Forest Resource Mapping
Đak Ang commune,
Kontum, Vietnam

Geoff Griffiths
Rudi Kohnert
Đặng Thanh Liêm
Tran Viet Dong

This presentation has been produced with the assistance of the European Union, although the views expressed are the sole responsibility of Fern and can in no way be taken to be the views of the European Union.

Objectives

Gain insights into the relationships between

- Official data on forest land designation / function (are the categories fit for purpose?)
- Actual forest quality and density of cover compared with official data and paper maps
- How different forest land areas are managed, and by whom

Structure of presentation

Section 1: Methodology

(classifying satellite imagery into land cover types)

Section 2: Comparing *satellite* land cover with *official* land cover maps

Does official data of land cover reflect actual land cover?

Section 3: Comparing tree cover and designated forest function maps

to assess if so-called 'protected Forest' is well protected
or whether 'production forest' is productive, degraded or put to other use

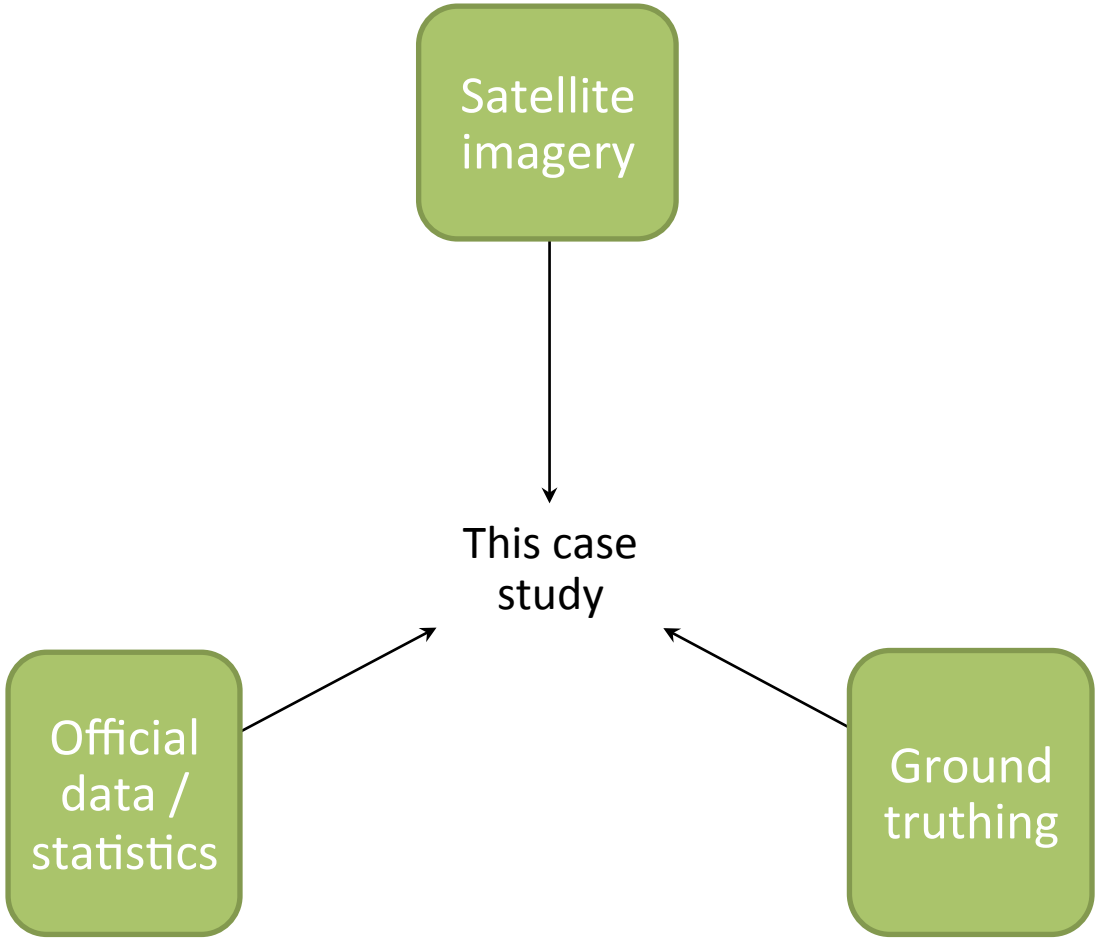
Section 4: Comparing land allocation and forest cover maps

Do households manage forest land any better than other land managers?

Section 5: Further potential of GIS

(household level social data, Agent Orange impact…)

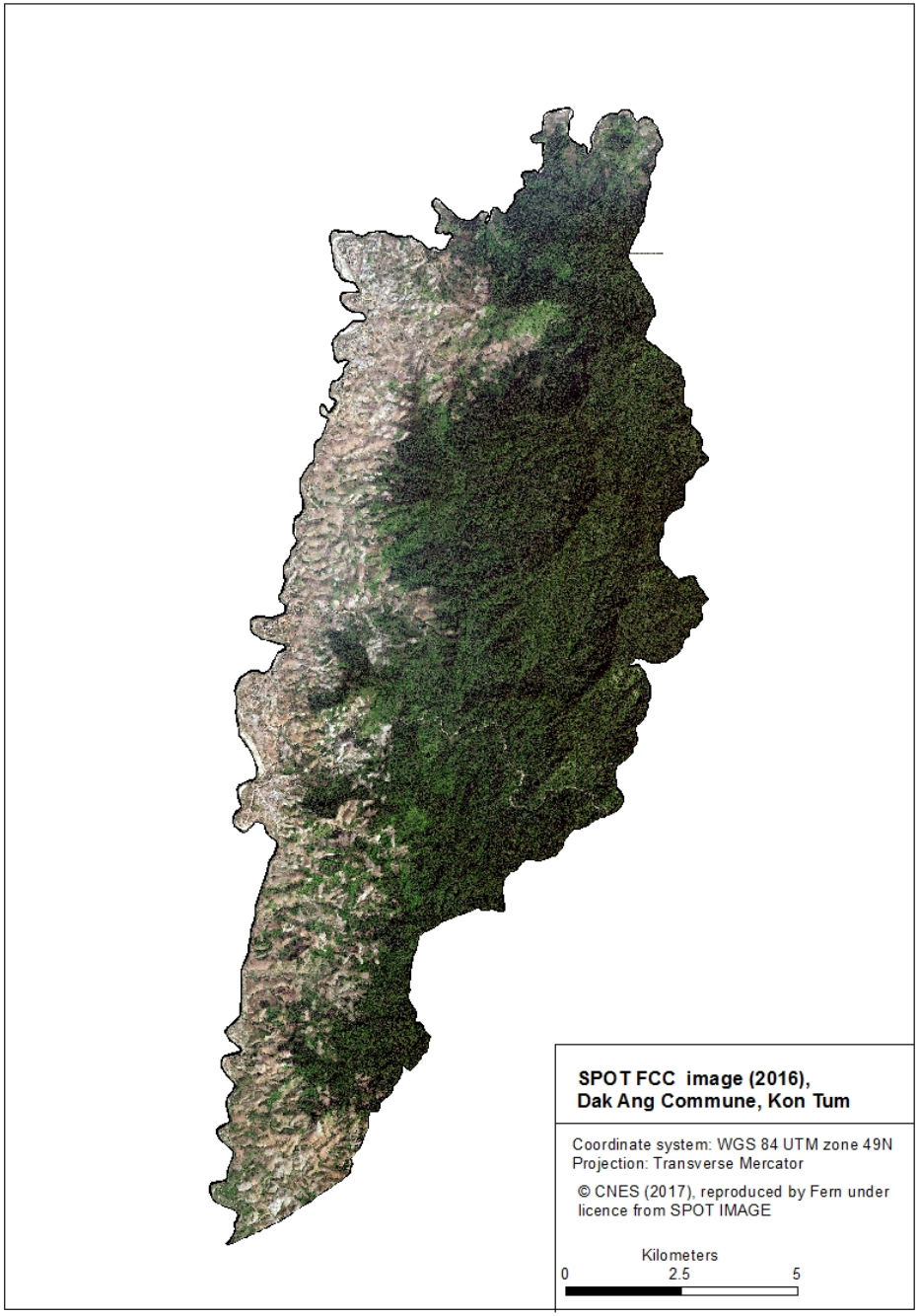
1. METHODOLOGY



Satellite image classification - STEP 1 – satellite image

A high resolution SPOT[1] satellite image (right) acquired in February 2016 was classified into the following forest/land cover types:

