



The Uplands Program (SFB 564)
Subproject D3

**Testing GIS/RS based approaches for estimating
village boundaries – the case of a region in
North-west Vietnam**

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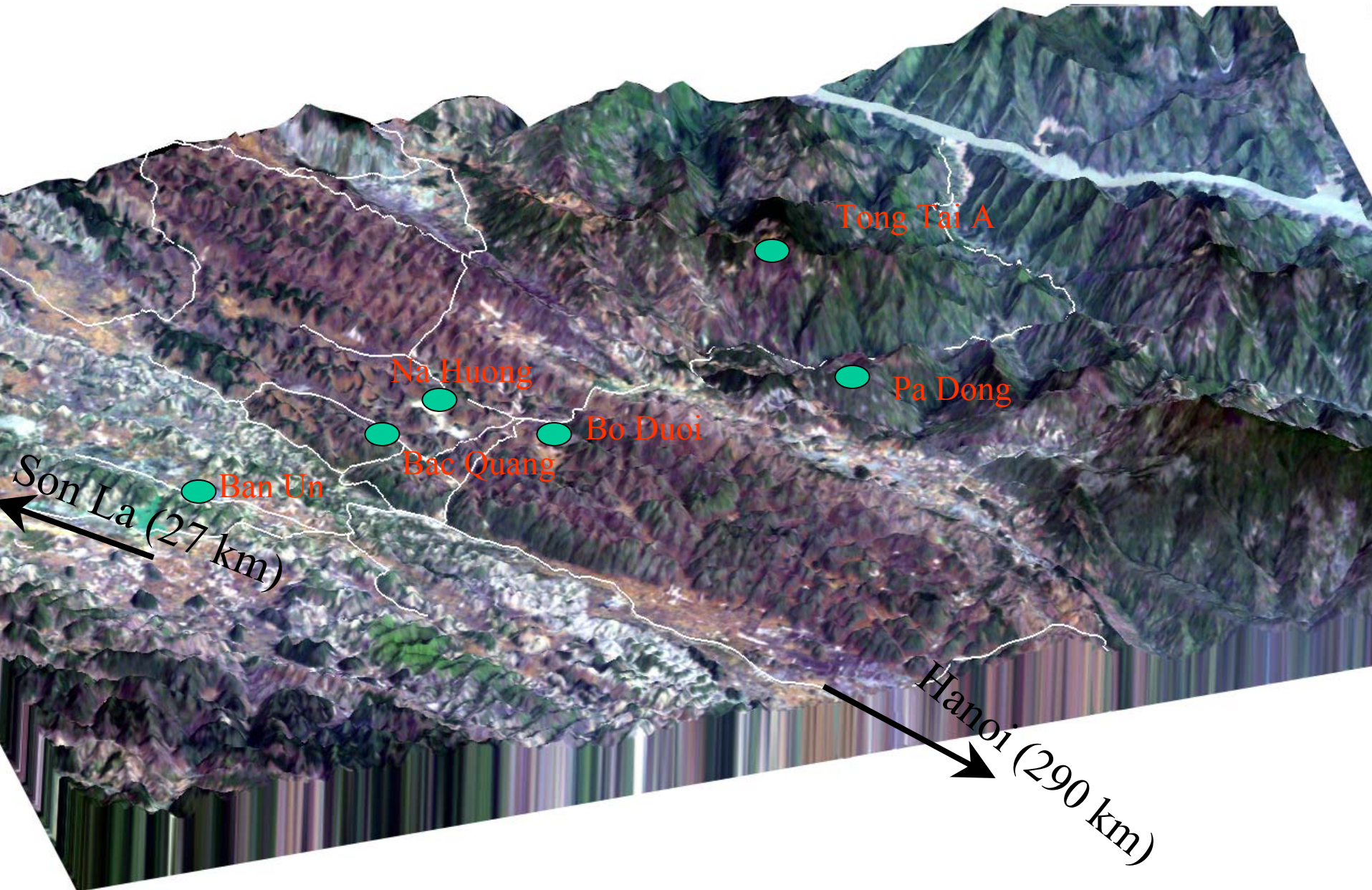
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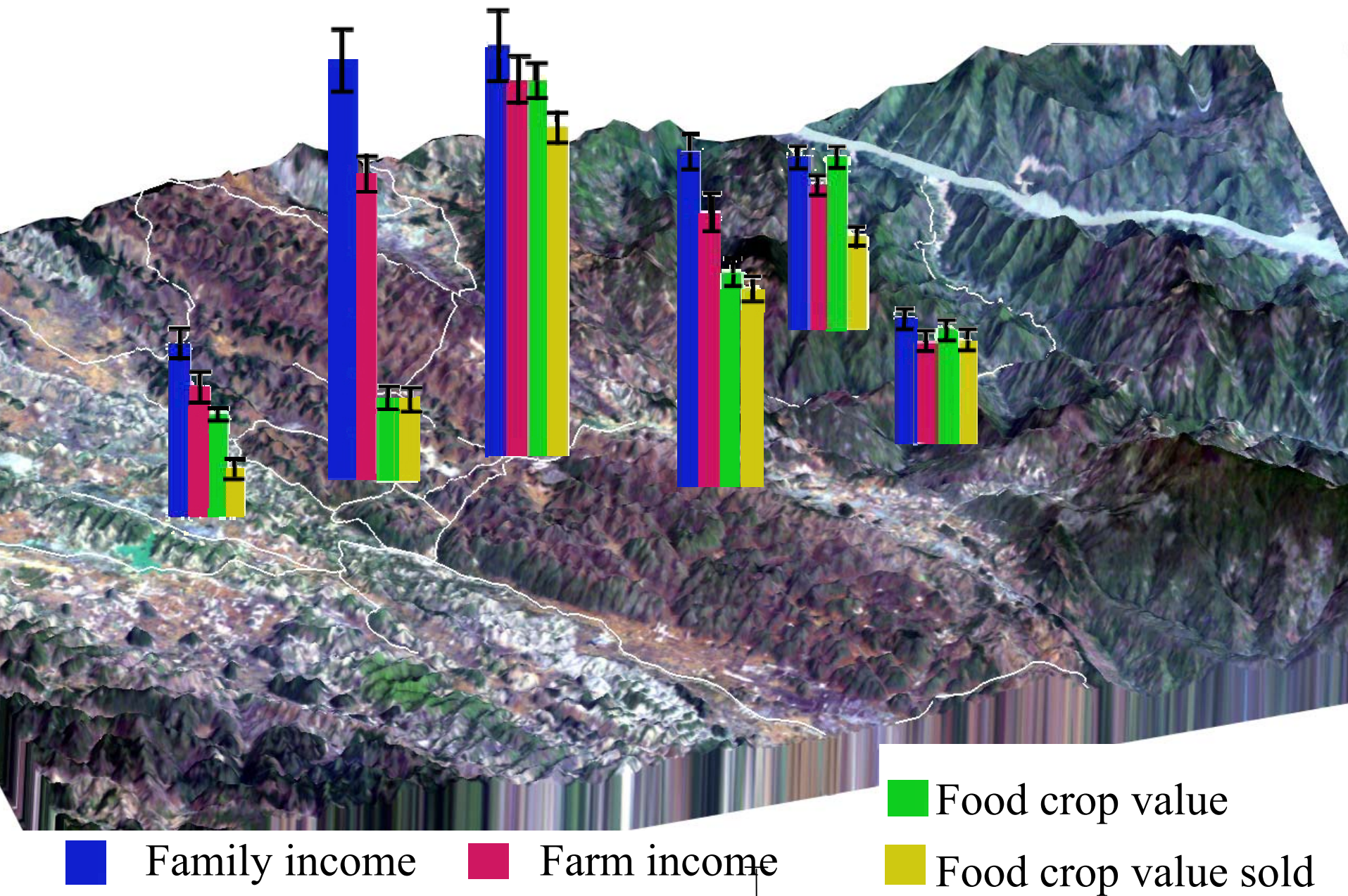
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The Study Area



