

Multidisciplinarity and Heterogeneity in Environmental Science

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My main interests

- Management and publication of scientific data

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=== make it digitally available and
accessible

[Files, Internet, etc]

Sharing of Data Leads to Progress on Alzheimer's

By [GINA KOLATA](#)

Published: August 12, 2010

= NEW YORK TIMES

In 2003, a group of scientists and executives from the [National Institutes of Health](#), the [Food and Drug Administration](#), the drug and medical-imaging industries, universities and nonprofit groups joined in a project that experts say had no precedent: a collaborative effort to find the biological markers that show the progression of [Alzheimer's disease](#) in the human brain.

share all the data, making every single finding public immediately, available to anyone with a computer anywhere in the world.

Our goal

Agenda/project(s) for research in
environmental science

Taking advantage of sensor data

Our main challenge???

Our main challenge???

Multidisciplinarity

and

Heterogeneity ----- OPEN PROBLEM in CS

Itaú-Unibanco gets record profit in 3rd trimester (nov 3 2010)

Largest private bank in Latin America

R\$ 3 billion profit – biggest bank profit in
Brazil in the period

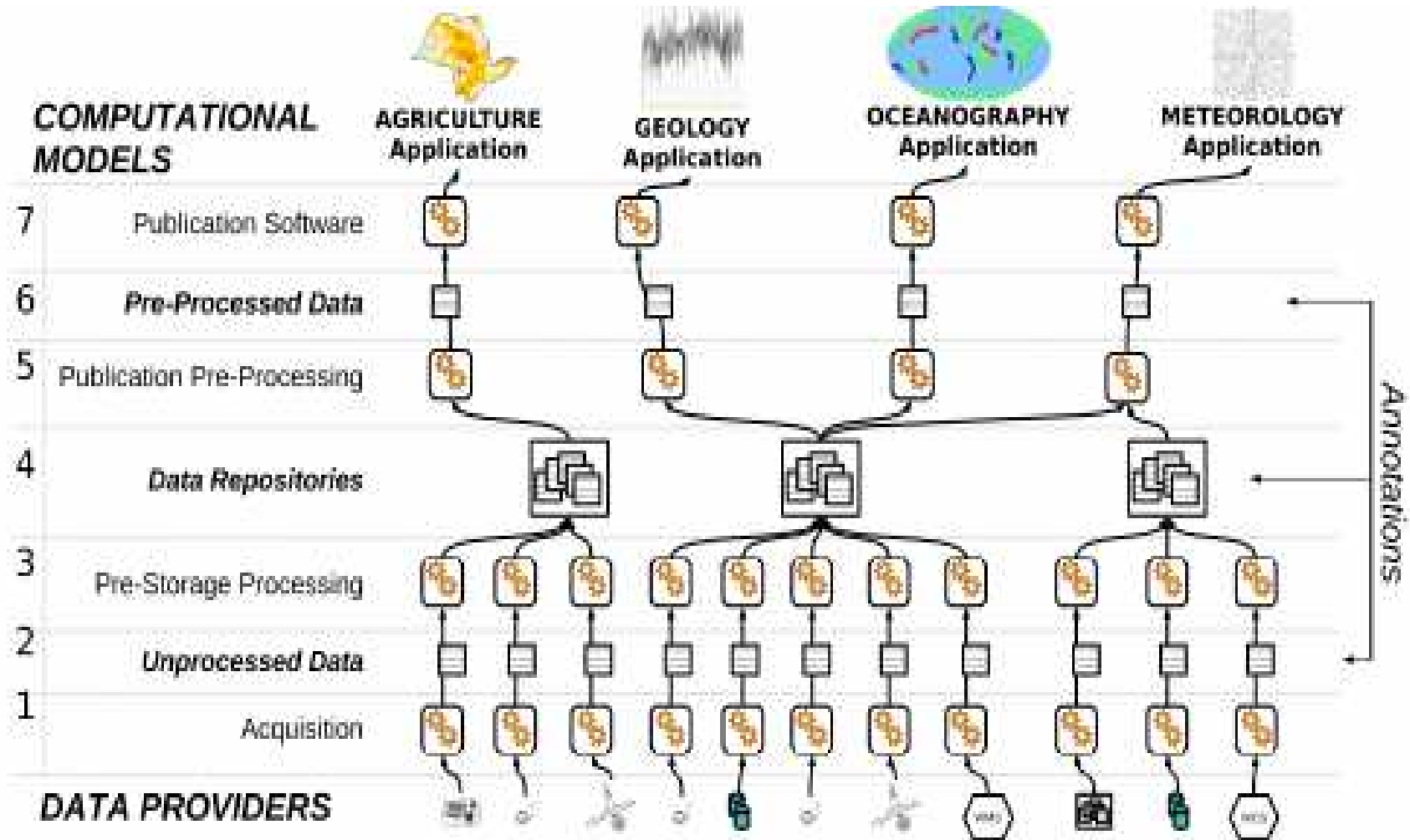


Itaú-Unibanco

- Fusion announced nov 2008
- Unification of ATMs in nov 2009
- Unification of all systems in oct 2010 (TV advertisement)

Lets go back to environmental
science

Escience (partial) life cycle



In many forms

Heterogeneity

- Of USERS – hence, everything else
- BUT --- Who is the user?

Heterogeneity

- Of USERS – hence, everything else
- BUT --- Who is the user?

POINT of VIEW --- lets not forget this!

Heterogeneity of Domain Requirements/Experts

- Multiple views of the world, hence
- Multiple methodologies, hence

Heterogeneity of Domain Experts

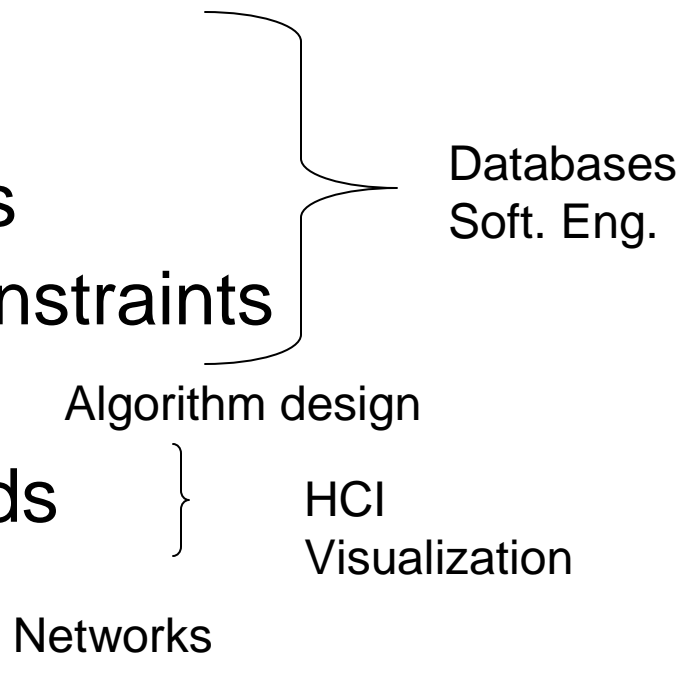
- Multiple views of the world, hence
- Multiple methodologies, hence

- Spatial and temporal scales
- Sampling/measurement units
- Quality, integrity, curation constraints
- Models/algorithms
- Visualization/interaction needs
- Cooperation modalities

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Main infra challenges

- Data availability/consumability/accessibility
- How to make it ... to all
 - Technical issues (equipment, power)
 - Ethical/privacy/ownership issues
 - ...

And scientific challenges?

