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Australia – China ABCC Project: Improving models for Carbon Accounting in forest, agriculture, and arid zones - assessing the role of vegetation dynamics on terrestrial carbon cycling

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November 2012

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Overall China – Australia Collaboration Project Aims

This project aims to better quantify the changes in forest and arid zone carbon stocks in China and Australia, through work on producing better estimates of annual increments and loses, including the effect of local land management options – 3 Case Studies

- Deforestation and forest degradation significant contributor (20%) to global GHG;
- Afforestation major tool for carbon pollution abatement (and other environmental benefits)
- Projecting future scenarios requires understanding of forest and arid zone ecosystem carbon dynamics = Modelling
- Making national assessment and quantifying effects of global change, requires making assessments across large areas, diverse forest condition, history and management = Remote sensing and inventory tools are ideal.

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Progress to date

- A number of bilateral visits for:
  - planning;
  - field work;
  - presentation;
  - knowledge sharing

- Development discussions
  - National priorities
  - Common interests
  - Joint benefits

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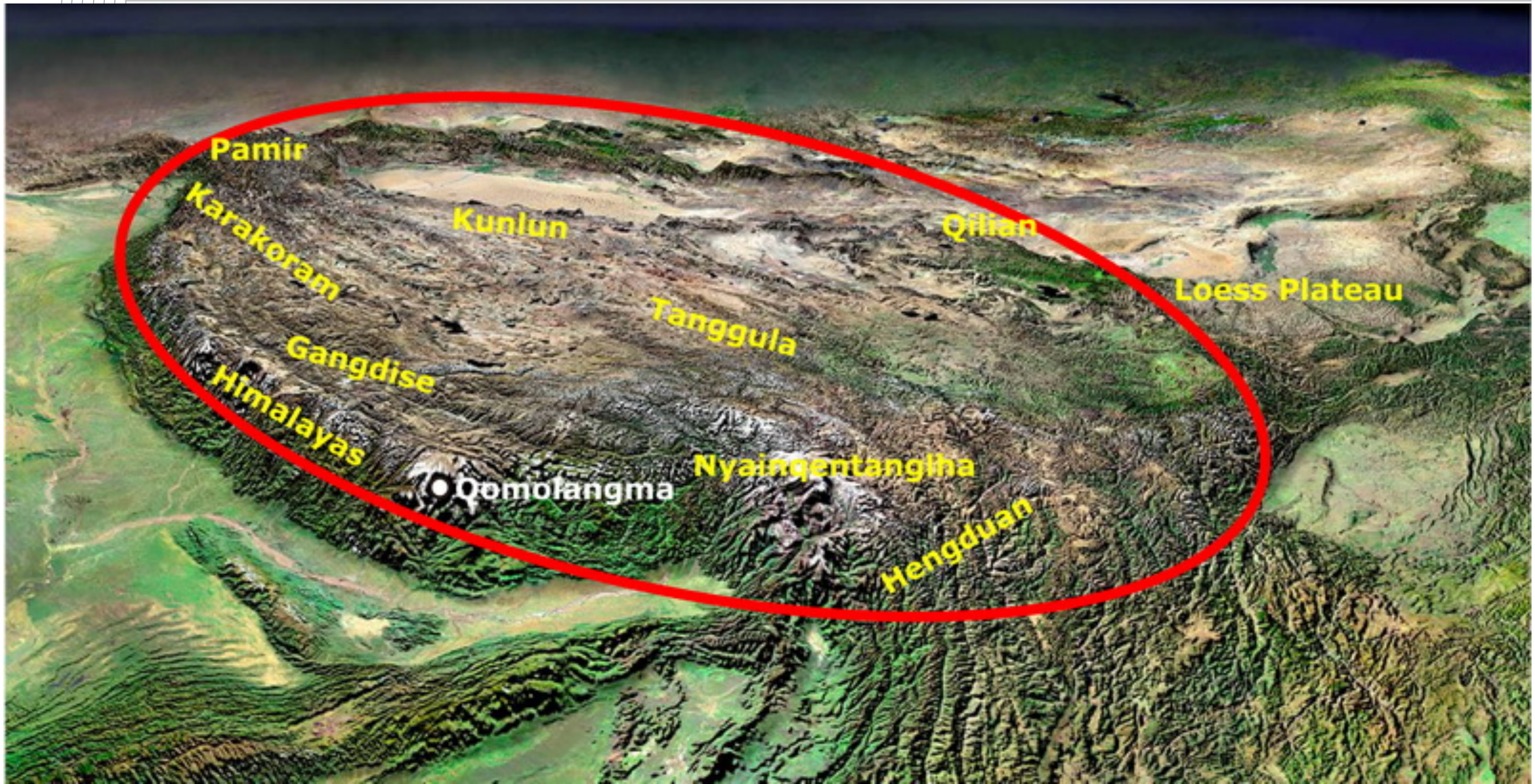
CASE STUDIES

Case 1: Implications of Climate Change for Tibet Plateau



- Implications of Climate Change for Tibet Plateau Roof of the World" - The Third Pole region
- 973 project "Earth observation for sensitive factors of global change: mechanisms and methodologies
- Impact of changes on carbon stocks have yet to be quantified

Case 2: carbon accounting for deforestation in China

Northeast China, from Beidahuang to Beidacang

From wild land to granary

- There are a large areas of forest and wetlands in the Northeast China before 1970's.

- However, land use in the Northeast China has changed greatly during the past 30 years, because farm production was strengthened.

- By using the GIS and RS, we can see that forest cover and grasslands have changed into cultivated land from 1976 to 2000.

- The conversion of forestry into other land-cover types could have potentially resulted in a loss of C.

- However, a lot of young trees also have been planted in reforestation area, which would fix a mount of C.

- ***Impact of changes on carbon stocks have yet to be quantified***

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Case 3: carbon accounting for afforestation in China

Three-North Shelter Forest Program

Green Great Wall Program

- In 1978, the Chinese Central Government decided to begin a tremendous afforestation project, the Three Norths Forest Shelterbelt program, in the Three Norths part of China (Northeast China, North China, and Northwest China).

- In accordance with the Chinese government's master plan, the Three—North program began in 1978 and will be finished in 2050. The project will take place in three stages (1978–2000, 2001–2020, and 2021–2050) following eight engineering schedules.

- The key goal of this program in the following decades was to improve forest coverage in arid and semiarid China from 5% to 15% by using this program as the primary method to combat desertification and to control dust storms.