Income Structure



Problem

As the income differs much according to the land endowment of a village, boundaries are indispensable for the linkage of agricultural activities with space and natural resources

- Official information on boundaries and size of village land is not available
- Limited accuracy and of participatory mapping
- GPS assisted mapping not accepted by local authorities

Designation of Land Territory

Available material for the village territory assignment:

GIS/ RS database:

- Communal boundaries,
- Village location,
- Digital elevation model and derived products,
- Original and classified Satellite Landsat7 imagery.

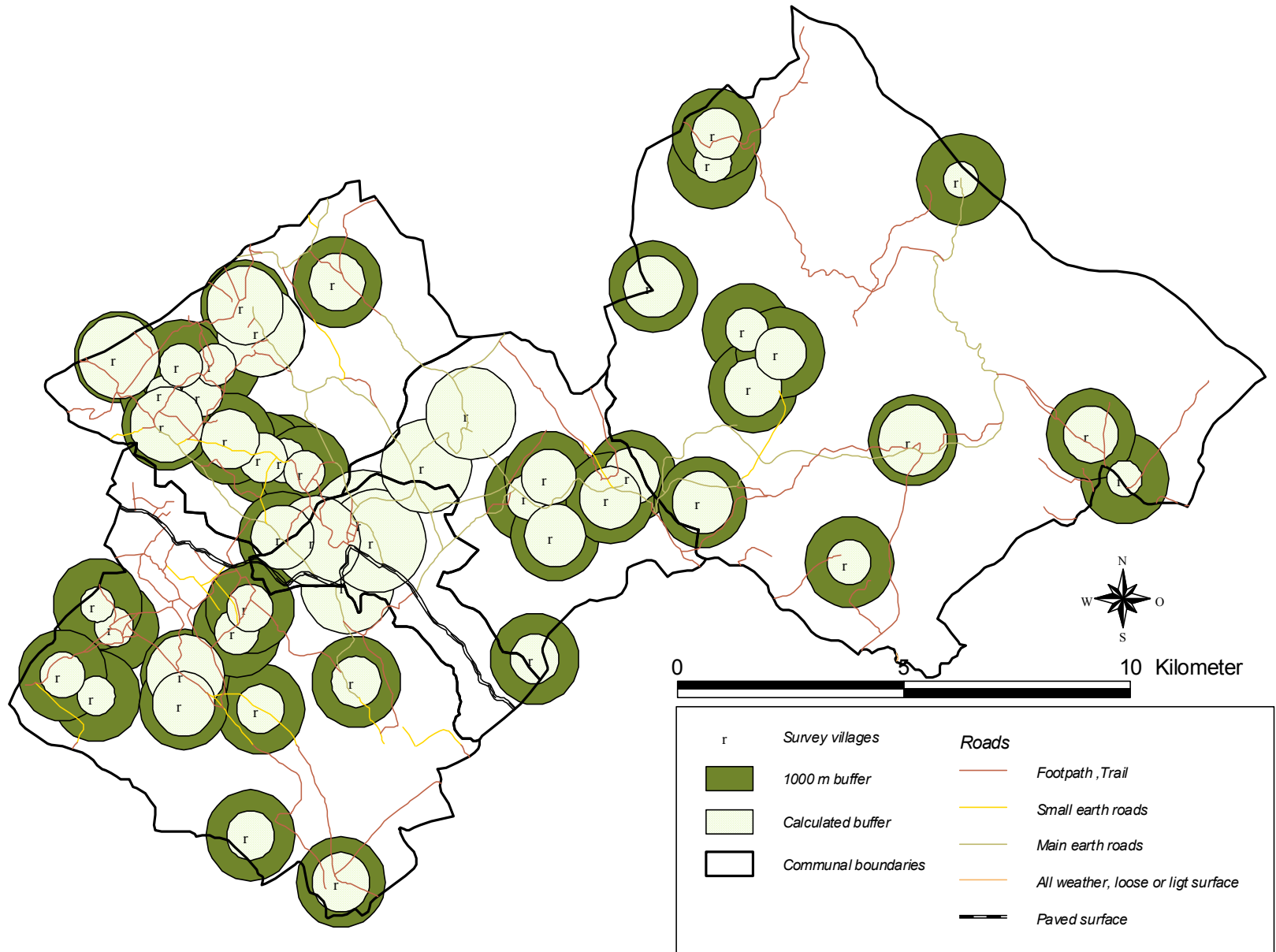
Survey database:

- Key person that covered the entire study area,
- Micro survey of 6 villages,
- Field experience and results of semi structured interviews and RRA methods.

Designation of Land Territory

- 1. 1000 m buffer around village centre:** first approximation buffer with a radius of 1000 meters around each village centre.
Not considered: land cover, village size (households)
- 2. Village size considered with calculated buffer:**
Total village land size estimated with survey data;
Buffer size according to village size
Not considered: land cover
- 3. Thiessen polygons, “optimal allocation”**
Construction of Thiessen Polygons was modified to consider accessibility with a weighted cost distance grid.
Not considered: land cover and village size