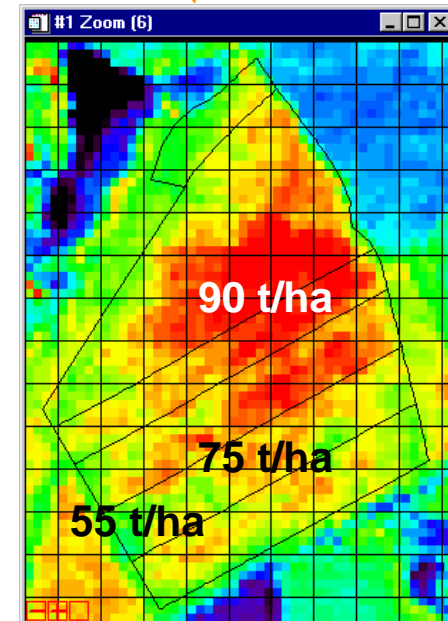
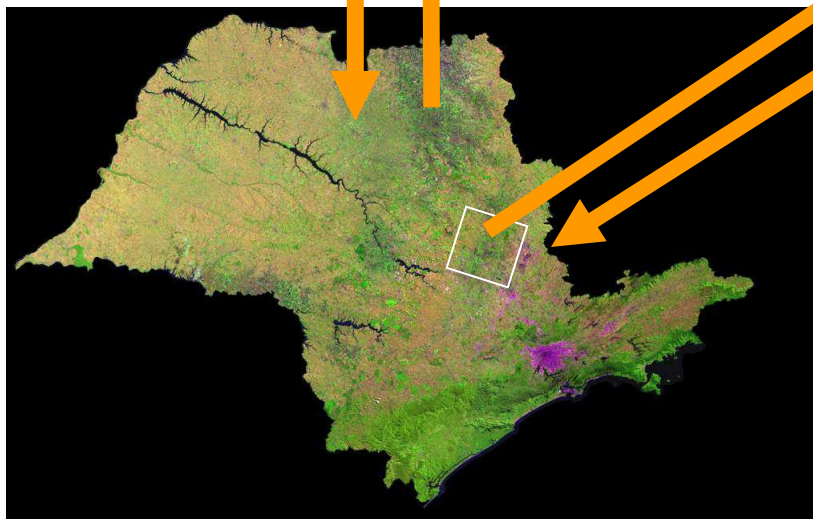
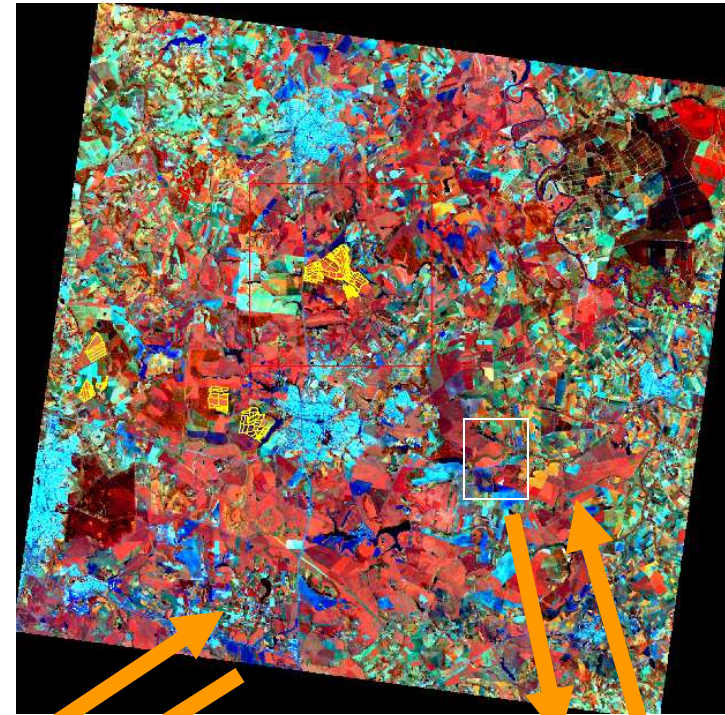
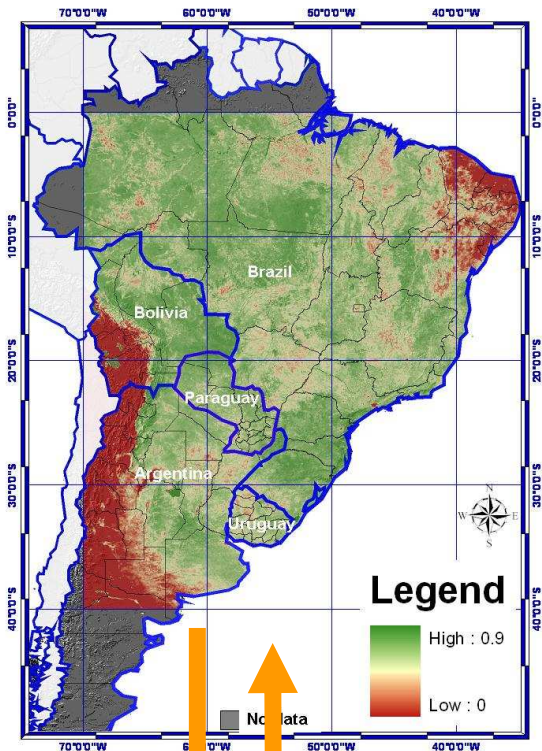
- Domain experts – HOW TO
 - Set up the experiment?
 - Spatio-temporal granularity
 - Sampling and collection methodology
 - Evaluate quality of data collected?
 - Extract/improve models from data?
 - Validate the experiment?
 - Determine cost/benefits?