- **Dark green**: forest
- **Light green**: plantations / tree crops and shrub / grassland
- **Grey**: agriculture/bare land



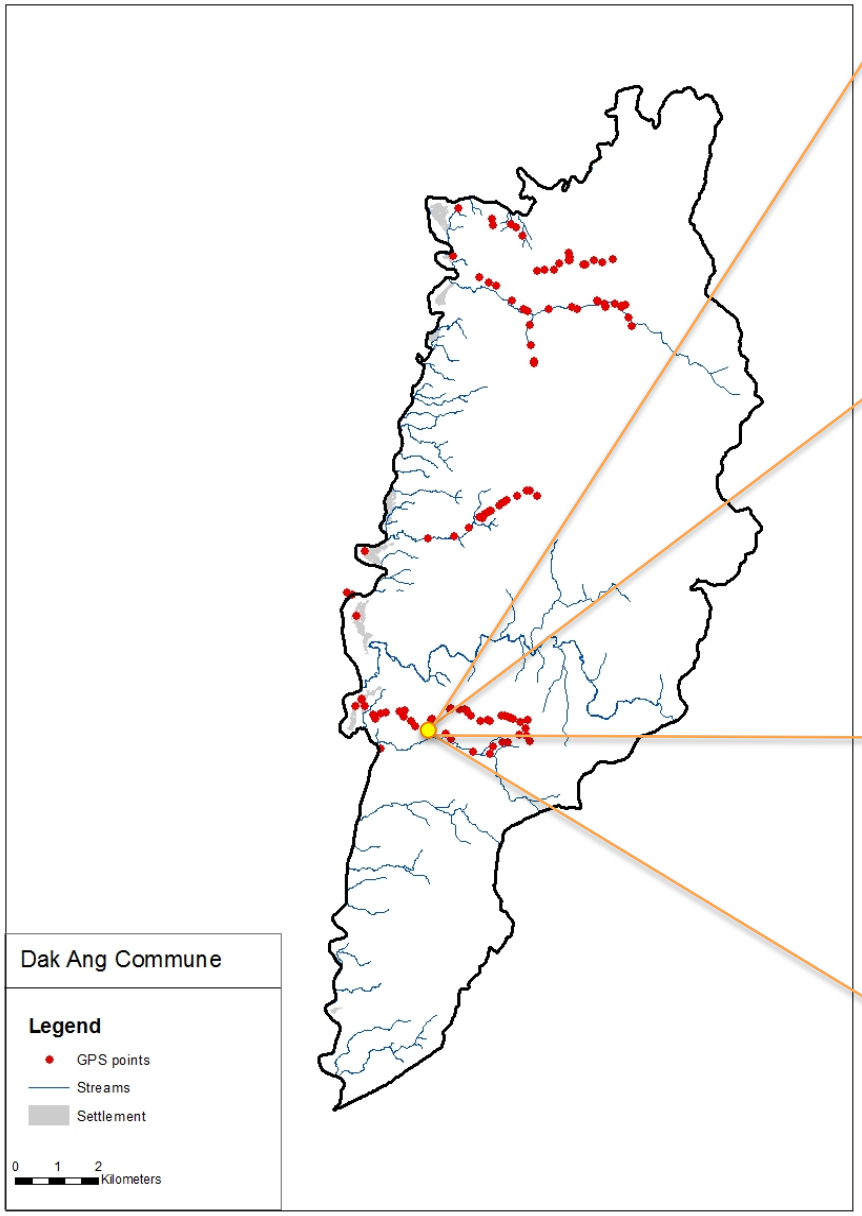
[1] *Satellite Pour l'Observation de la Terre*

Satellite image classification

STEP 2 - Ground data collection

GPS waypoints and photos were collected in the field, August 2016.

The ground data were used to develop and validate the satellite image classification



Satellite image classification

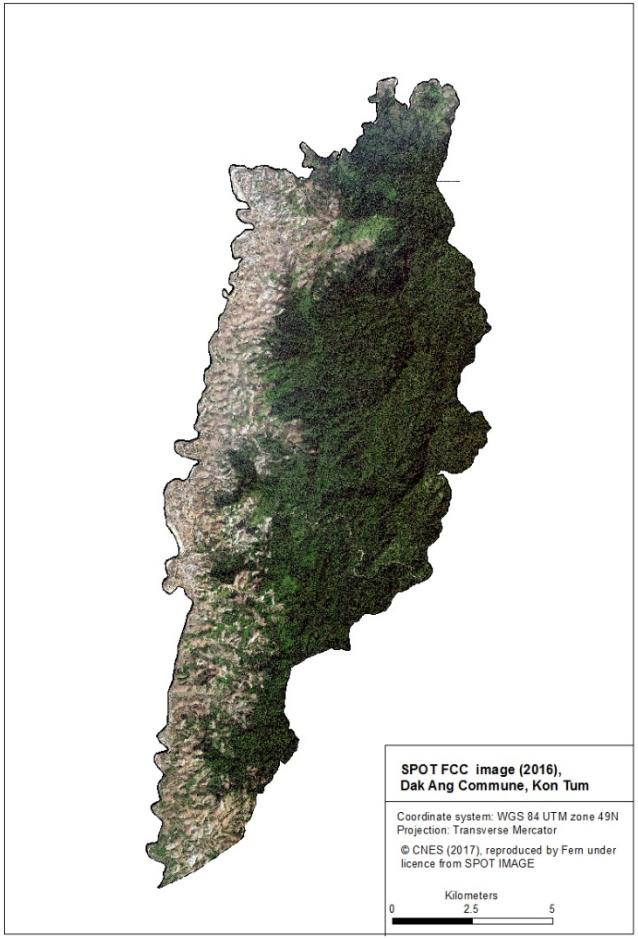
STEP 3 - A resulting typology of land cover from classifying the satellite imagery

Based on the GPS waypoints and associated ground photos, a typology was assigned to 7 land cover classes:

