Who am I

• 25 years GIS/RS
  – CSIRO Canberra
  – NTG Alice Springs/Darwin
  – Consultant Tiwi, NAILSMA...
  – CDU 11 years
    • Eastern Indonesia
    • Darwin Centre for Bushfire Research
• For me spatial sciences necessarily require cross disciplinary engagement. Maps have no meaning without (multiple) interpretation(s)

• Almost every field of research has a spatial component.
Heavy Metal Bands Per 100,000 People

Sources:
1. http://www.metal-archives.com/browse/country

(CC) BY-SA depo 2012
Map of worldwide incarceration rates as of 2012
What do I do

• Eastern Indonesia
  – NRM
  – Health Information

• Savanna fire information

• Post Graduate supervision
MODIS IMAGE
Eastern Indonesia

• NRM
  – Satellite imagery for fire 2003
  – Spatial data NRM
  – Small scale (Artisinal) mining
    • West Timor
    • Sulawesi
Mining - Impacts

• Environmental
  • Erosion/Landslides
  • Degradation/Sedimentation

• Health
  • Deaths from mine collapse

• Livelihoods
  • Livelihoods shifting from subsistence farming to small scale extractive mining.
Mining - Impacts

• Small scale (artisinal) manual mining maybe the best way to transfer mineral wealth to the poorest people through working their own land.
We have a problem!
Big impacts!
How big?

Very Big!
Kawasan hutan

Hutan Lindung
Hutan Produksi
Produksi konversi
Produksi Terbatas

km
• Data ini adalah data base spasial.
Lokasi risiko erosi tinggi

Kemirinagan > 5%
Luas > 50m²
Erodibilitas = 3
Lokasi risiko erosi tinggi sekali

LS Faktor > 3
Kemirinagan > 5%
Luas > 50m²
Erodibilitas = 3
ASMG Sulawesi

• Bombana
  – Scale
  – Sediment and environmental mercury
  – Monitoring
Kabupaten Bombana

Landsat 8 Image 28/04/2014
This landcover map produced as a result of project training shows the scale and extent of the mining (Red) and its proximity to rice growing areas (Yellow) and an extensive aquaculture region (Dark Blue).

Map produced by Iradaf Mandaya
This map, produced as a result of project training shows, the modelled potential sediment flow from the gold mining region. It is clear from this and the previous map that run off from the mining areas goes straight through to rice growing and aqua culture regions.
Health projects (2008-2013)

1. Mapping Health Indicators
2. Field Data collection
3. Access Modelling
4. SMS health reporting
Reliable social, economic and health data are essential for sustainable development in eastern Indonesia.

In eastern Indonesia through decentralisation, there has been a devolution of budgeting and planning power to the Kabupaten level without a corresponding provision of the base data and analysis skills for required for good decision making.
Data collection and analysis at the local level can increase data understanding and data quality.
Goal

Empower local health professionals to analyse and understand the data they collect to guide better (more accurate) data collection to inform service delivery and program development at the local and national level.
Three components

- Integration of existing data for spatial visualisation
Three components

- Integration of existing data for spatial visualisation

- Field Data collection for:
  - Updating health infrastructure data
Three components

- Integration of existing data for spatial visualisation

- Field Data collection for:
  - Updating health infrastructure data

- Service Availability Mapping
  - *Modeling travel time to health services*
A model of service access

SERVICE DELIVERY GOAL

Effectiveness Coverage

Contact Coverage

Acceptability Coverage

Accessibility Coverage

Availability Coverage

TARGET POPULATION

Target population who do not contact services

Process of service provision

Coverage curve
A model of service access

- SERVICE DELIVERY GOAL
  - Effectiveness Coverage
  - Contact Coverage
  - Acceptability Coverage
  - Accessibility Coverage
  - Availability Coverage

TARGET POPULATION

Strong geographic dimension
SERVICE AVAILABILITY MAPPING (SAM)

Legenda
- Puskesmas
- Transportasi Jalan
KLASIFIKASI
- Jalan Kabupaten
- Jalan Negara
- Jalan Propinsi
- Ekowis

Travel Time Puskesmas
- 0 - 15 minutes
- 15 - 30 minutes
- 30 - 45 minutes
- 45 - 60 minutes
- > 60 minutes
- Bukan Jarak Jalan
Figure 5: Estimated travel time of up to two hours around the clinics which provide basic emergency obstetric care and the hospital providing comprehensive emergency care in Ngada district, Flores.
Fire Mapping

• Last 10 year produced Kakadu’s fire mapping.
• Last 4 years have produced the mapping for NAFI and as the base dataset for the CFI

• CFI as developed at the DCBR focused on (1) Indigenous livelihood opportunities (2) Biodiversity conservation (3) carbon abatement.
• The Savanna Burning methodology involves the use of early dry season strategic prescribed burning to reduce the area and severity of tropical savanna affected by fire.

• Fire history and vegetation maps are used to determine the 10 year baseline emissions from any property implementing an abatement project.