And scientific challenges?

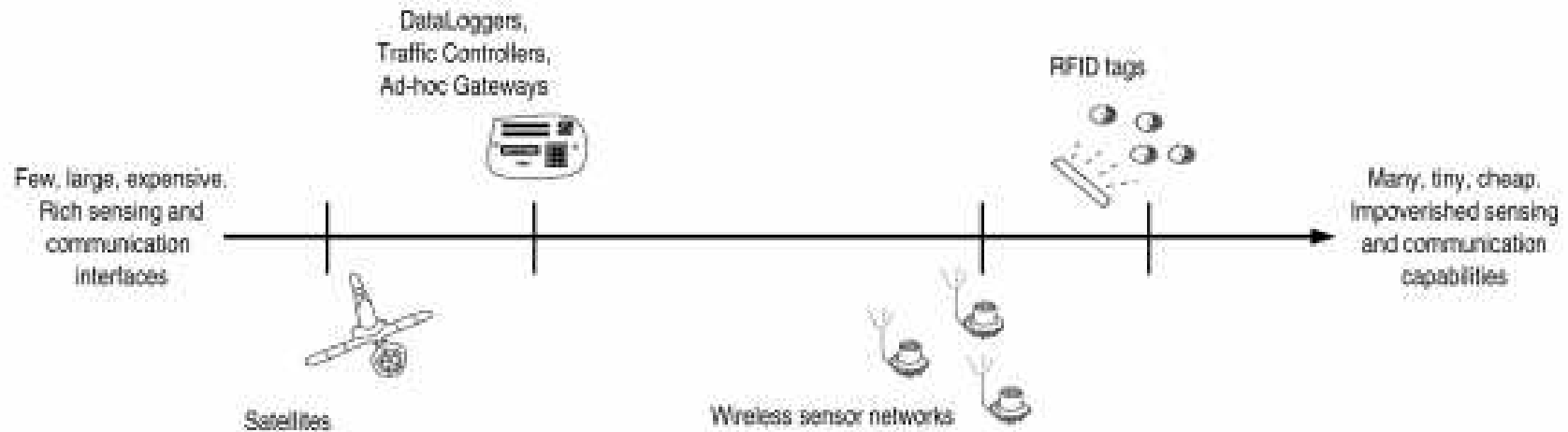
- Computer science – HOW TO
 - Organize data?
 - Query/mine data?
 - Show results (visualization and interaction)?
 - Update?
 - Calibrate equipment?
 - Develop tools to support cooperation in a distributed environment?