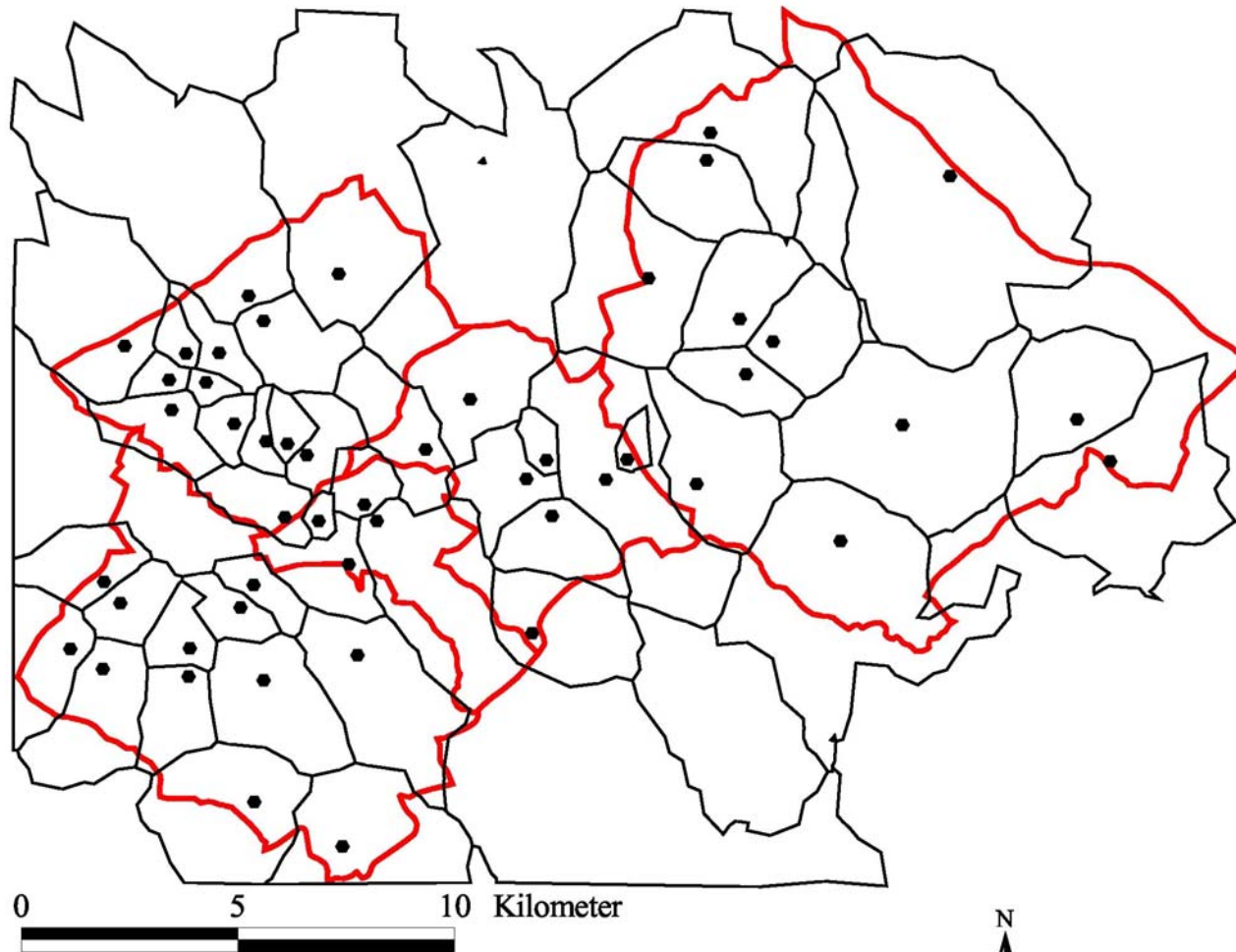
Buffers Around Village Centres



Designation of Land Territory

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Optimal Allocation



- Key Person Survey Villages
- Optimal Allocation Boundaries
- Communal Boundaries

The boundaries are set on the places, where the access cost between the villages in question is equal.

Designation of Land Territory

4. **Land polygons** calculated village area and additional criteria

- Participatory mapping, group discussions and expert knowledge indicate:

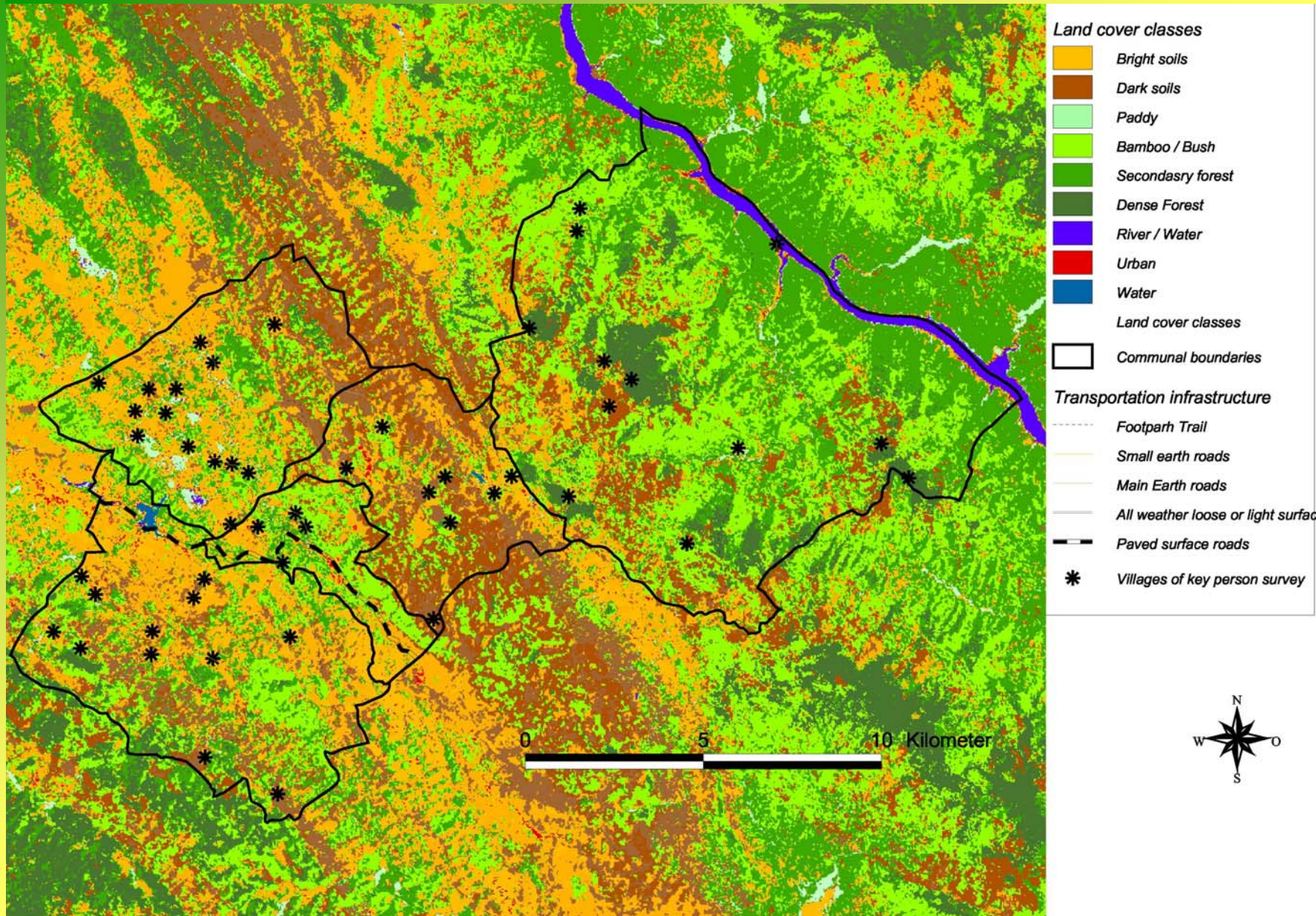
Watersheds are often used as natural boundaries

Agricultural land typically lies near the village center

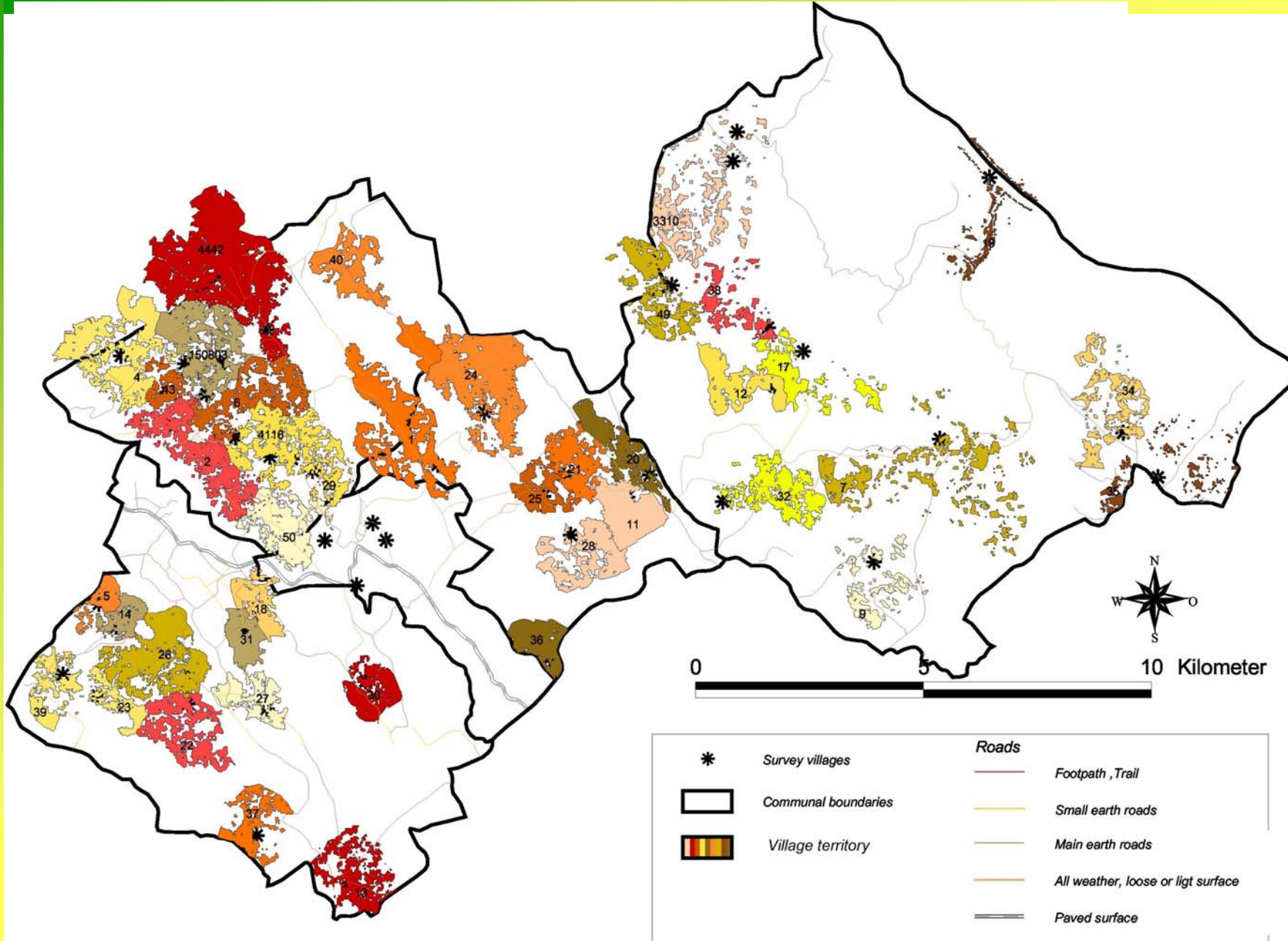
Villages close to each other have no clear boundaries

