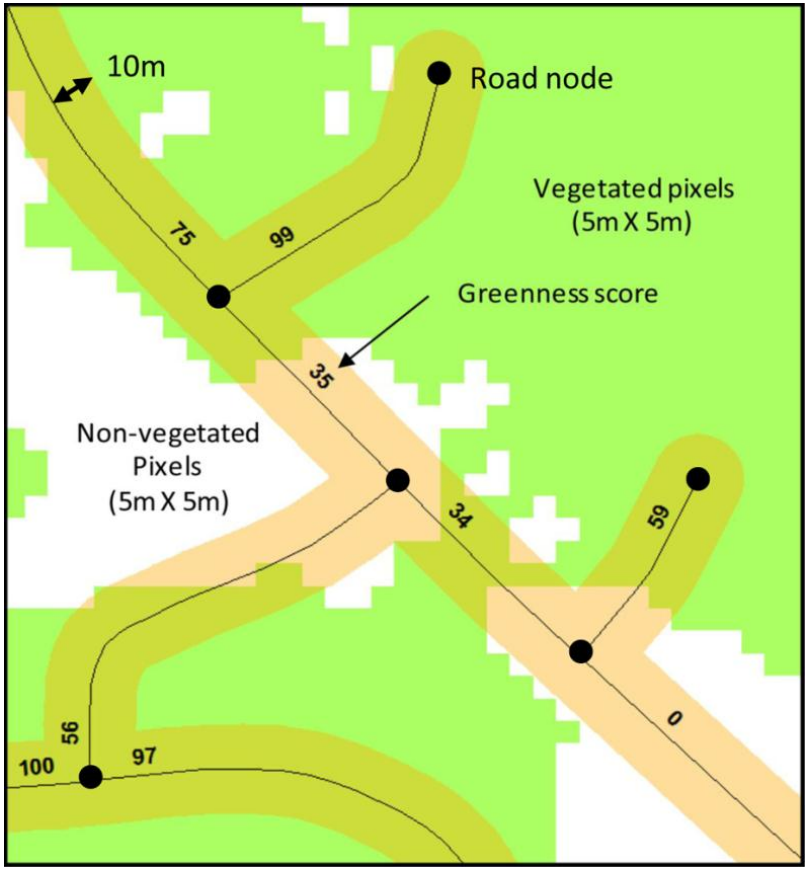
GIS ROAD NETWORK DATA MODEL

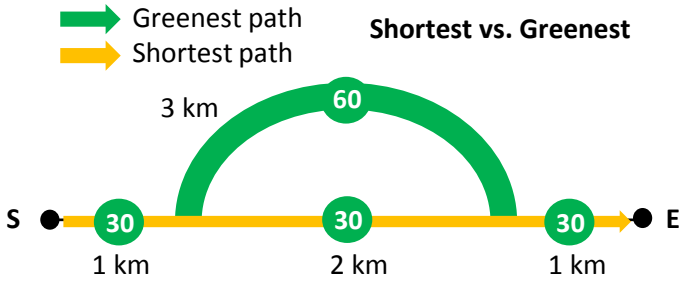


GIS Road Network Data Model preparation

SMART ECOPATH FINDER

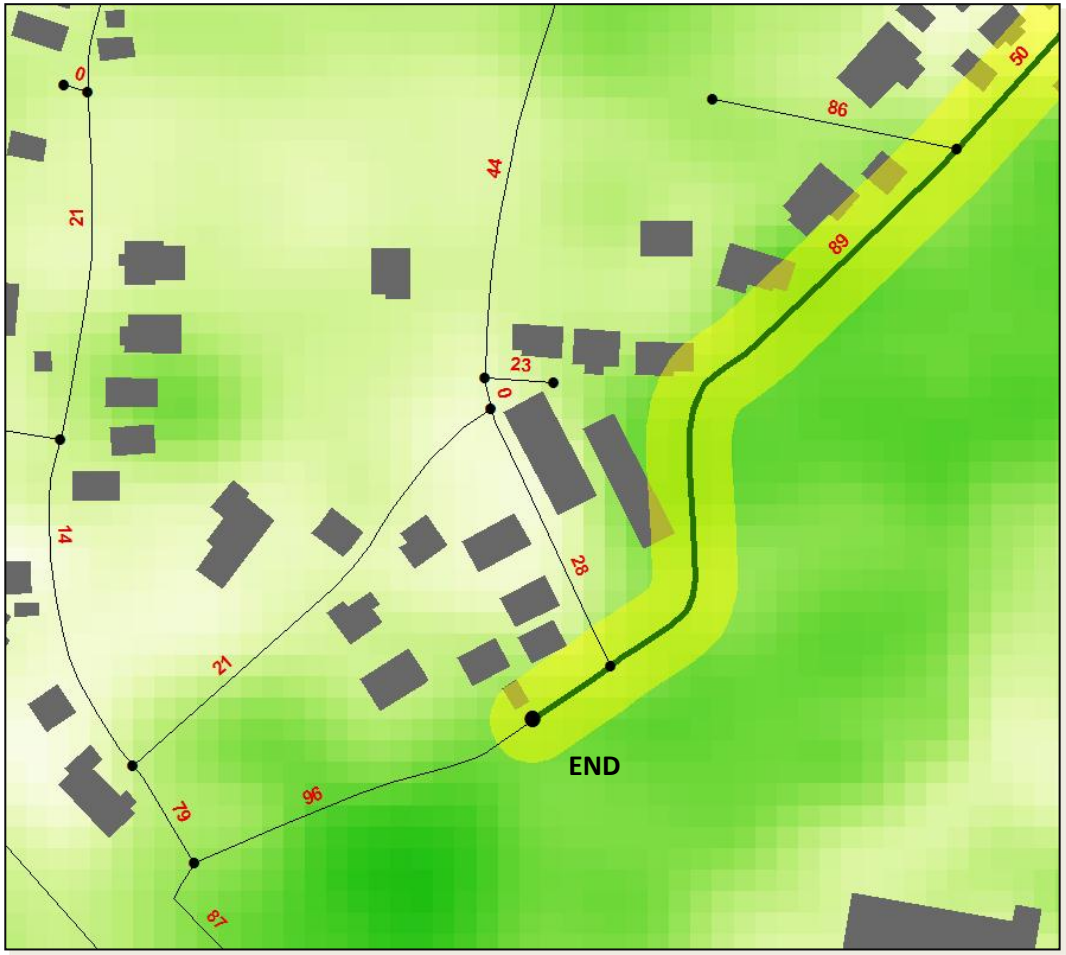
GREENNESS SCORE



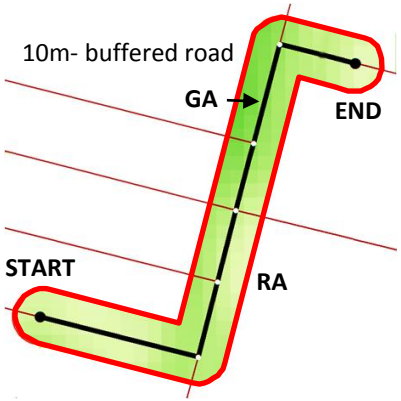


SMART ECOPATH FINDER