Example - agriculture

Mudança de Escala

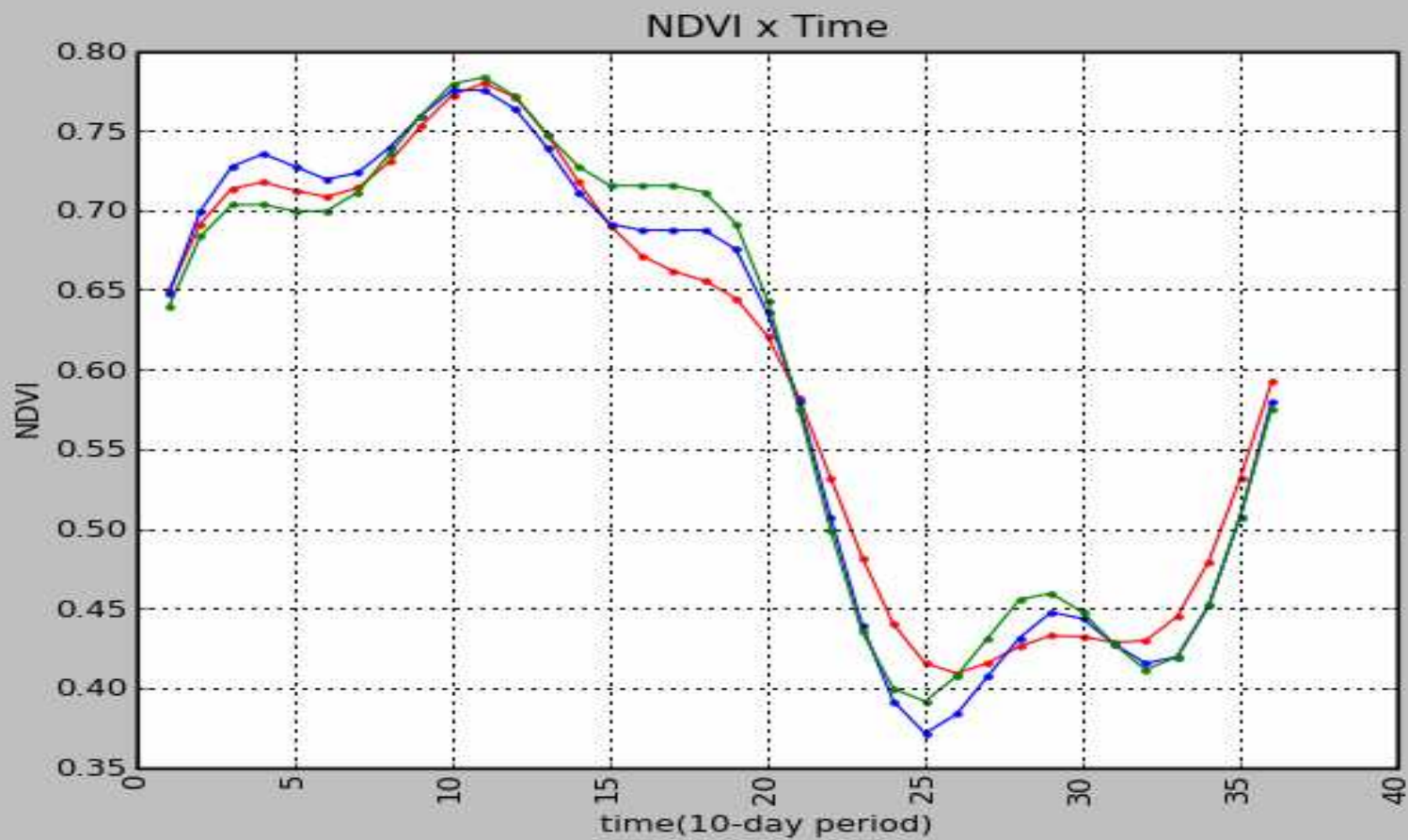


Sensor spectrum