• Ongoing fire mapping from NAFI is then used to determine emissions under the new fire management regime and calculate greenhouse gas emissions abatement benefits.
North Australia: times burnt 2000-2011
MODIS Mapping.
North Australia: times LATE dry season burnt 2000-2011
MODIS Mapping.
• WALFA

• CALFA

• FISH RIVER

• Kimberly
Beyond NAFI - Alternative fire data and 3D fire simulations

Rohan Fisher

Darwin Centre for Bushfire Research
Research Institute for Environment and Livelihoods
Charles Darwin University
Core Duties- NAFI

- Weekly NAFI fire mapping NT/WA
- Liaising with QLD CYSF NAFI fire mapping
- Managing NAFI derived fire regime data
- Managing mapping methodology developments
- Responding to carbon project mapping requirements.
- Engaging with DCBR research activities
Figure 1. NAFI Burnt area mapping coverage.
Mapping Process

• Segmentation (OBIA)
  • Remove pixel based classification anomalies (salt and pepper)

• Classification
  • Density slicing based on 2 image dates band 2 (NIR)

• Manual identification
  • Shape, Pattern, Context
  • Ancillary data
    • Hot-spots
    • **User input**
Mapping Process

• **Mapping temporal scale**
  • Every 1-2 weeks
  • Monthly mapping
  • Yearly double check
  • Ruled by cloud cover

• **Validation**
  • Annual areal transect data
  • For this chapter – LANDSAT based comparison
Field point based validation

Figure 3. Map of north Australia illustrating the coverage by aerial and ground validation transects, 2011-13.
Error matrix assessment.

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of waypoints (n)</td>
<td>9,761</td>
<td>7,324</td>
<td>6,527</td>
</tr>
<tr>
<td>Overall accuracy</td>
<td>0.86</td>
<td>0.90</td>
<td>0.85</td>
</tr>
<tr>
<td>Burnt omission error</td>
<td>0.14</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Burnt commission error</td>
<td>0.09</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>Unburnt omission error</td>
<td>0.06</td>
<td>0.14</td>
<td>0.12</td>
</tr>
<tr>
<td>Unburnt commission error</td>
<td>0.17</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Kappa statistic</td>
<td>0.71</td>
<td>0.79</td>
<td>0.70</td>
</tr>
</tbody>
</table>
Land manager support activities

- Capacity building activities for land managers
Limitations

• **Spatial** – 250m
  
  – **Solution:** use free Landsat data

• **Temporal:** Weekly – Fortnightly
  
  – **Solution:** direct access free MODIS imagery
Landsat data

Libra Development Seed download
Go to the Libra development seed site at http://libra.developmentseed.org/.
MODIS

Image Visualisation

• **Software**
  – *SAGA GIS*
  – Free Open Source Software
  – No installation

• **Training material development**
  • Screen shot video tutorials
  • Training manual

• **Software development collaboration with SAGA development team**
Burnt area visualisation

- Hi-resolution Landsat 8 imagery
  - Fast simple image visualisation
  - Assessing management burns

- MODIS
  - Near real-time data more accurate than hot-spots
  - Animating fire spread
Other SAGA Tricks

• Mapping burnt areas
  – Rapid classification of burnt areas using Object Based image analysis in SAGA
Other SAGA Tricks

• Exporting imagery from SAGA for field applications
  
  – Using PDF maps with SAGA.
3D Interactive fire simulations

- Inspired by Sim Table
  - www.simtable.com

- Combined
  - Surface interactivity
  - Agent based models (Fire spread)
  - A sandpit

- Training support tool.
3D Interactive fire simulations
Simulation of fire spread

• **NOT** a model of fire spread
  – Not trying to predict fire path rather mimic fire behaviour in relation to biophysical variables.

**Work in progress.**

• Fuel load (Veg + TSLB)
• Slope
• Wind Speed direction
• Curing
Sand
3D Printed surface
3D Printed surface
Simulation of fire spread

- Training/Gaming Tool
  - Looking to incorporate
    - Measure of burning intensity
    - Cost of chopper
    - Burning efficiency
    - ?

- rohanfisher.wordpress.com

- Rohan.fisher@cdu.edu.au
Post Graduate students

• **Sarah** – Catchment Management - Sumba
• **Kris** – Biophysical assessment of Catchment West Timor
• **Pia** – tenure and rice production in West Timor/Participatory mapping of marine protected areas.
• **Frederika** – Agent Based modelling of access to services – Nusa Tenngara Timor
• **Abilio** – Climate Change adaptation Timor Leste
GIS is not ESRI!

- Participatory
- Open Source
Why choose open source?

- It’s free!
  - To use and distribute. Simple installation.
  - Licensing costs is one of the major impediments to a broader uptake of GIS applications.

- It works.
  - Fits common spatial data standards
  - Broad functionality

- Customisable

- Often easier to learn than proprietary packages.
• GIS has the potential to reduce or exacerbate social inequities, to further concentrate power in a techno-elite or to democratise information. It all depends on who controls the information and its analysis.

• Democratising GIS for local decision making
  • Enabling better health data analysis at the clinic level.
  • eg – forest management in Indonesia.
• Field data collection software
  • Cybertracker
  • PDF Maps

• Vector mapping and analysis
  • Open Jump
  • Quantum GIS
  • gvSIG
  • Map Window

• Raster Vector Analysis software.
  • SAGA
  • ILWIS
  • SEGMENTATION - software
Android field data collection

CyberTracker

PDF Maps
Get the App. Get the Map.

Winner of multiple awards including
- Best Map Product Worldwide in 2011
- Best Maps for Multimedia Application
- New Technology & New Media Award
- Technology Innovation Award for Mobile Mapping
• Java Based

• Very nice charting tools

• Good visualisation tools.

• My choice for our health project work.
Quantum GIS (QGIS)

- Open Source Geographic Information System (GIS) that runs on Linux, Unix, Mac OS X, and Windows. QGIS supports vector, raster, and database formats. QGIS is licensed under the GNU Public License.

- Well developed functionality with a very active development team. Regular updates.

- Easy to use. My choice for the Eastern Indonesian field intensive.
SAGA
System for Automated Geoscientific Analyses

Official SAGA Homepage
SAGA Project Homepage at SourceForge

• http://www.saga-gis.org