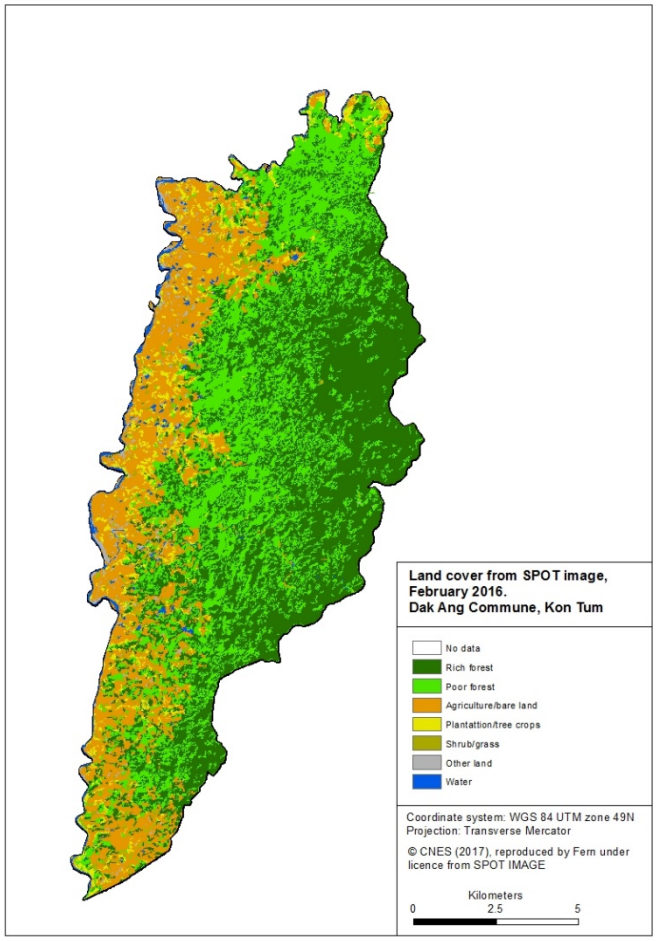
- **Rich/'medium' forest** (closed canopy forest)
- **Poor/'recovery' forest** (more open, disturbed forest)
- **Agriculture/Bare ground**
- **Plantation/tree crops**
- **Shrub/grassland**
- **Other land** (including roads, buildings)
- **Water** (principally rivers)

Satellite image classification – STEP 4: Resulting map

Original satellite image



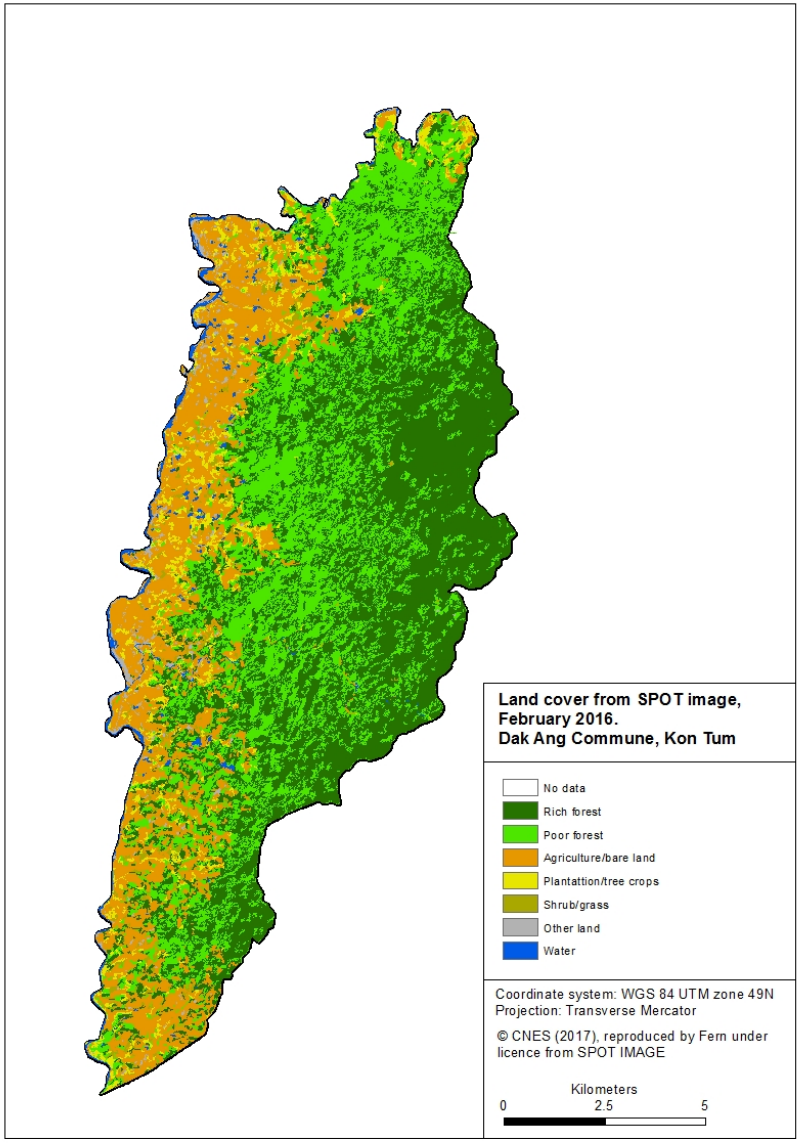
Resulting classified land cover map



Satellite image classification - What this tells us already

Rich/medium forest	Poor/recovery forest	Agriculture/bare land	Plantation/tree crops
40%	30%	21%	5%

- About 70% of the commune has some form of tree cover
- Of this
  - Rich/medium forest covers a greater area (40%) than
  - Poor/recovery forest (30%)
  - Less than a quarter of the commune is bare land or land set aside for agriculture



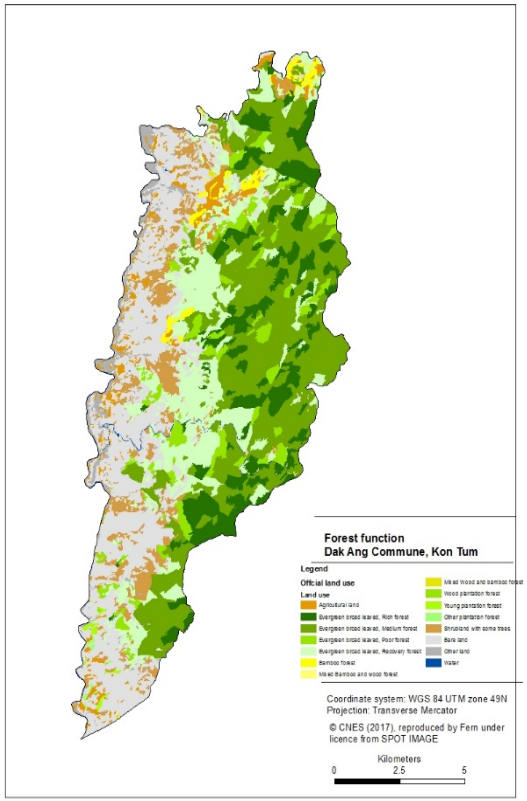
2: COMPARING SATELLITE LAND COVER MAP WITH OFFICIAL LAND COVER MAP

(Does official data of land cover reflect actual land cover?)

Land cover – satellite image vs official data

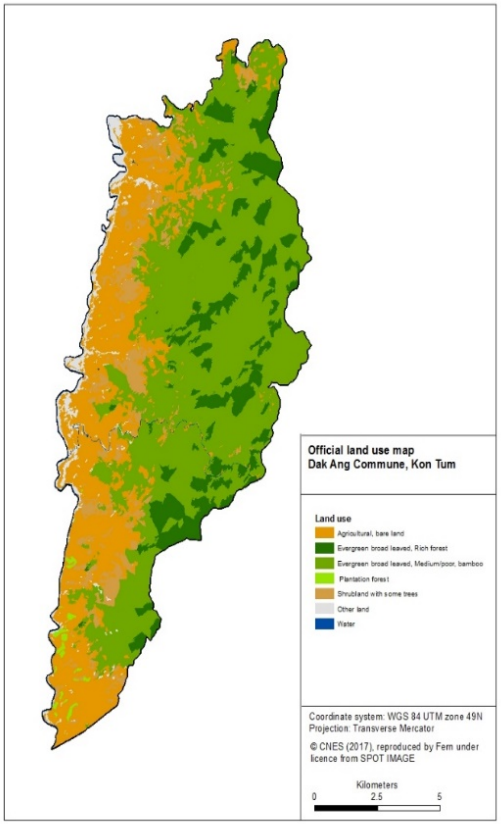
STEP 1: Simplifying the original *official* land cover map (via 'look-up table') to convert the official typology to the same typology used for satellite land cover maps