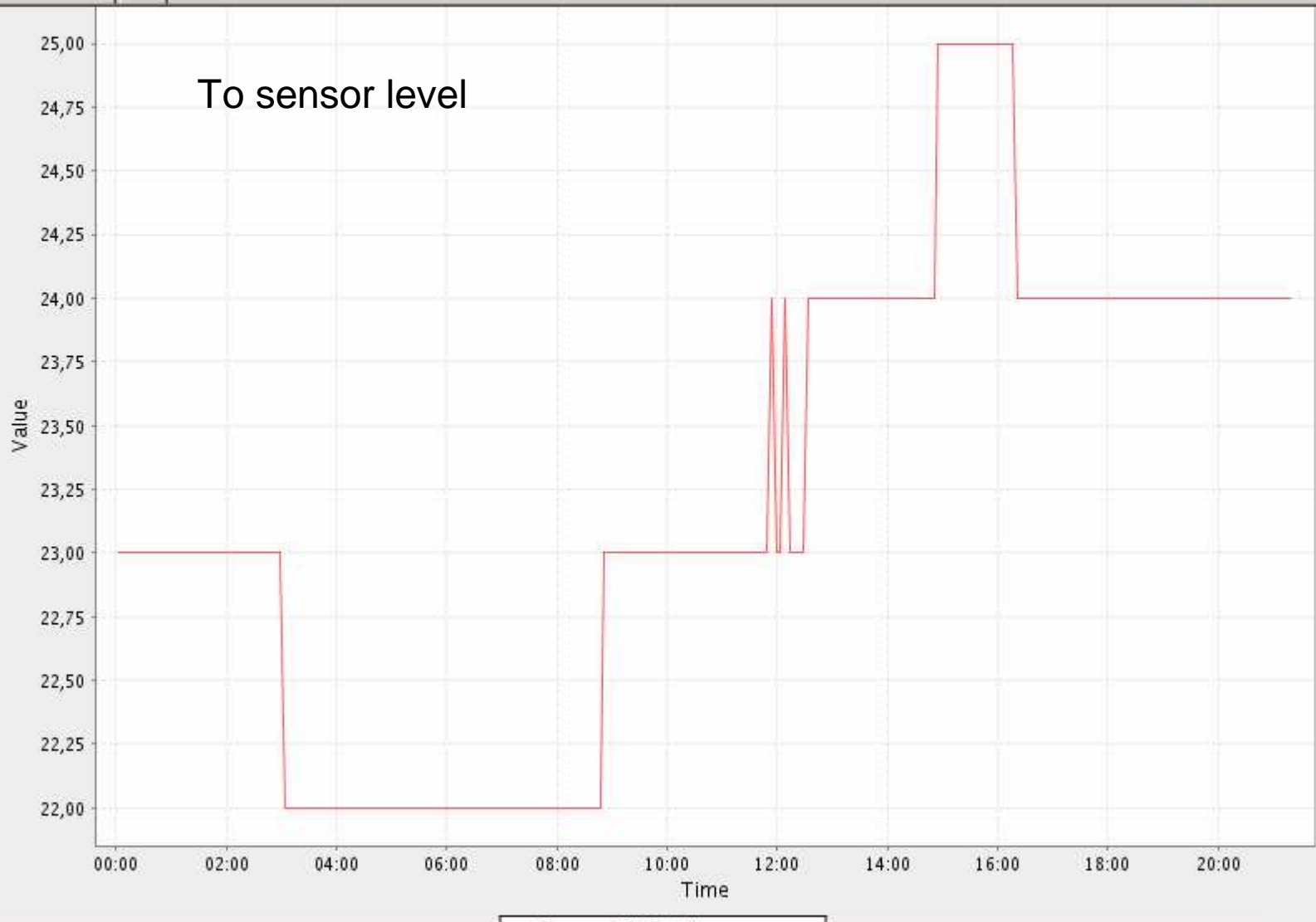


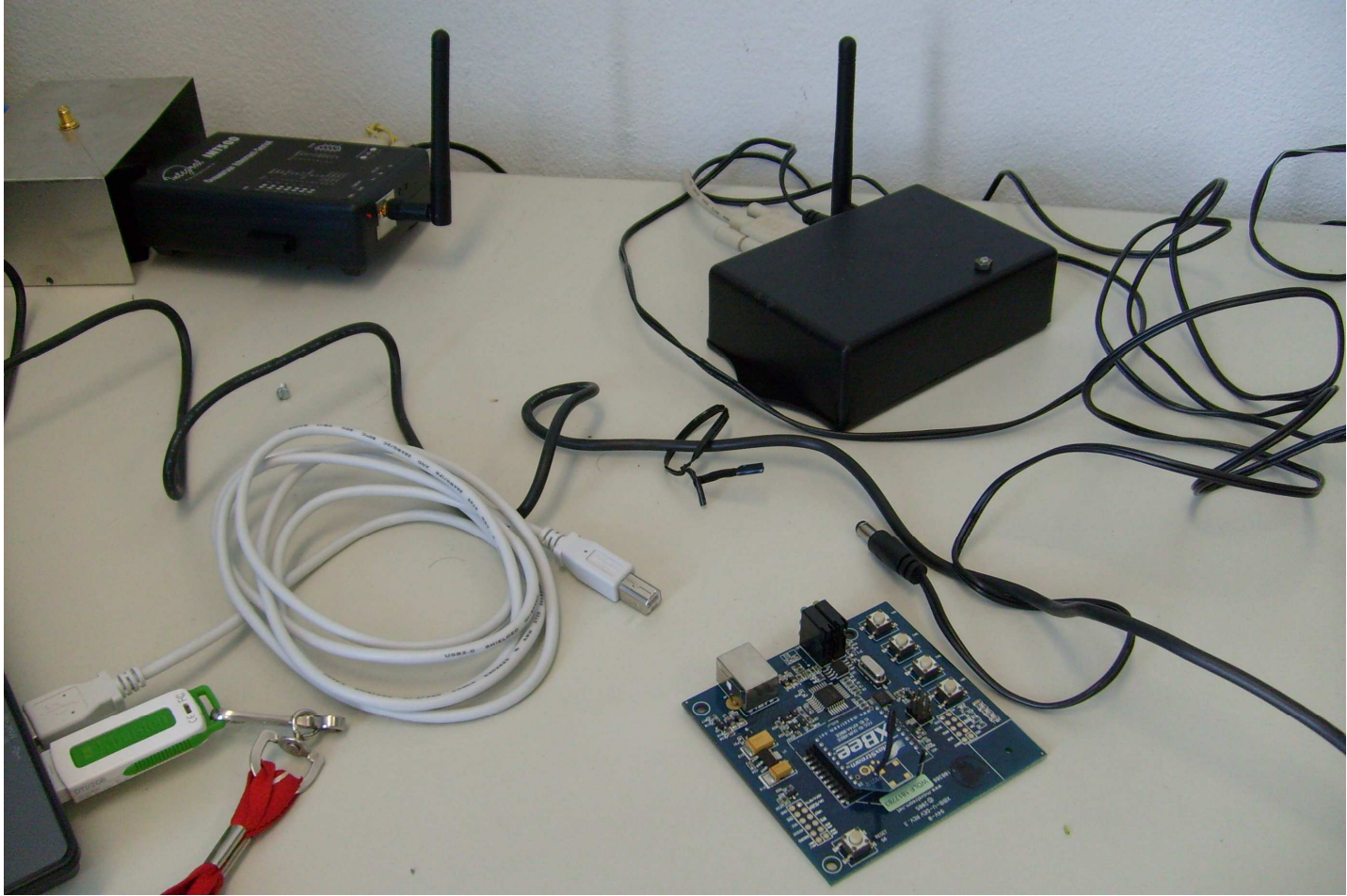
Hellerstein, Hong, Madden – Sensor Spectrum: Technologies, Trends And Requirements. ACM SIGMOD Record 32(4):22-27, 2003