- ***Impact of changes on carbon stocks have yet to be quantified***

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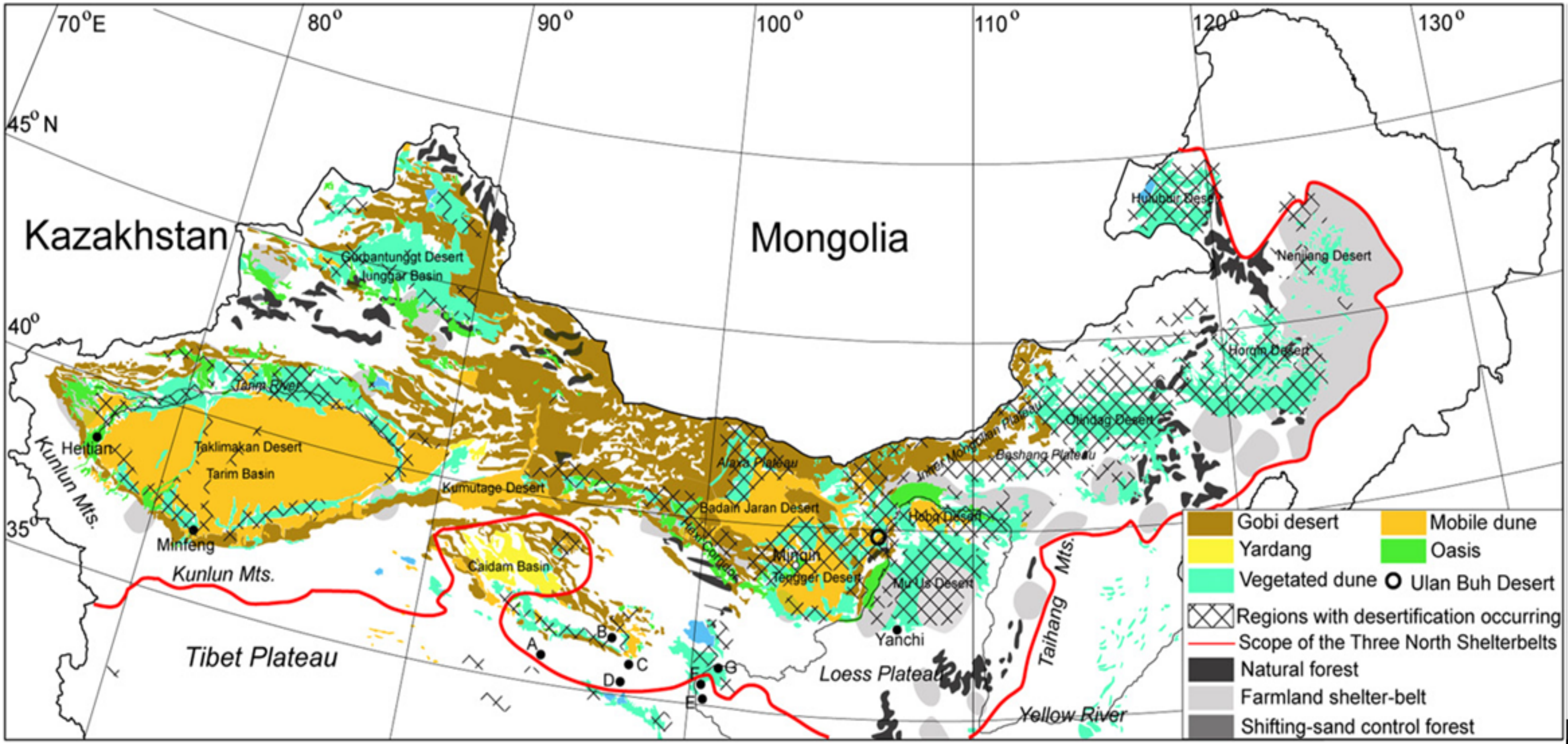
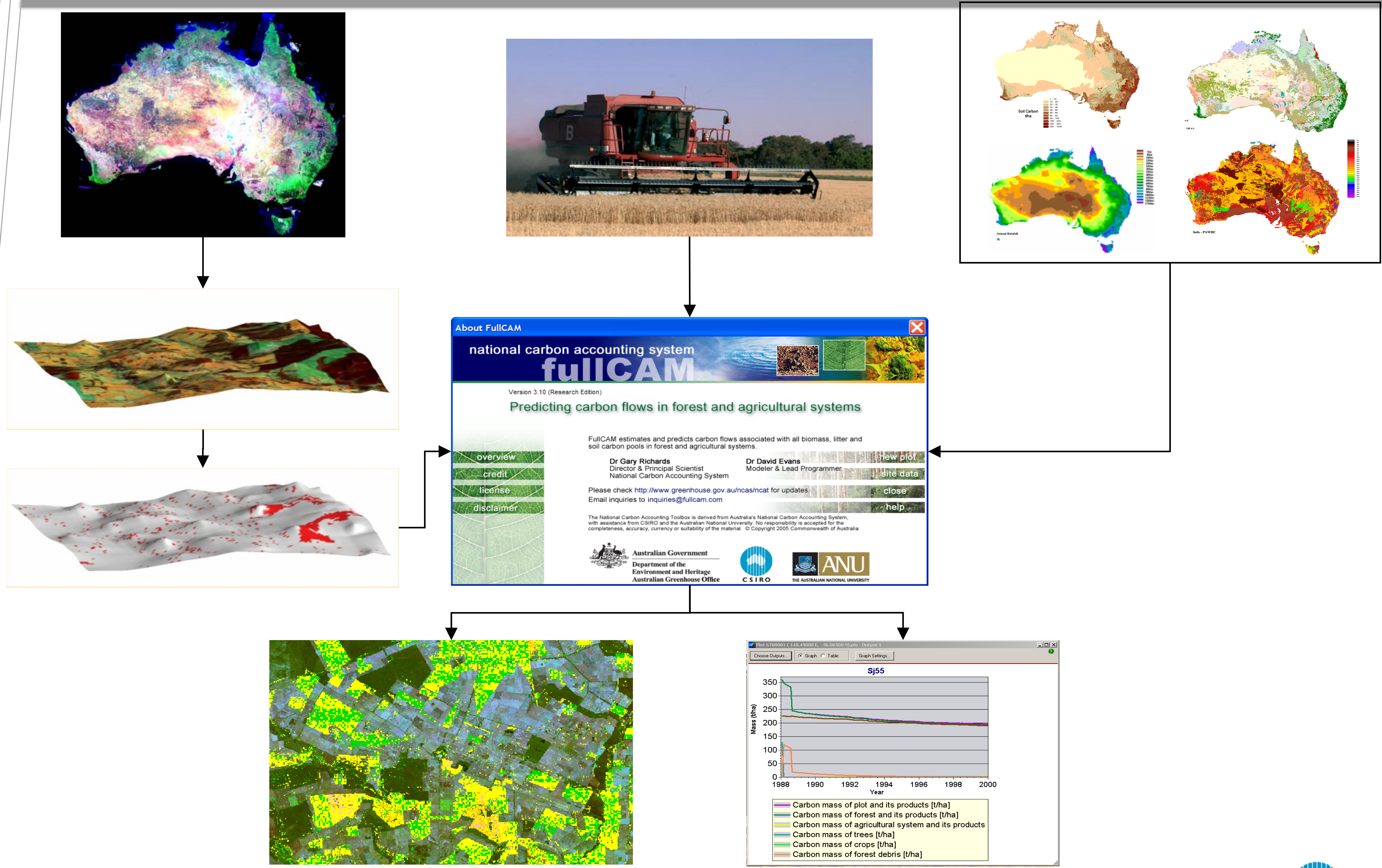


Fig.1.Map of the Three－North Forest Shelterbelt program

The framework of 3N Shelterbelt is configured during the past 30 years, and many large-scale afforestation areas have been completed, which is supposed to increase Carbon Sink Capacity, but there is a need to study and prove this.