original official land cover map



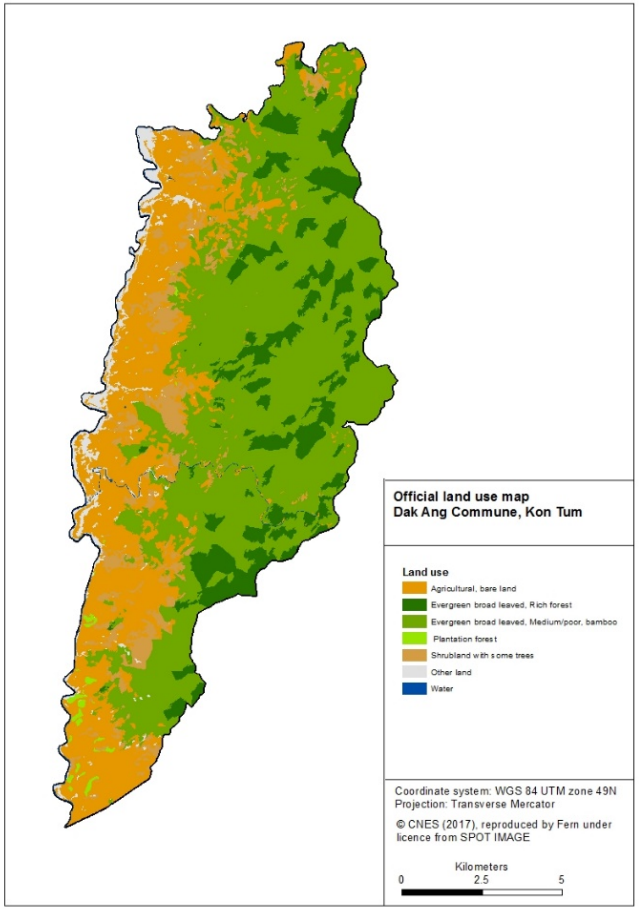
Official typology	Satellite typology
Evergreen broadleaved, Rich forest	Rich/medium forest
Evergreen broadleaved, Medium forest	Medium/poor forest
Evergreen broadleaved, Poor forest	
Evergreen broadleaved, Recovery forest	
Bamboo forest	
Mixed Bamboo & Wood forest	
Mixed Wood & Bamboo forest	
Shrubland, with some tree cover	Shrub/grass
Plantation forest, mature	Plantation/tree crops
Plantation forest, young	
Other Plantation forest	
Agricultural land	Agricultural land
Bare land	
Other land	
Water	Water

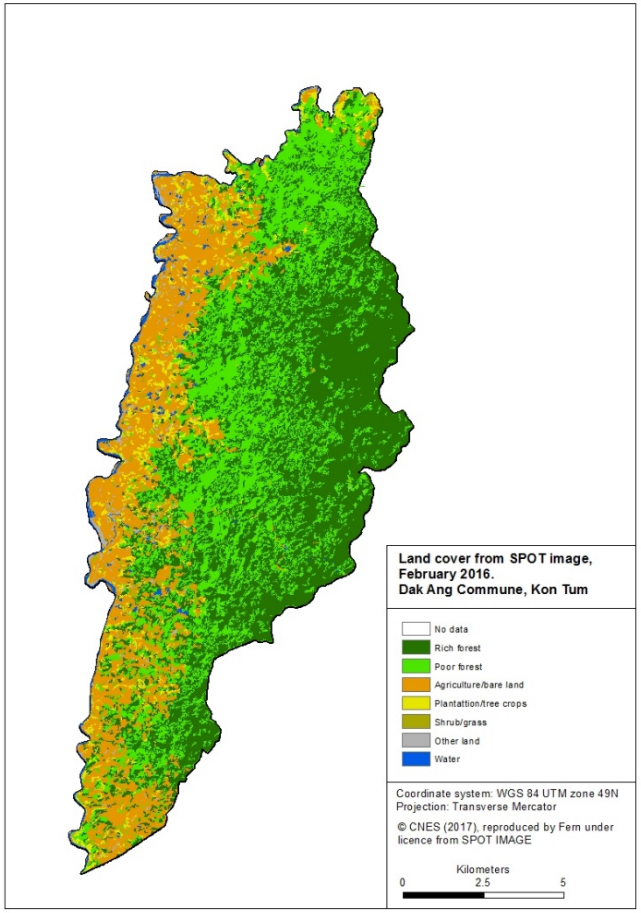
simplified official land cover map



Land cover – satellite image vs official data

STEP 2: Taking the simplified official land cover map and juxtaposing onto the classified satellite map …





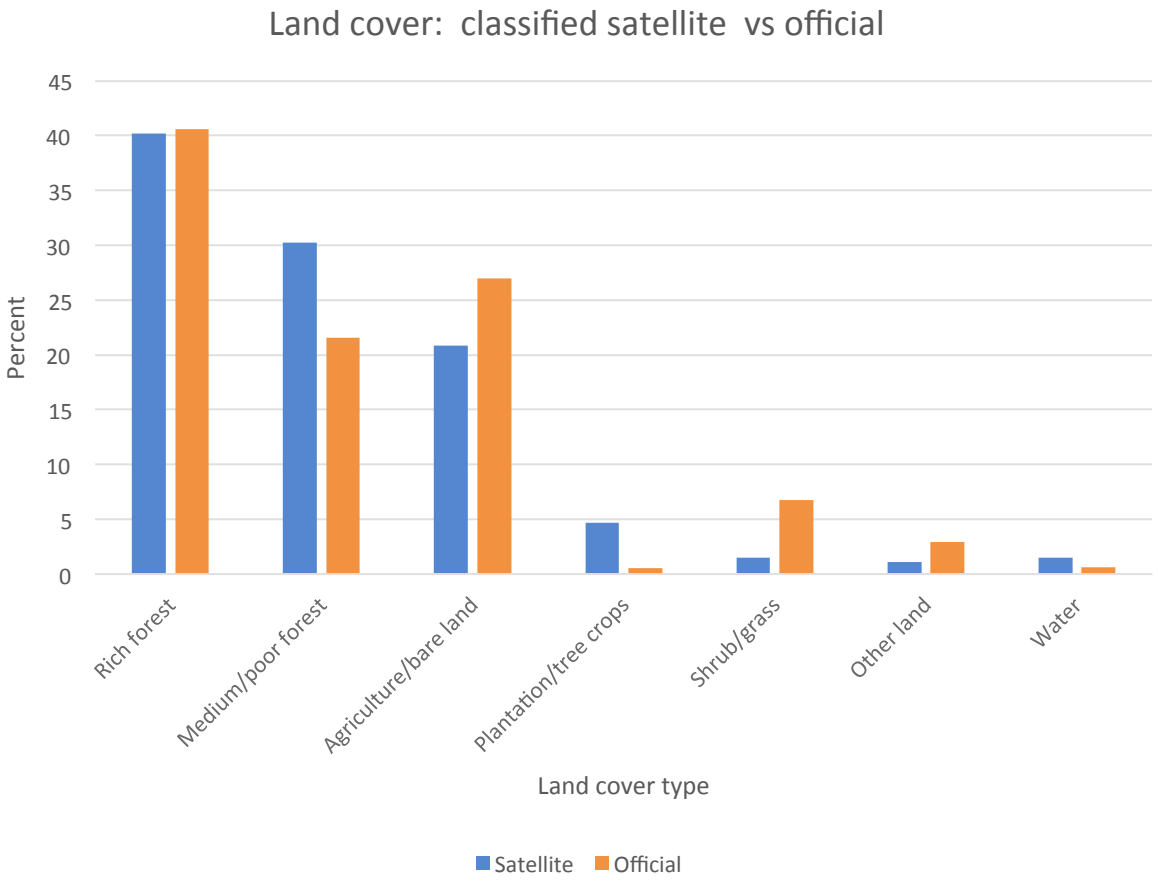
Simplified official land cover map

Classified satellite land cover map

Land cover – satellite image vs official data

STEP 3: resulting difference between official data and satellite land cover image