- Average land size per family from micro survey data
- Land cover data: soil classes, area with crops and urban
- Infrastructure: accumulative cost and optimal allocation
- DEM derived watershed boundaries
- Differencee in altitude from the village to the fields as small as possible

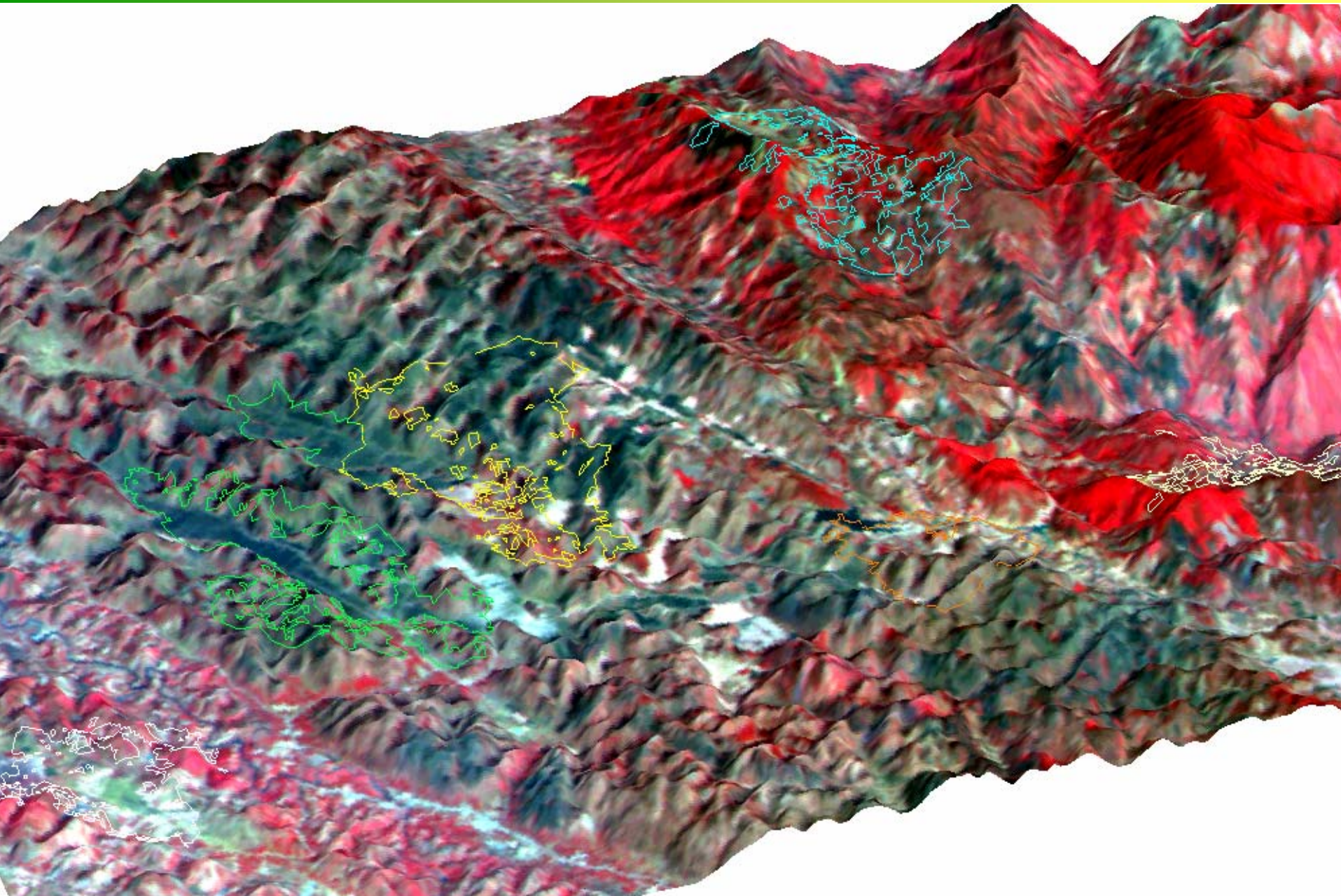
Classified Landsat Scene (April 2000)