From pixel level



To sensor level



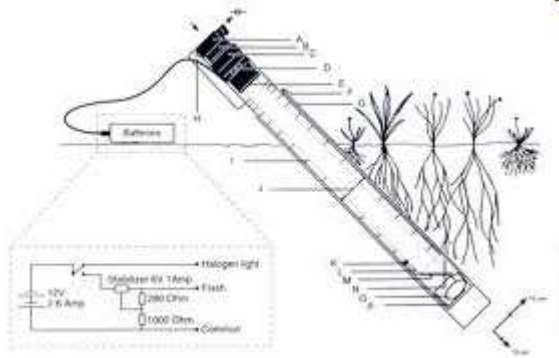




Water flow



Sap flow



Minirhizotron

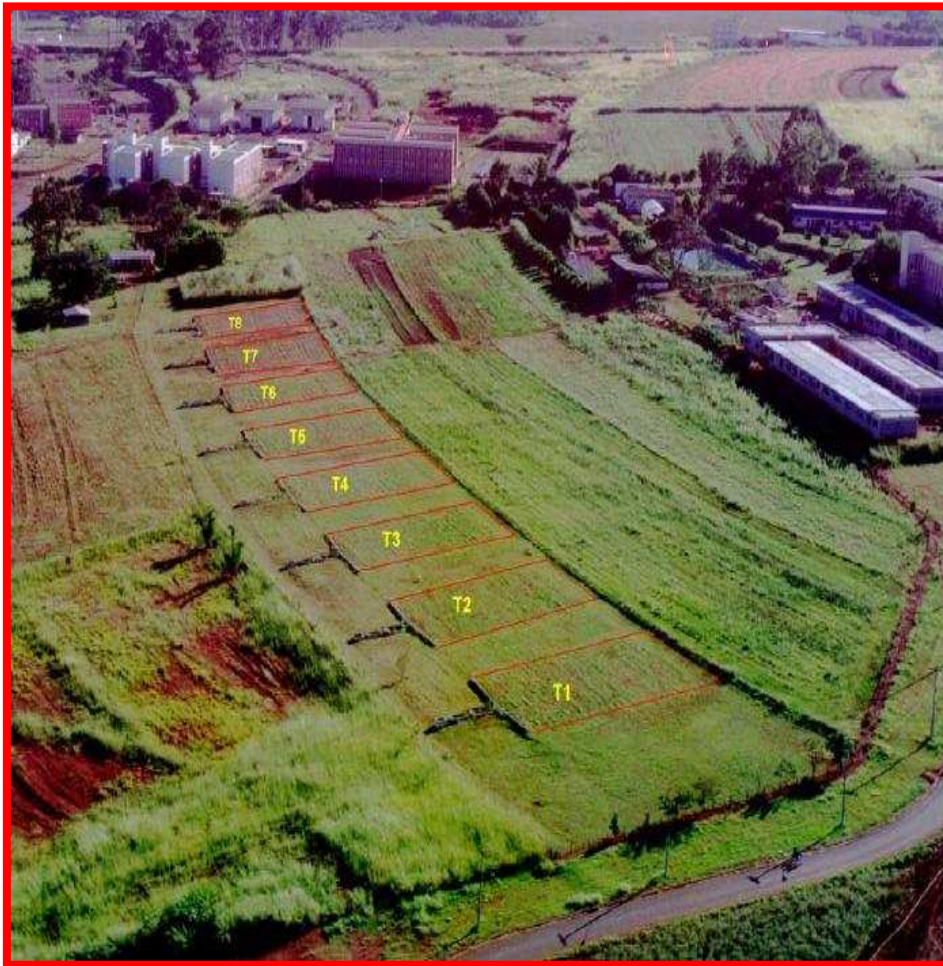


Rhizotron



Human sensing— plant count

Experimental farm grounds







Our task

- Devise multidisciplinary projects
- That involve handling environmental issues
- Taking all the previous challenges into consideration