From putting together the 2 maps of land cover (official and satellite), we get the following results illustrating the discrepancies between official and satellite data

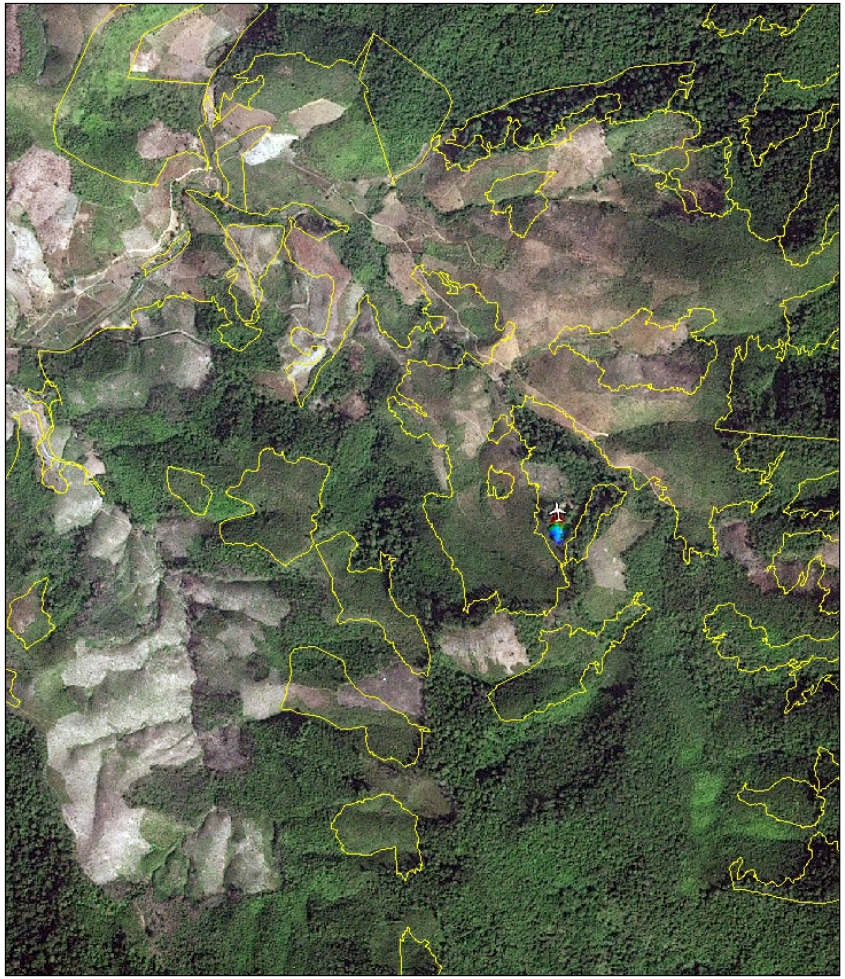


Land cover category	Satellite (percent of total)	Official (percent of total)
Rich forest	40.17	40.57
Medium/poor forest	30.24	21.57
Agriculture/bare land	20.81	26.97
Plantation/tree crops	4.69	0.57
Shrub/grass	1.49	6.78
Other land	1.12	2.90
Water	1.48	0.65

Land cover – satellite image vs official data

Zoomed image of official land cover over the raw satellite map.

Official land cover data (yellow lines) superimposed onto the satellite image to show the discrepancies between official information and satellite data



3: COMPARING TREE COVER WITH OFFICIAL DESIGNATED FOREST FUNCTION

Is ‘Protected Forest’ well protected everywhere?

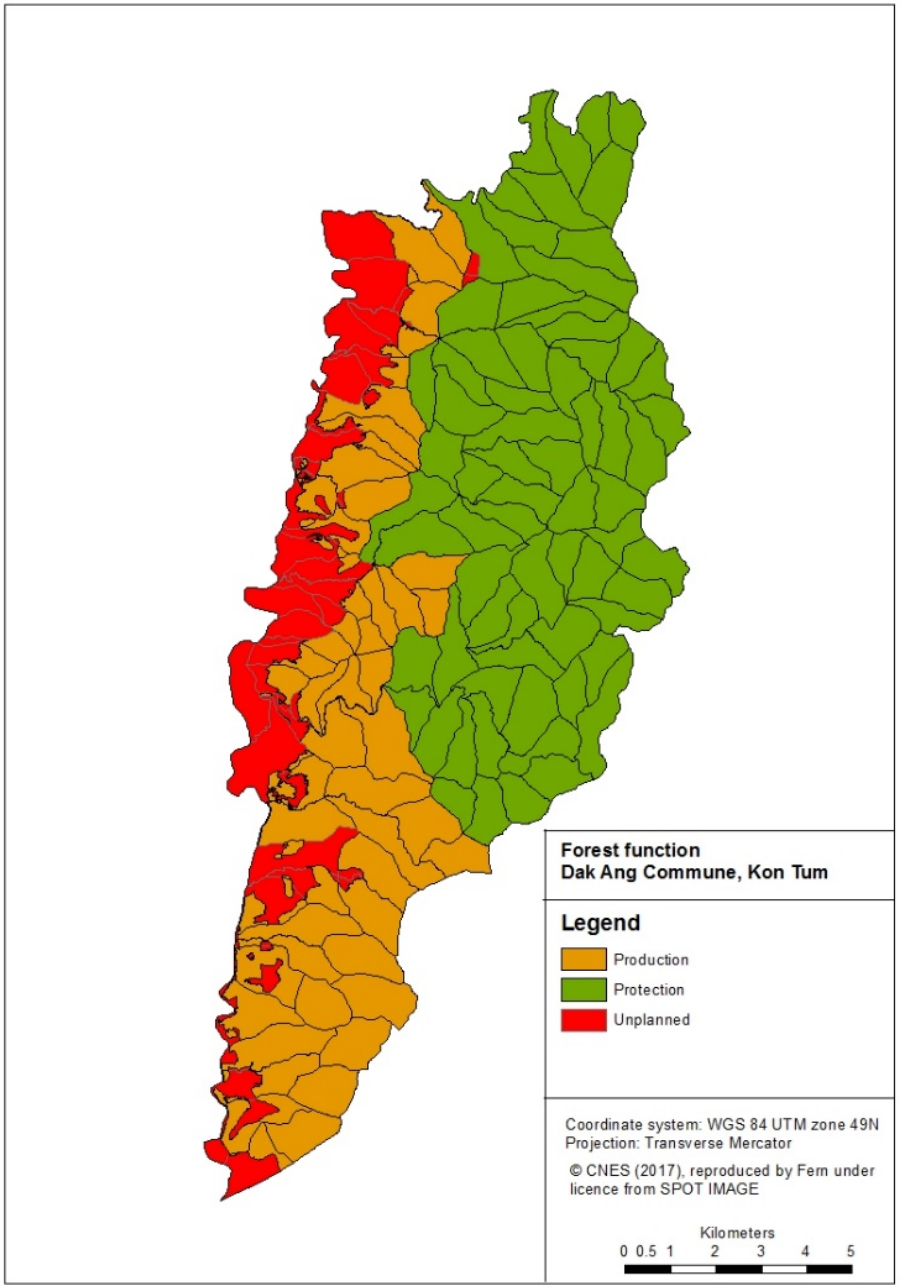
Is ‘Production forest’ actually forest at all, and if so, or whether it is productive, degraded or put to other use?