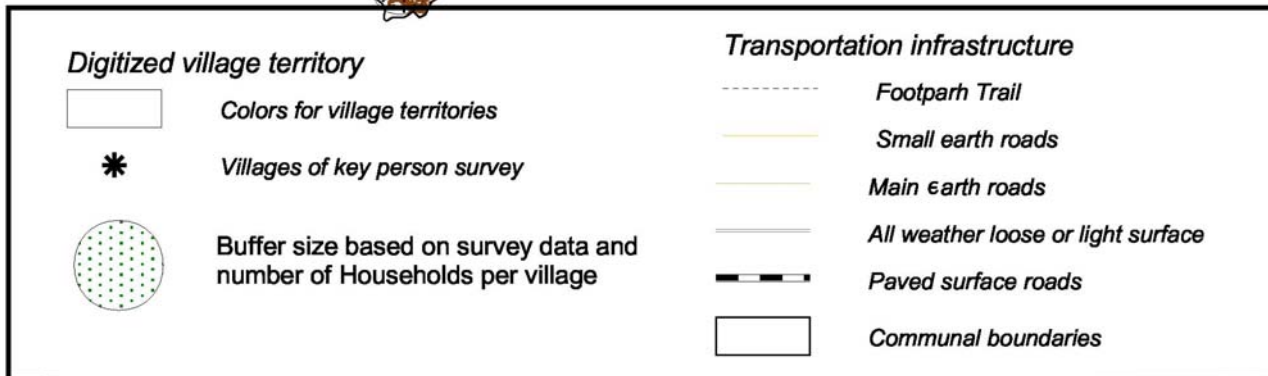
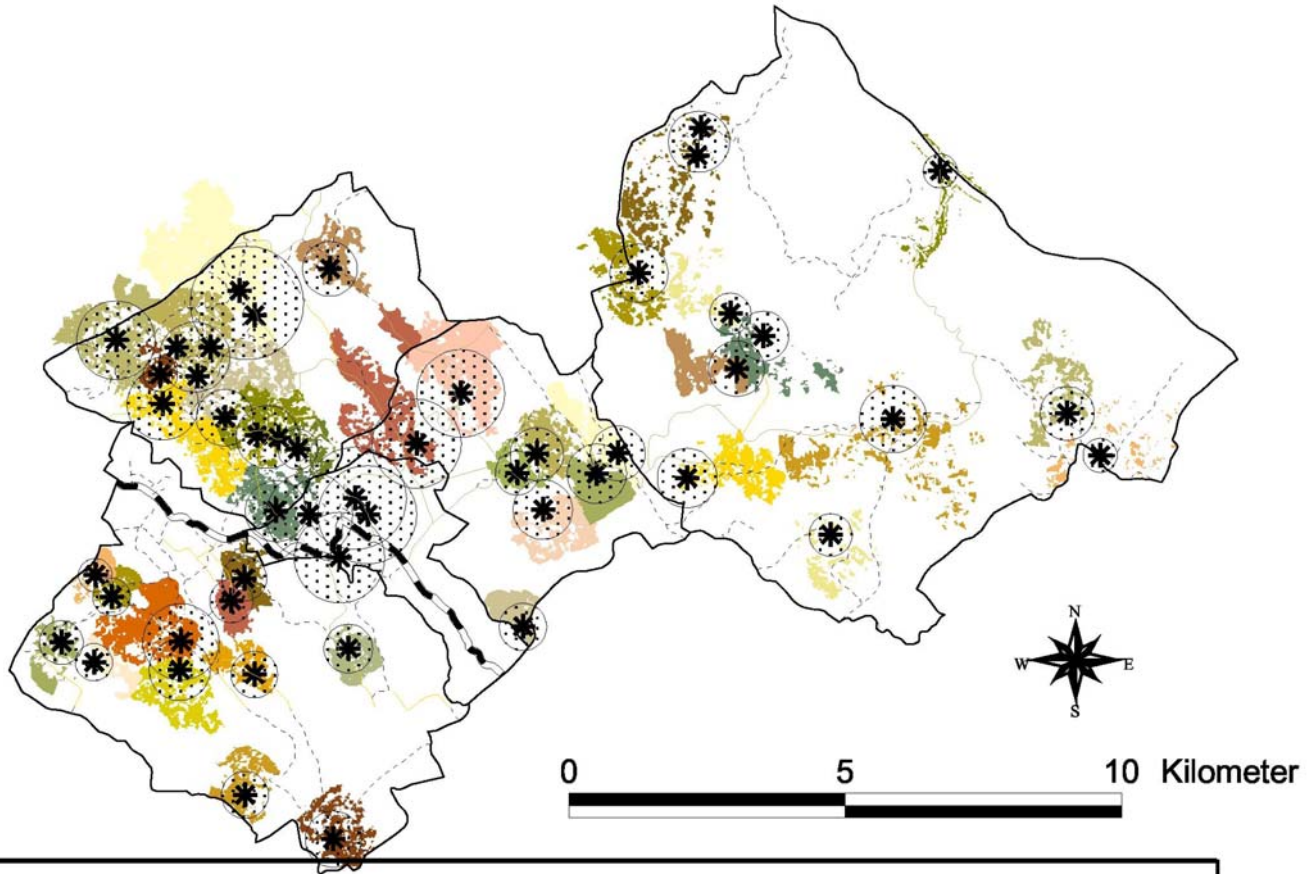
Land Polygons