ROUTE GREENNESS SCORE



Route greenness score

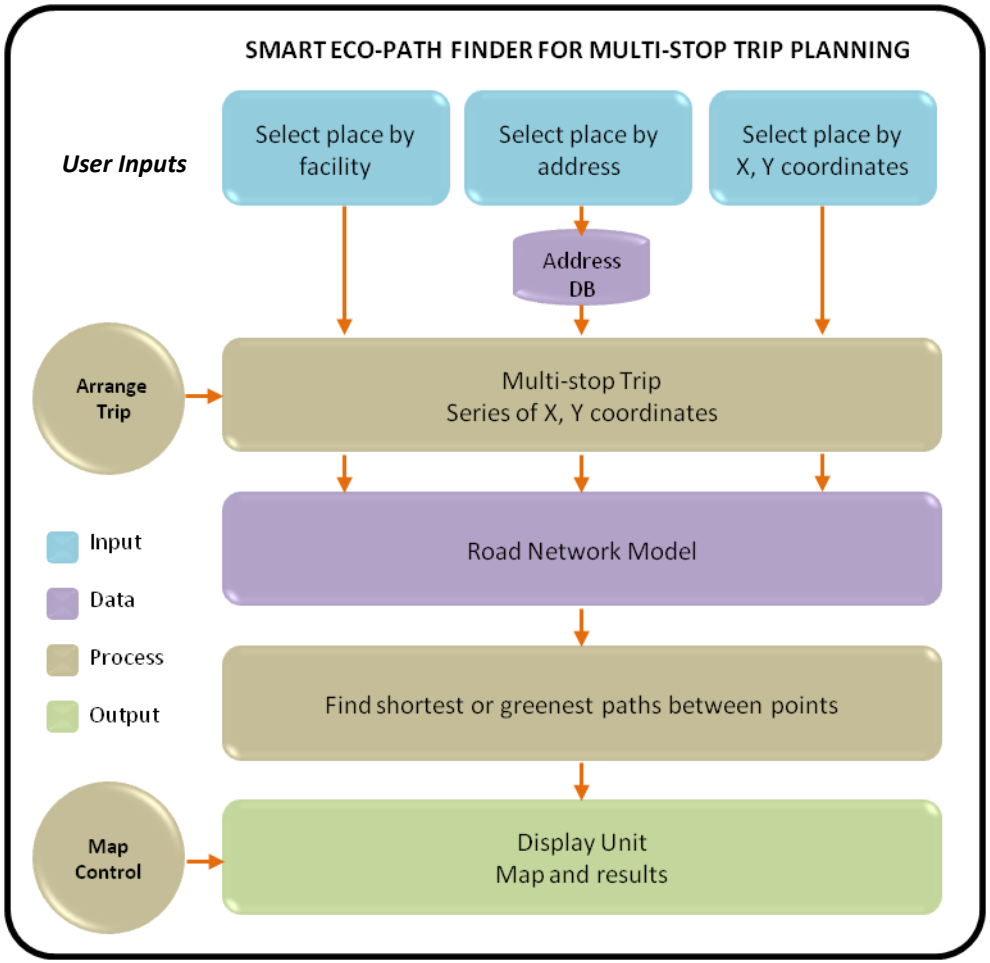


Average greenness score by walking route

Average Greenness Score = (GA / RA) * 100

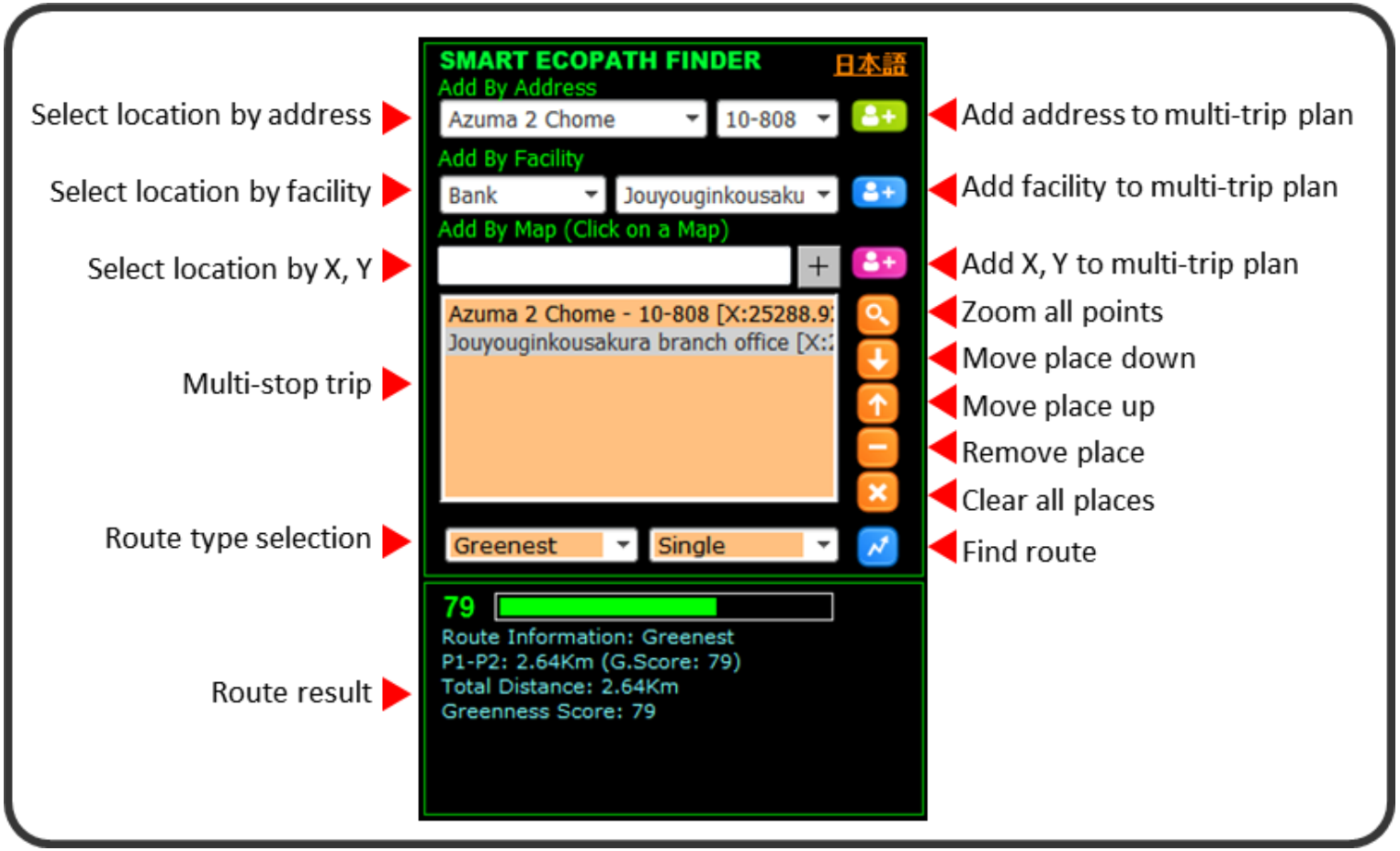
SMART ECOPATH FINDER

SYSTEM OVERVIEW



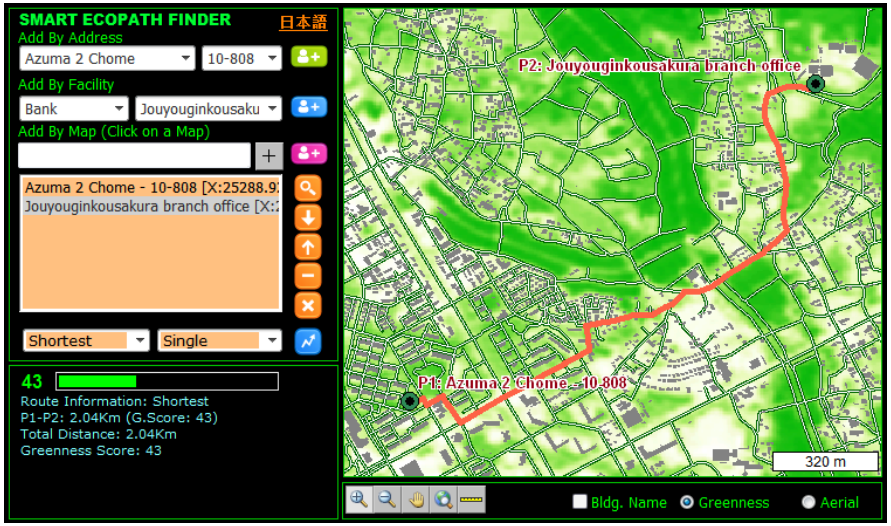