Links to Australia's National Carbon Accounting System and Related R&D



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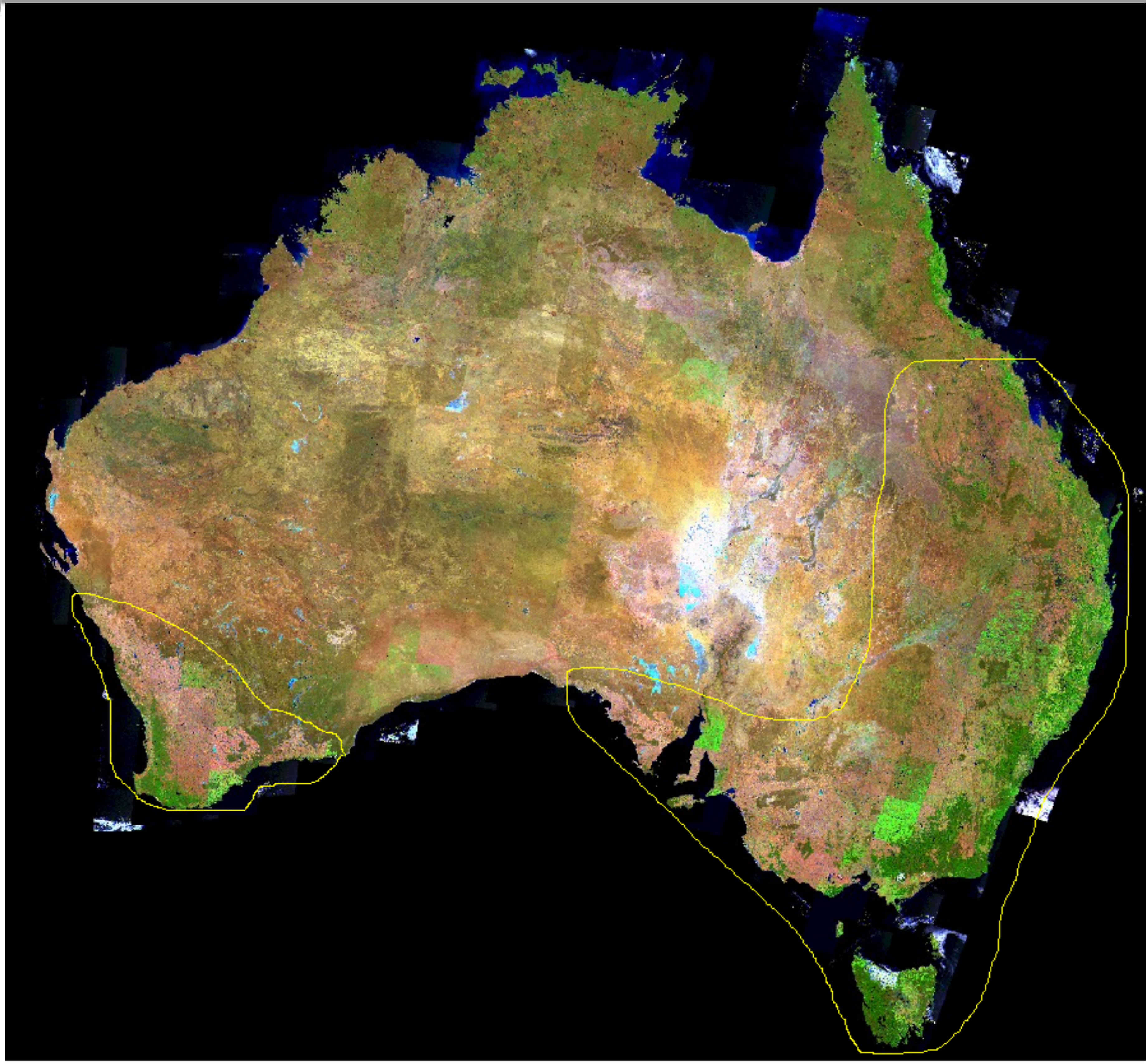
Initial Focus on Australia's intensive land use regions (C Acc.)



To date:

Deforestation

Reforestation

Afforestation

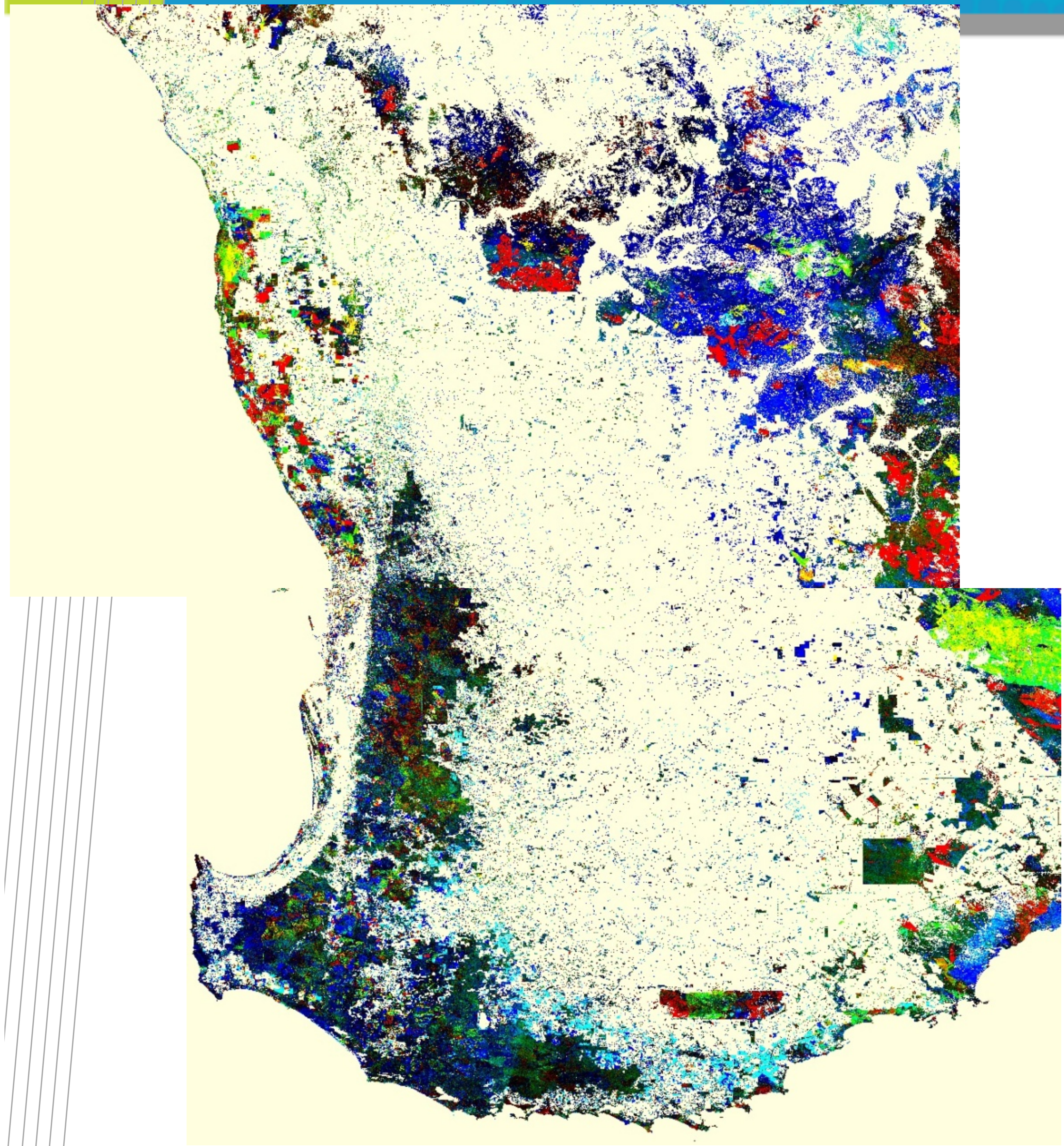
Agriculture

Proposed:

Arid zones

Native forests

R&D Activity- Developing Quantitative measures of Vegetation change from Remote Sensing



zone nr.	av. coeff.	Comments
1	-0.257863	(2346146 pixels)
2	-0.0951173	(7484578 pixels)
3	-0.303734	(2936614 pixels)
4	-1.26353	(2191692 pixels)
5	-1.0947	(461294 pixels)
6	-0.149041	(8925085 pixels)
7	0.698869	(9942958 pixels)
25	-0.810256	(3657918 pixels)
14	-1.02189	(3208444 pixels)
11	-1.33593	(31287253 pixels)
9	-3.53259	(3452446 pixels)
8	-1.0855	(4756846 pixels)
12	-0.93772	(2320383 pixels)
10	-3.18141	(833764 pixels)
101	0.445015	(1662918 pixels)

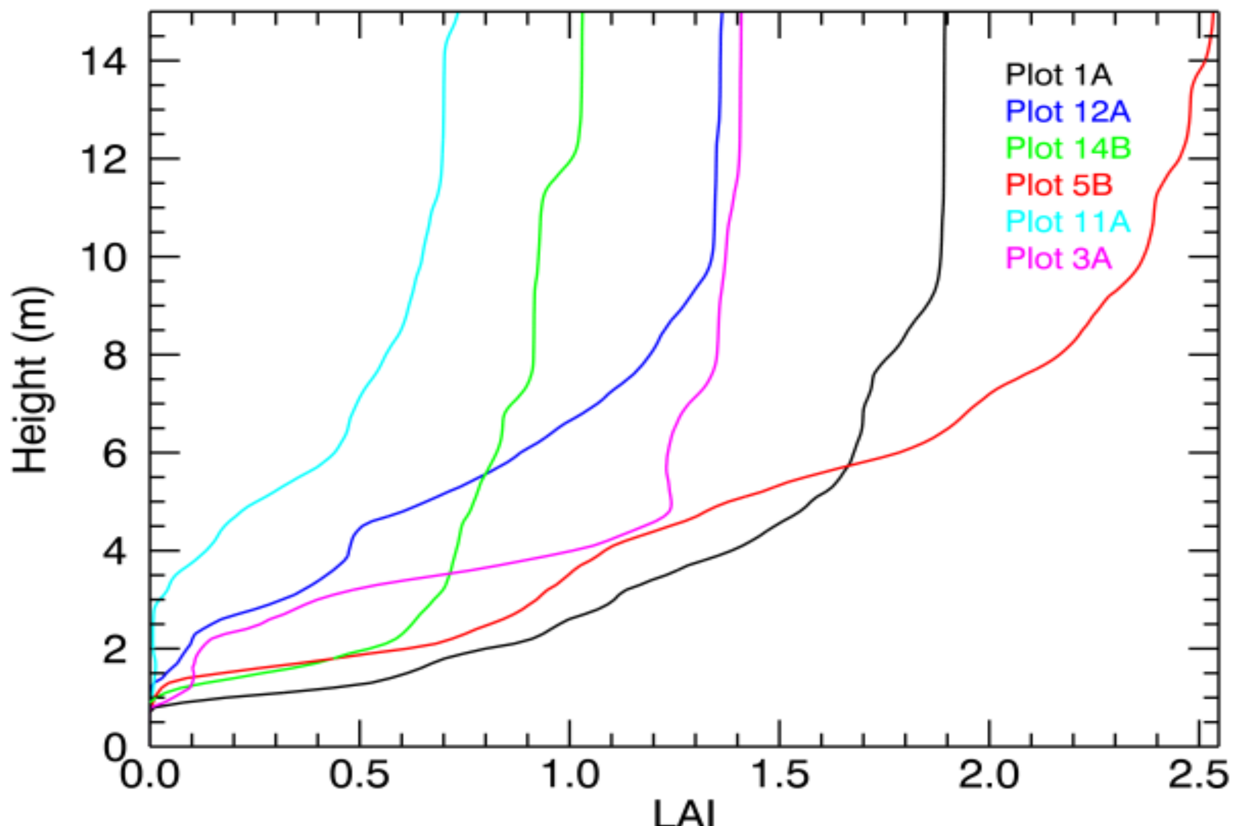
Interest in attributing these changes

Mixture of human induced and natural

Landsat scale useful for comparing and using management scale data

Tighter coupling of trends and models

Refining Biomass Allometrics & Models via Ground Lidar and Field Measurement



Grassland Biomass Validation

e.g. Crop Circle Use Kimberley Region (Exclosure)

Key Issues in Australia - China Projects

Tibetan Plateau
Climate change

Land-use change
and carbon accounting
for NE China

Assessing success
and C change
in three north
shelter forest
program

Improved carbon
accounting and
carbon loss risk
for Australia native forests

Assessing carbon
stocks in sparse
Vegetation
(shrublands, savannas,
regrowth)

Issues
Forest type and carbon accounting
Land-use change and GHG balance
Carbon yield curves
Forest condition and change detection
Disturbance intensity and frequency

Issues
Intra- and inter seasonal dynamics
Carbon stocks assessment
Soil carbon

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Joint Project Goals

This project will explore solutions to common goals and research issues identified as:

- Systems for Forest type and arid zone carbon accounting
- Estimating Land-use change and GHG balance
- Calibrating and estimating Carbon yield curves
- Forest and arid zone condition and change detection
- Disturbance intensity and frequency
- Estimating soil carbon

Leveraging off initiatives that have been identified as in national interest

Overall Context

- For China, in each of its cases, the impact of changes on carbon stocks have yet to be quantified.
- In Australia, the modelling framework and related parameters and estimates are less well developed for the rangelands.
- Both parties would benefit through scientific exchange on alternative methods and models in these arid environments, with the view to better understanding the underlying environmental processes, leading to new/improved systems to quantify the quantities of interest.

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Collaborations will Lead to New Knowledge generated for…

- The Tibetan Plateau for climate change response
- The NE China for Land-use change and carbon accounting
- Assessing success and C change in three north shelter forest program
- Improved carbon accounting and carbon loss risk for Australia native forests
- Assessing carbon stocks in sparse Vegetation (shrublands, savannas, regrowth)

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Project steps

[0-6] months: Planning workshop in China, and post workshop follow up, to:

• Project planning – further refinement and identification of which areas of potential application are best suited to initial exploration considering data availability.
• Identify data availability: forest, meteorology
• Review available remote sensing data platforms
• Examine forest types and associated inventory and other data used in model calibration
• Capability matching – for example CAS has advance RADAR remote sensing skills matched by complementary multi-temporal change detection remote sensing skill in CSIRO.
• Determine training opportunities for early career researchers in both CSIRO and CAS, specifically to explore if the interpretation and modelling skills in both nations can be enhance by periods of staff exchange.
• Explore avenues for third party funding to extend the collaboration into areas such as REDD.

[6-18] months: Data synthesis

• Data synthesis, collation and reporting as preparation for testing and comparison of multi-platform assessment of remote sensing of forest C stocks. This will follow a process of collection and compilation of on the ground vegetation and land-use change and condition data for identified sample regions and compilation and analysis of existing spatial information layers, including the tasking and acquisition of new data.

• As part of this process of data compilation and analysis staff exchanges will be organised to transfer skills and knowledge. A focus will be the training of early career researchers.

• Conduct a project workshop to 1) consider project progress and 2) showcase achievements to date with key potential stakeholders of research outcomes including the improvement in carbon accounting methods and remote sensing technologies.

• At this stage of the project collaborators will be capturing or actively engaged in developing third party funding opportunities in the area of carbon accounting and remote sensing arising from the enhanced capability.

[18-36] months: Field application, modelling and evaluation

• Field application and modelling in study areas verifying image interpretation and carbon model parameterisation.
• Evaluate potential for incorporation of new techniques, models and methodologies into Carbon Accounting systems of both countries.
• Production of publications on methodology and comparison of imagery interpretation
• Conduct a project completion workshop to 1) consider project achievements, 2) showcase achievements with key stakeholders of research outcomes, disseminate technologies.