Land Polygons



Village Territory Comparison



Village territory comparison

Inclination Classes	Statistic Parameters	Territory assessment method		
		1000 m buffer	average buffer	land polygon
>1° not inclined	Mean	59,7 ^{a, b}	24,7 ^c	25,2
	95% Confidence Interval	13,1	7,6	9,1
1° - 2° very weakly inclined	Mean	9,6 ^{a, b}	2,3 ^c	2,3
	95% Confidence Interval	4,1	0,7	0,7
2° - 5° weakly inclined	Mean	20,4 ^{a, b}	11,1 ^c	10,8
	95% Confidence Interval	5,3	5,1	5,3
5° - 10° moderately inclined	Mean	25,3 ^{a, b}	12,1 ^c	12,5
	95% Confidence Interval	4,2	3,4	3,6
10° - 15° strongly inclined	Mean	29,0 ^{a, b}	11,9 ^c	11,9
	95% Confidence Interval	3,8	2,8	2,9
15°-20° heavily inclined	Mean	37,0 ^{a, b}	14,0 ^c	14,7
	95% Confidence Interval	4,1	3,2	3,3
20° - 30° steep	Mean	82,3 ^{a, b}	30,8 ^c	32,6
	95% Confidence Interval	10,4	6,8	7,6
< 30° very steep	Mean	49,3 ^{a, b}	19,7 ^c	18,0
	95% Confidence Interval	13,9	6,3	6,0

Real village boundaries are not available to test which method is best

Slope inclination as test criterion:

1000 m buffer differs from average buffer and land polygon

Average buffer and land polygon do not differ significantly

^a 99% probability of significant differences between 1000m buffer and average buffer according to Mann-Whitney U test.

^b 99% probability of significant differences between 1000m buffer and land polygon according to Mann-Whitney U test.

^c No significant difference between land polygon and average buffer according to Mann-Whitney U test.

Conclusion

The test result of non significant differences between adjusted buffer method and the village polygon method is surprising at first view

Possible reasons for non significant differences:

- Geomorphologic nature of the study area: three main landforms
- Slope classes within watersheds are similar
- Slope inclination in the surroundings of the villages is similar

Conclusion

Why is the village polygon method able to describe the land endowment and production capacity of villages, while buffers are not ?

- Village polygons are build with a sound data base and according to best knowledge
- The land cover classes show, which area is really used for cropping. This information is not considered in the buffer methods
- More information is used e.g. satellite images, digital elevation model and cost distances
- Local knowledge is considered