SMART ECOPATH FINDER

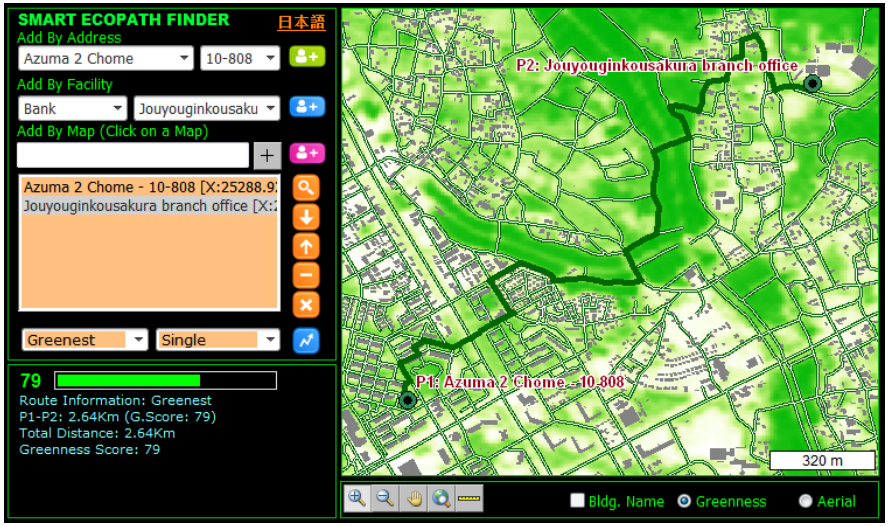
HOW IT WORKS



SMART ECOPATH FINDER

HOW IT WORKS



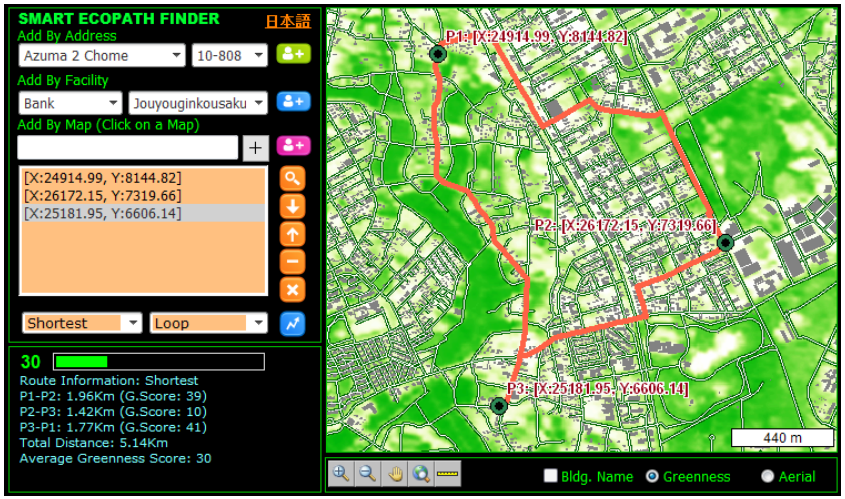


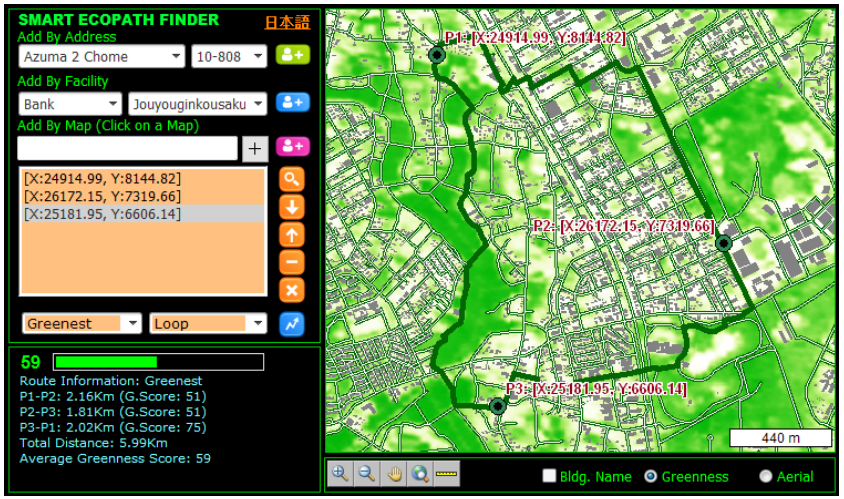
Shortest vs. Greenest

SMART ECOPATH FINDER

HOW IT WORKS

Multi-stop Trip Planning





SMART ECOPATH FINDER

HOW IT WORKS

Provide aerial imagery for real-world visualization

THANK YOU

MAKE IT UNIQUE
KEEP IT SIMPLE

DIVISION OF SPATIAL INFORMATION SCIENCE, UNIVERSITY OF TSUKUBA

Project home: http://giswin.geo.tsukuba.ac.jp/teacher/murayama/projects/ecowalkability/index.htm
Project URL: http://land.geo.tsukuba.ac.jp/ecowalker/

Read more: Lwin, K. K., & Murayama, Y., (2011), Modelling of Urban Green Space Walkability: Eco-friendly Walk Score Calculator, ***Computers, Environment and Urban Systems***, 35(5):408–420.
http://www.sciencedirect.com/science/article/pii/S0198971511000469