Comparing tree cover and designated forest function

STEP 1: Introducing forest *function*

Forest function is how the government designates forest zones for different uses:

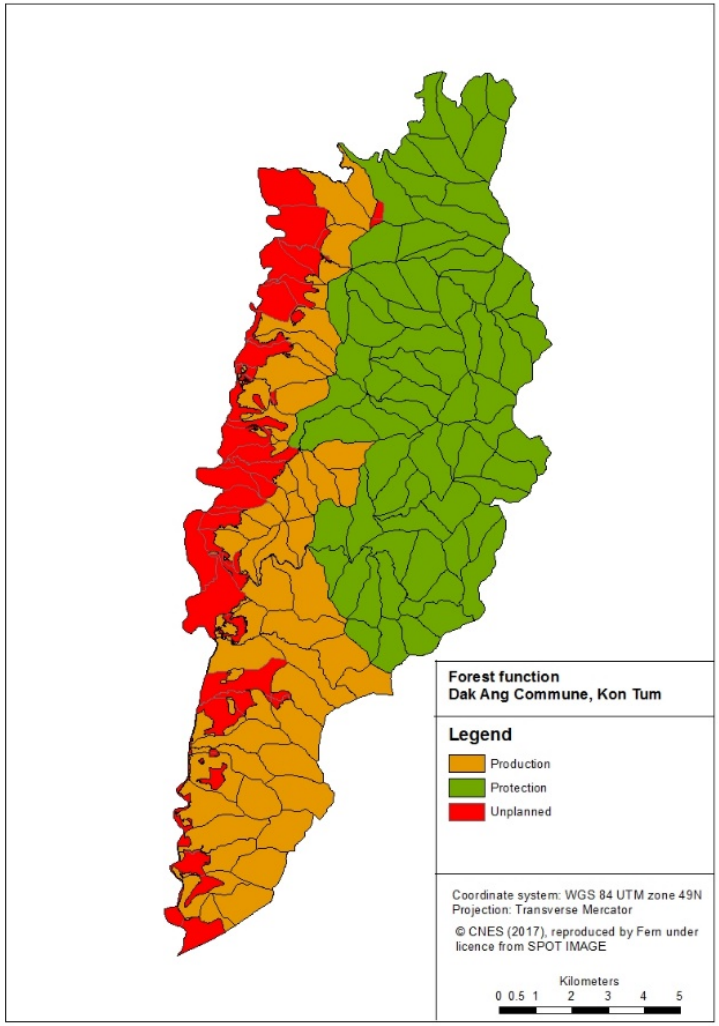
- Production forest
- Protection forest
- Unplanned

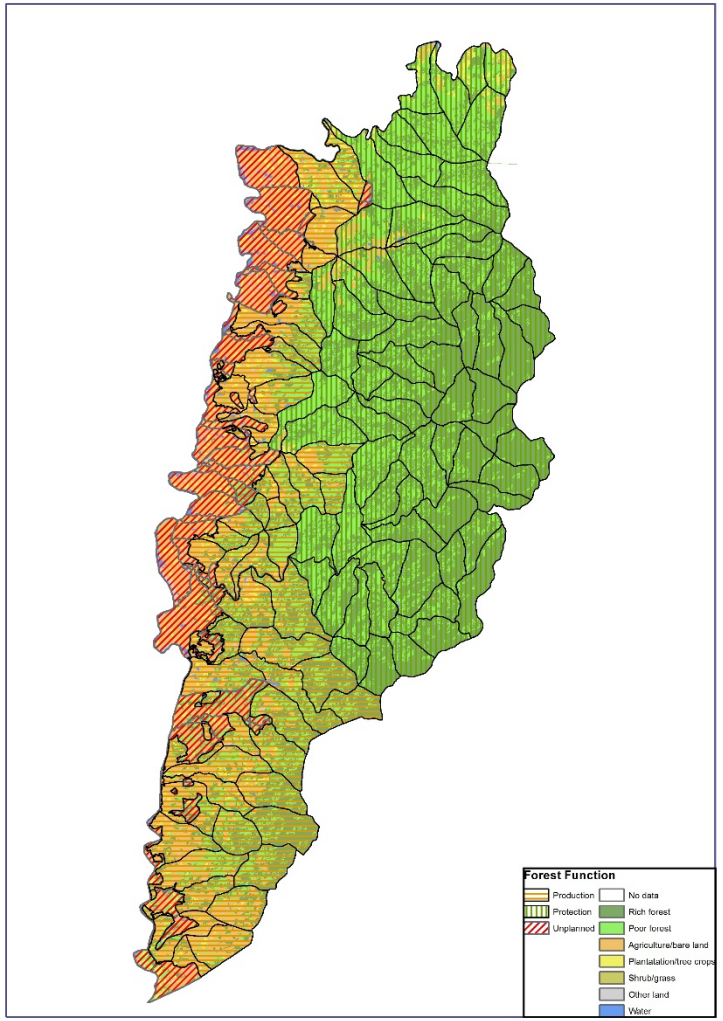


Comparing tree cover and designated forest function

STEP 2: Comparing forest function to the satellite land cover map

When we overlay the forest function map onto the satellite land cover map, we get a sense of the extent to which the supposed function of the forest matches the actual quality of the forest in that same area…





Comparing tree cover and designated forest function

What does this tell us?

	Rich / medium forest	Poor / recovery forest	Agriculture / bare land
Production	31	28	31
Protection	56	39	2
Unplanned	7	8	59

When we juxtapose the map of forest functions with the map of forest quality (land cover) we see that:

- Almost 40 % of 'protected forest' is in poor condition or recovering and 2% is being used for agriculture or is bare land
- Almost a third of what is designated as 'production forest' is actually agriculture, and of the rest almost another third is poor forest or recovering forest

4: COMPARISON OF SATELLITE LAND COVER WITH WHO USES THE LAND

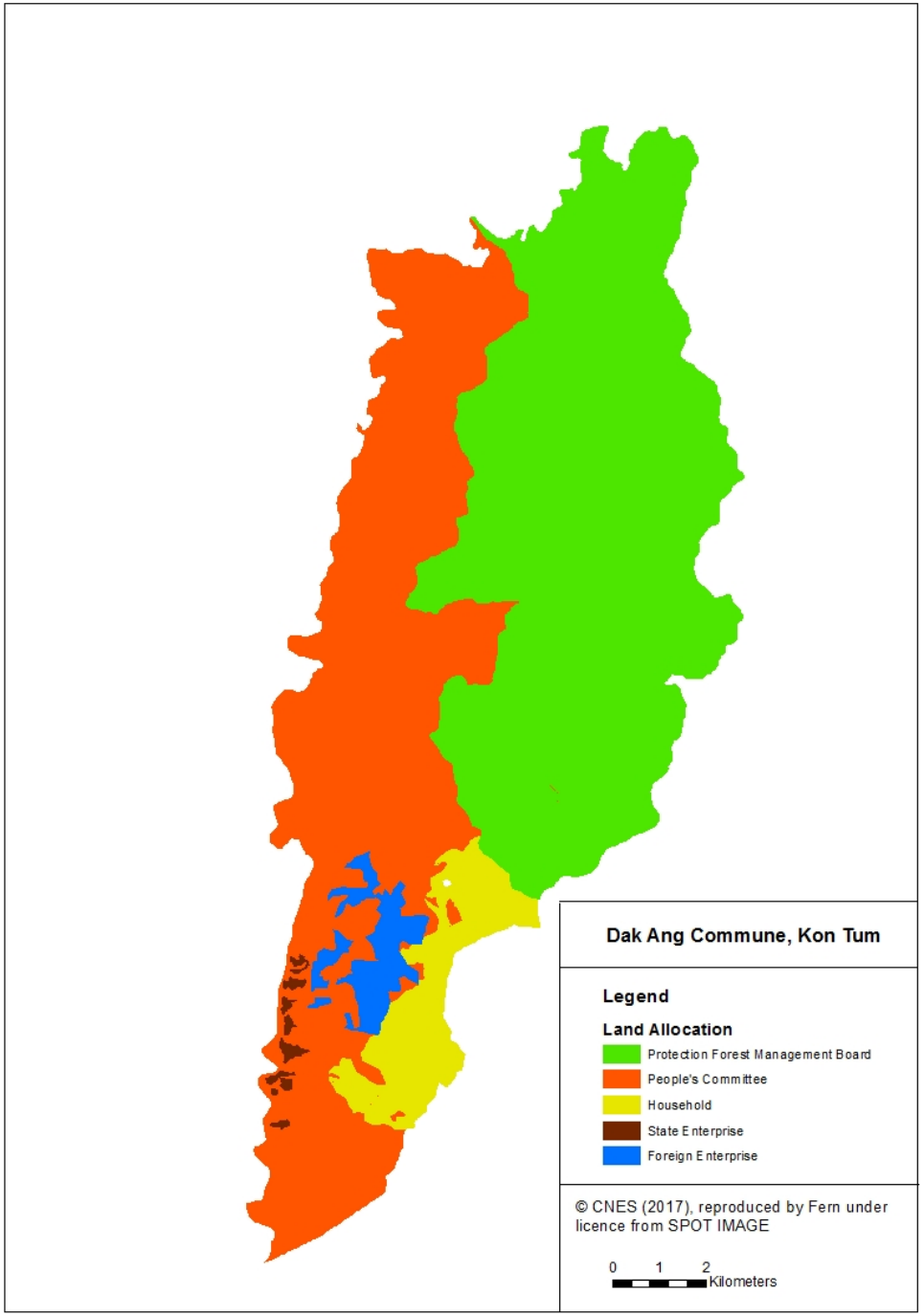
(Do households manage forest land any better than other land managers?)