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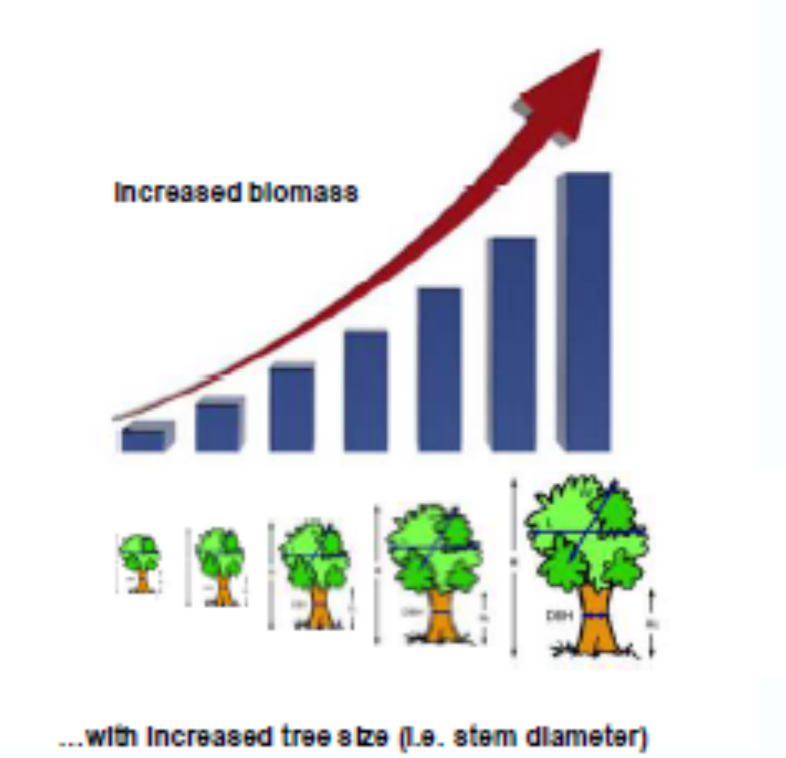
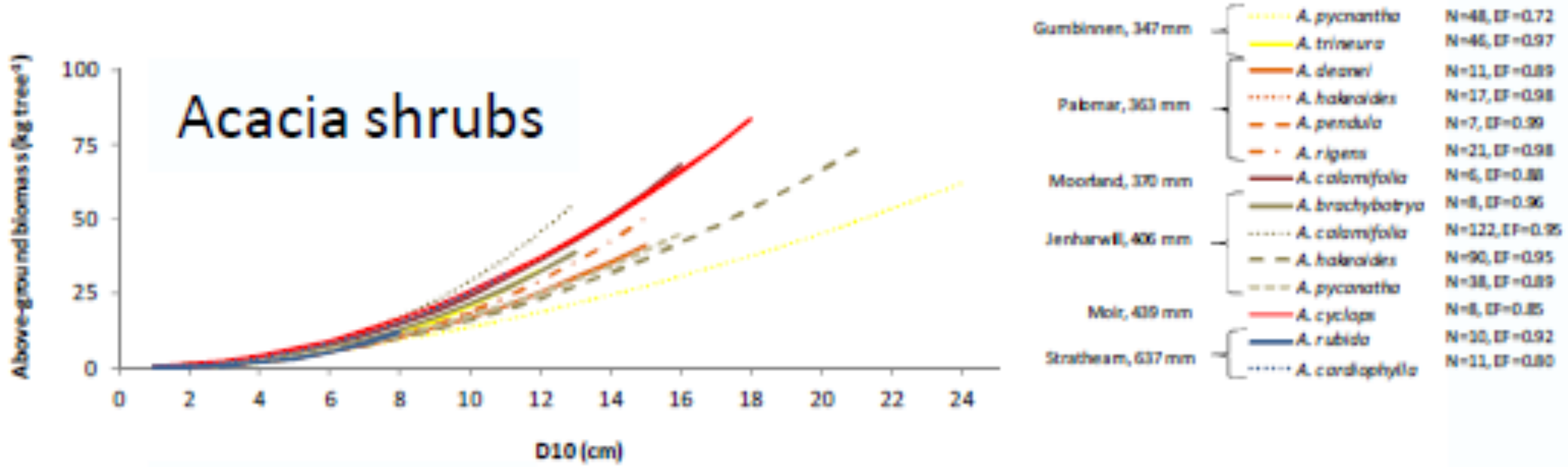
Destructive Sampling / Model Calibration – Victoria Australia 2011 (Keryn Paul *et. al* CSIRO , Dailiang Peng CAS)