Land allocation vs land cover

STEP 1: Introducing land users in Đak Ang

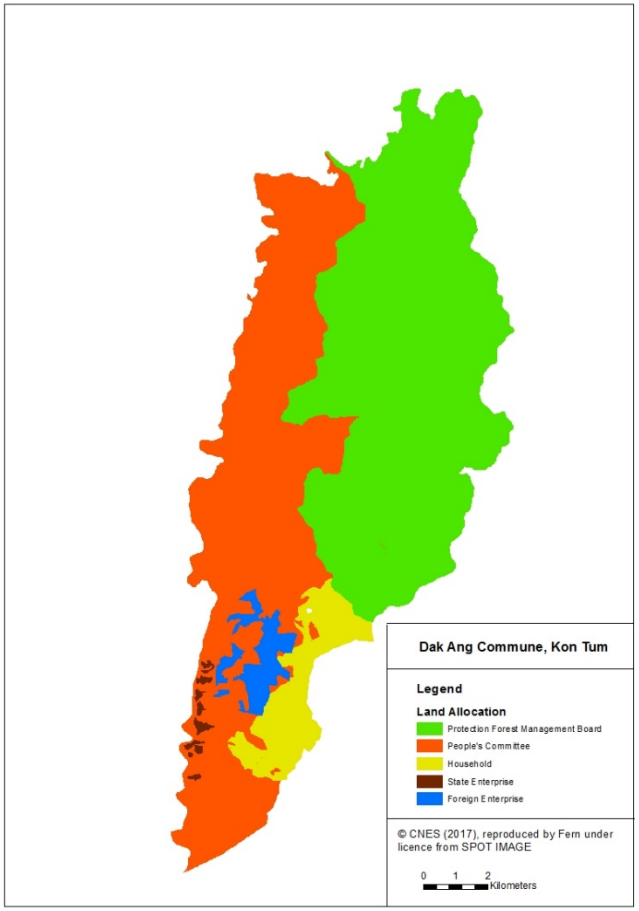
Land is allocated to

- **households** (either formally with ‘red book’ user certificates) or not (yet)
- **local government** (the commune People’s Committee)
- **a management board** responsible for managing protection forest (PFMB)
- **companies** (Vietnamese and foreign)

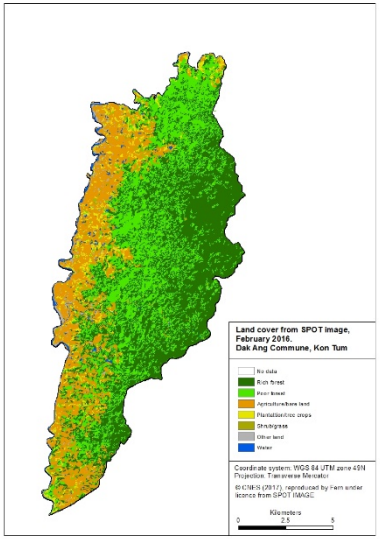


Land allocation vs land cover

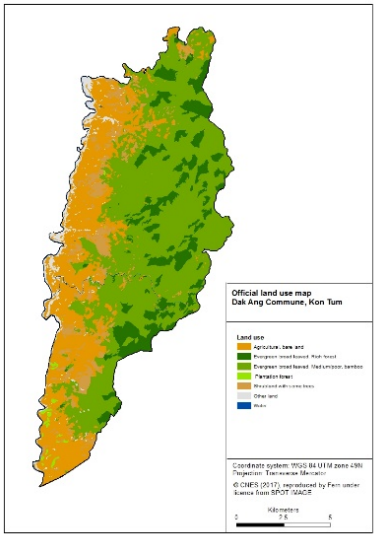
STEPS 2 and 3: Comparing the land users map with (a) the satellite map of cover, and (b) the official map of cover



Land users



Land cover (satellite)



Land cover (official data)

Land allocation vs land cover

Comparing the land users map with the *satellite* map of cover, we observe the quality of forest cover being managed by different forest users.

Note how this differs from the official view when comparing the land users map to the *official* map of cover.

according to **official** data

Official data	Rich/medium forest	Poor/recovery forest	Agriculture/bare land
Commune People's Committee	4	30	58
Foreign Enterprise	0	34	66
Households	79	20	0
People's Forest Management Board	66	29	4
State Enterprise	0	41	59

according to **satellite** image

Satellite data	Rich/medium forest	Poor/recovery forest	Agriculture/bare land
Commune People's Committee	17	19	46
Foreign Enterprise	24	30	36
Households	63	33	4
People's Forest Management Board	56	39	2
State Enterprise	17	9	62

A bar chart of difference between two tables follows on the next slide.