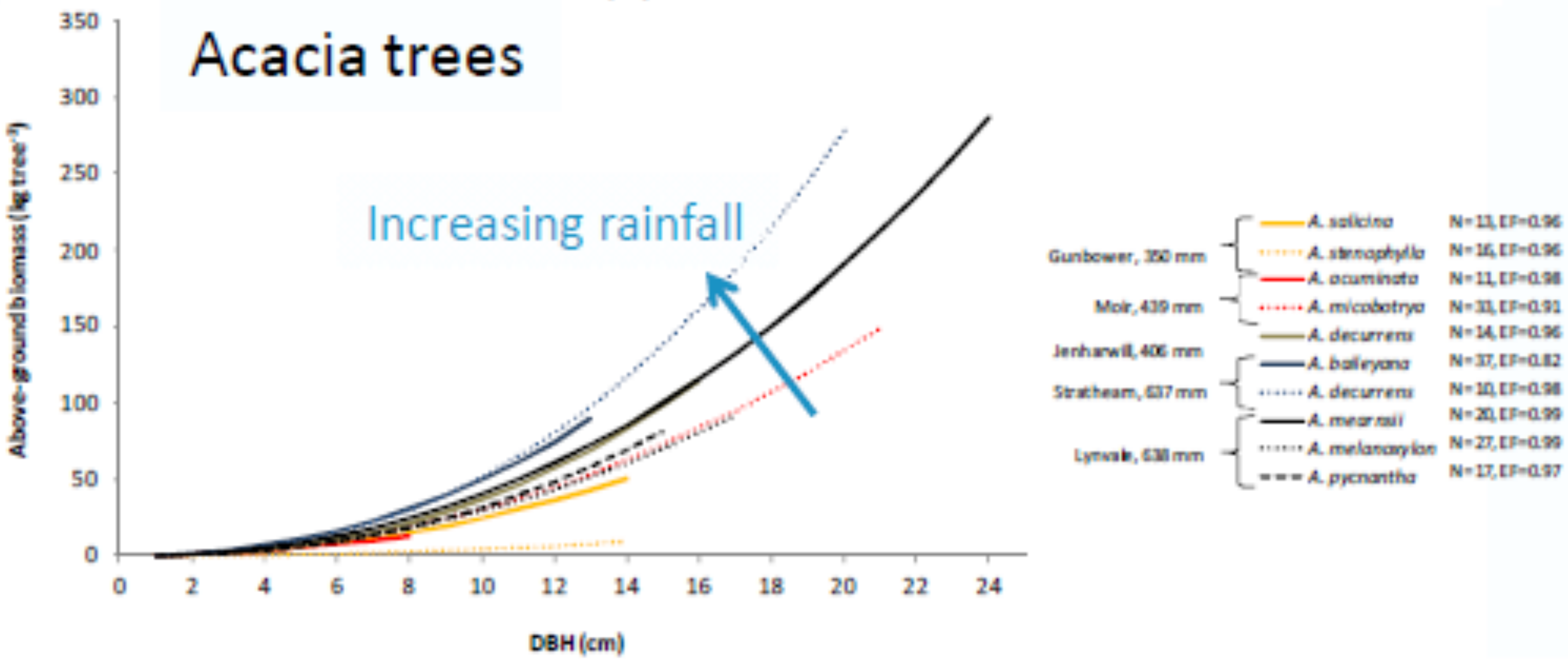
Allometrics

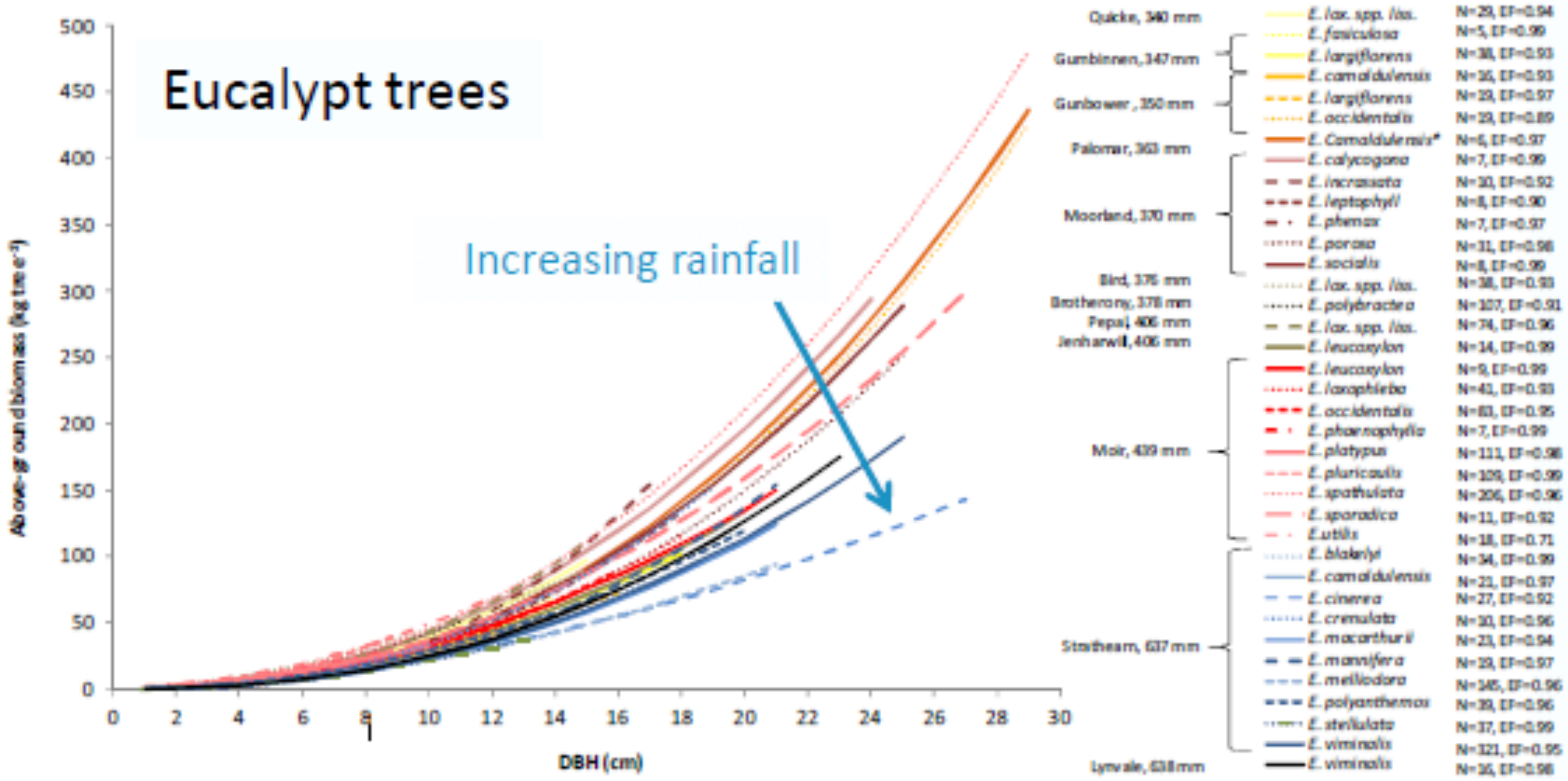
Differences between:

- Life-forms
- Species
- Rainfall zones



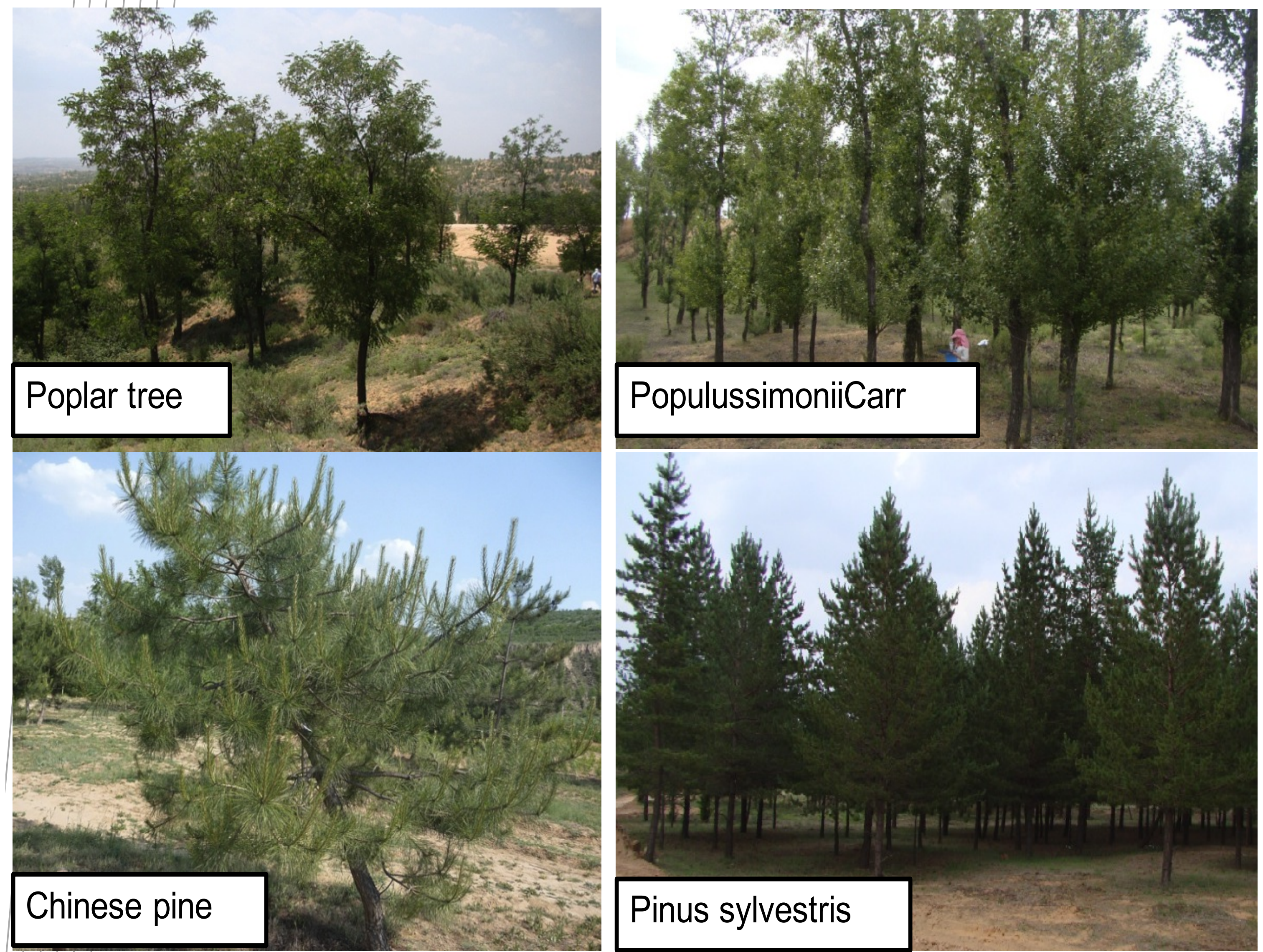


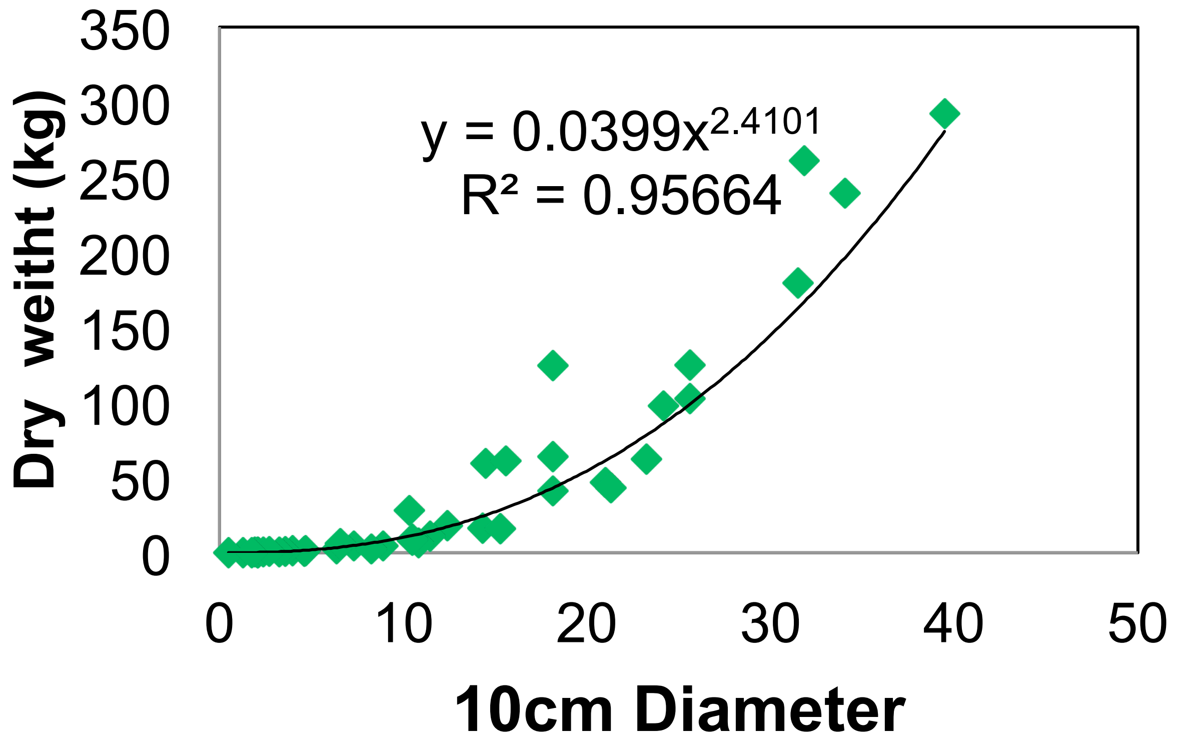


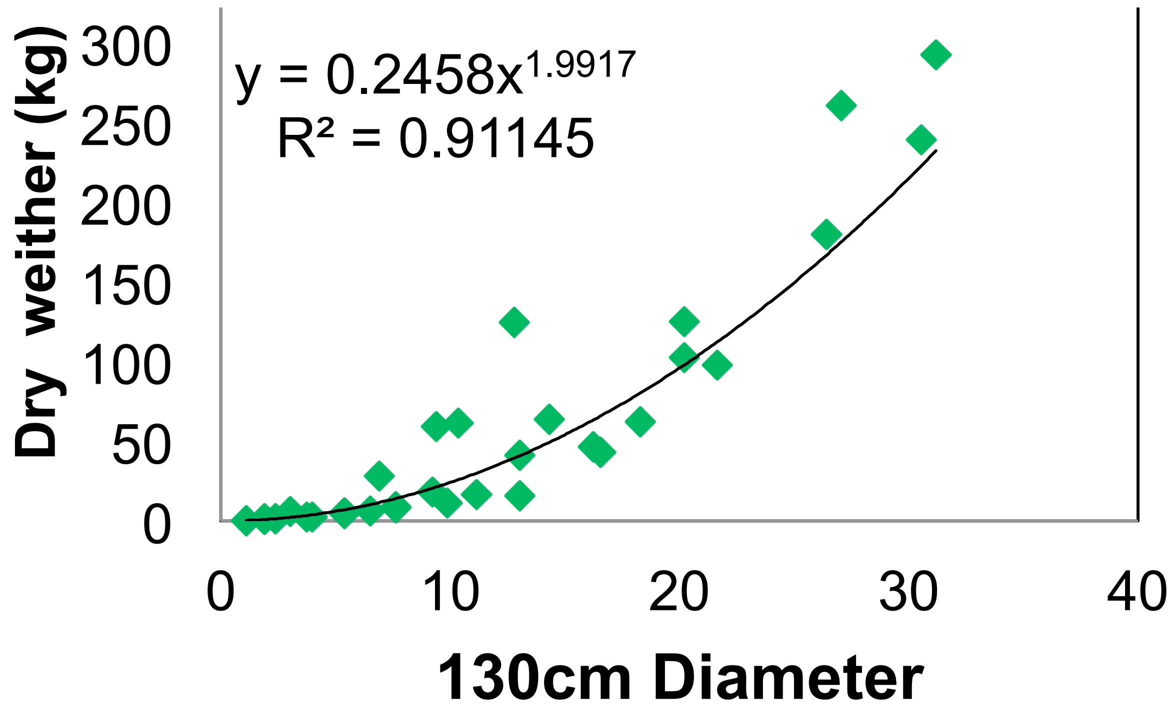


Biomass harvesting Experiment (Liangyun *et. al*)

Relationship between above ground biomass (AGB) and diameter, four species together (PopulussimoniiCarr, poplar tree, Chinese pine, and Pinus sylvestris).