5. FURTHER POSSIBILITIES OF GIS (2 examples)

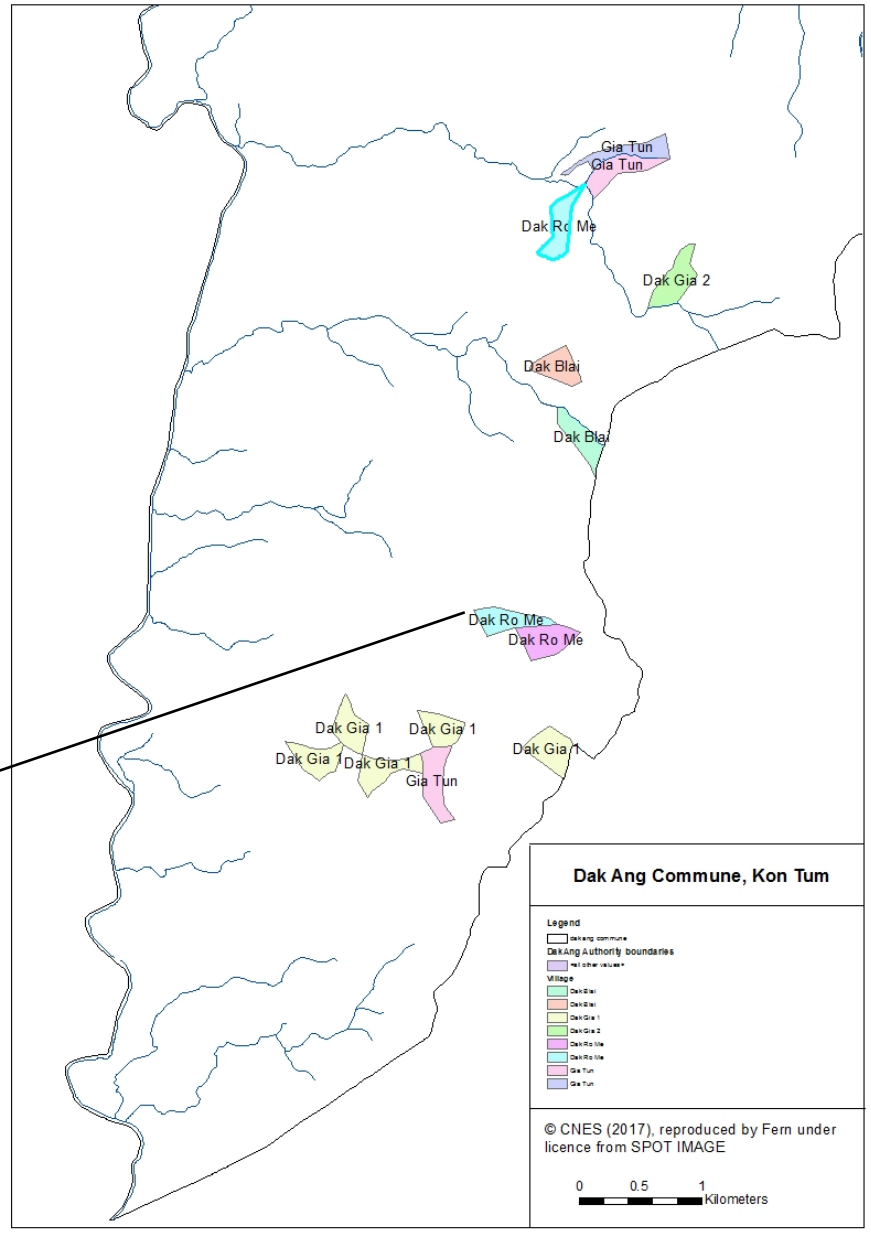
- Zooming into household level social data
- Impact of US military spraying of Agent Orange

Further potential of GIS

Eg. 1: Household level social data

For each household plot we can call up data associated with it…. (eg on land or food security, household size, wealth ranking, ethnicity or gender etc.)

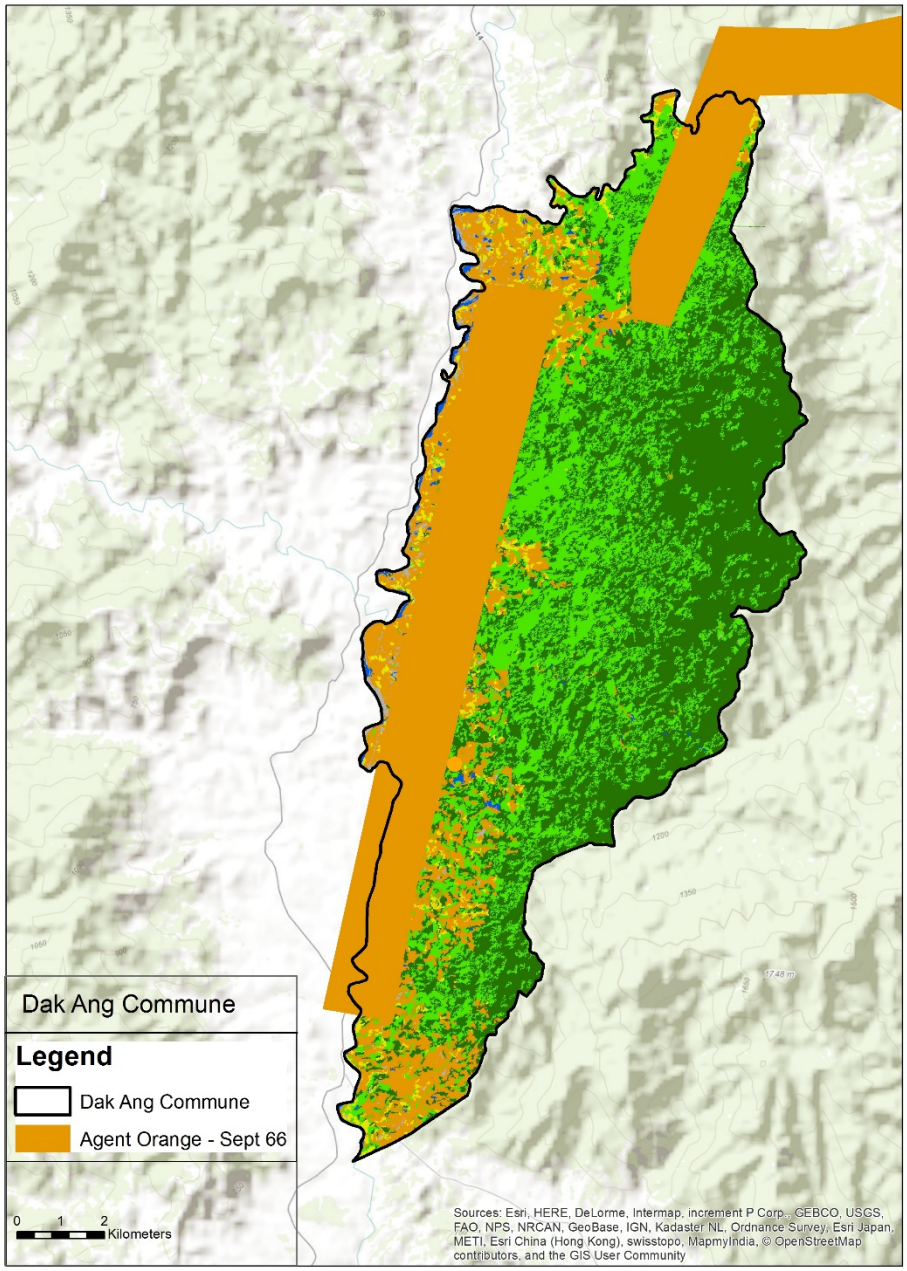
Dak Ro Me Village	
Gender of head of household	Male
Ethnicity	Xedang
Household size	8
Wealth ranking	Poor
Insufficient food	3 months/yr
No. Plots	3
Sufficient land	No
Seek more land	Yes
Red book (land use certificate)	Yes



Further potential of GIS

Eg. 2: Impact of Agent Orange

Similarly we can assess correlation between existing land use and areas where forests were destroyed by US chemical weapons (land which remains poisoned decades later)



Lessons and summary

- How useful are the designations ‘protection’ & ‘production’ forest?
- Maps can raise important questions that need work on-the-ground to interpret
- Official land cover data can be different to satellite-derived land cover data
- Requires contextualising in terms of an internationally recognised typology (e.g. UN)
- Improve classification techniques (radar etc.)
- Protected forest shows high levels of degradation and disturbance
- A large proportion of production forest appears to have been encroached by agriculture
- Monitoring change potential
- Far better to have a representaive sample of targeted data than an exhaustive set of questions from too small a sample.

Some recommendations…..

- Civil Society has a useful tool to explore their ideas…increases awareness of the issue they are working on.
  - Improved awareness leads to right questions…commission the right technical people

- Provides evidence and confidence…
  - CSO credentials vis-à-vis policy- makers.

- Extrapolation – what can this exercise tell us about the national level?
  - Indicates to donors and policy-makers the pitfalls of taking data at face value