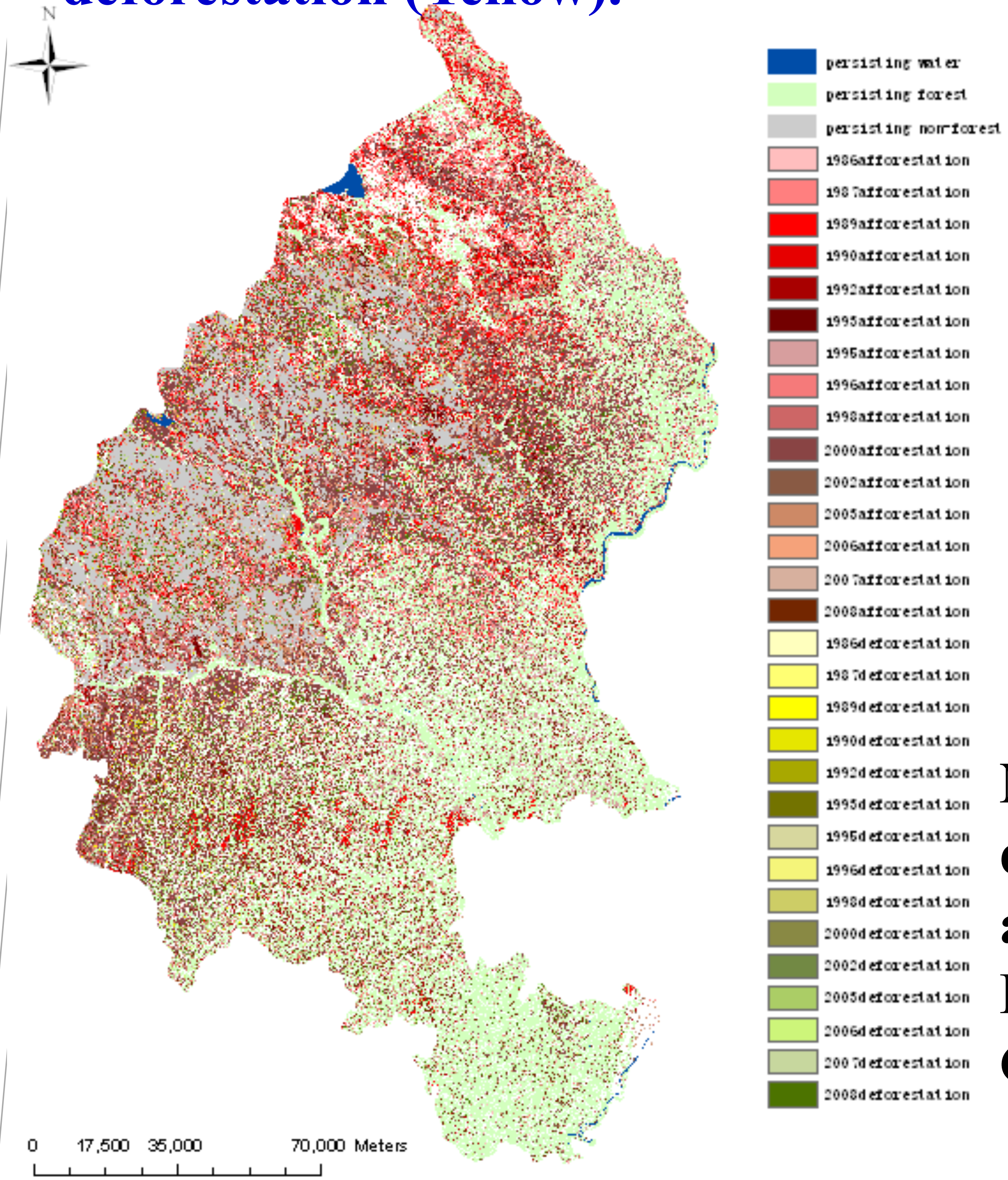


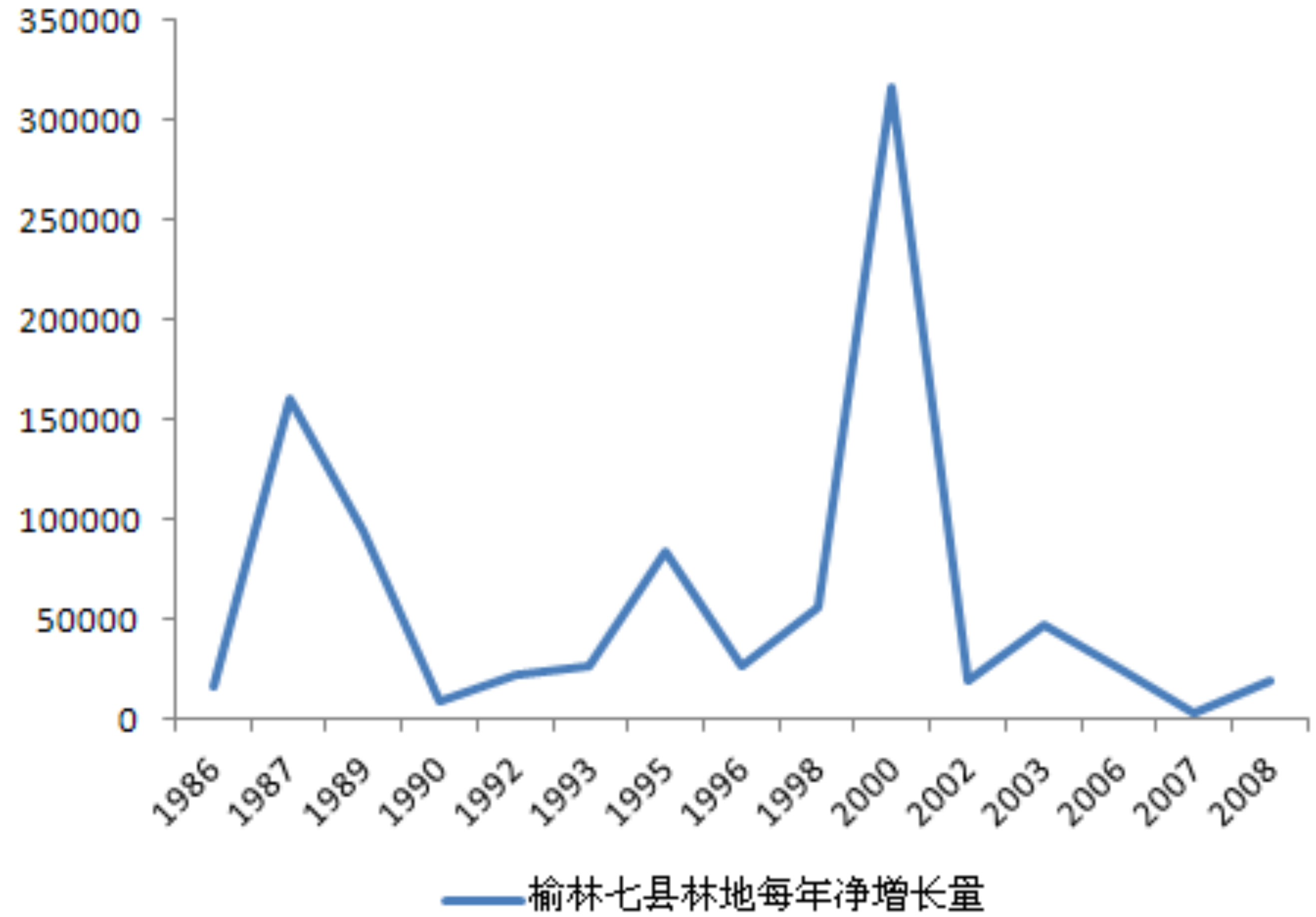




Forest changes mapping in China

Forest cover changes from 1986 to 2008, afforestation (Red) and deforestation (Yellow).





Net increase of forest area in Yulin district, Shanxi Province, China
a key part of Three-North Shelter Region, contributed to the famous Green Great Wall Project

Complementary CSIRO Activities and links to ABCC (part of CSIRO's Sustainable Agriculture Flagship)

Perth

- Liangyun Liu is on research exchange in Perth Australia. November-January 2012/2013
- Comparison of existing CAS and CSIRO RS methods
- Experiments in combined RS methods
- Project meetings (Remote Sensing & Biomass Modelling)

Canberra/Brisbane

- Co-Lead on GEO FCT – GFOI
- GEO Ecosystems map for Australia (via CSIRO & TERN)
- GEO GLAM (via ABARES & CSIRO) – Australia launching sub-task on Rangeland and Grassland Monitoring

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