



Consequences of large hydropower dams on erosion budget within hilly agricultural catchments in Northern Vietnam by RUSLE modeling

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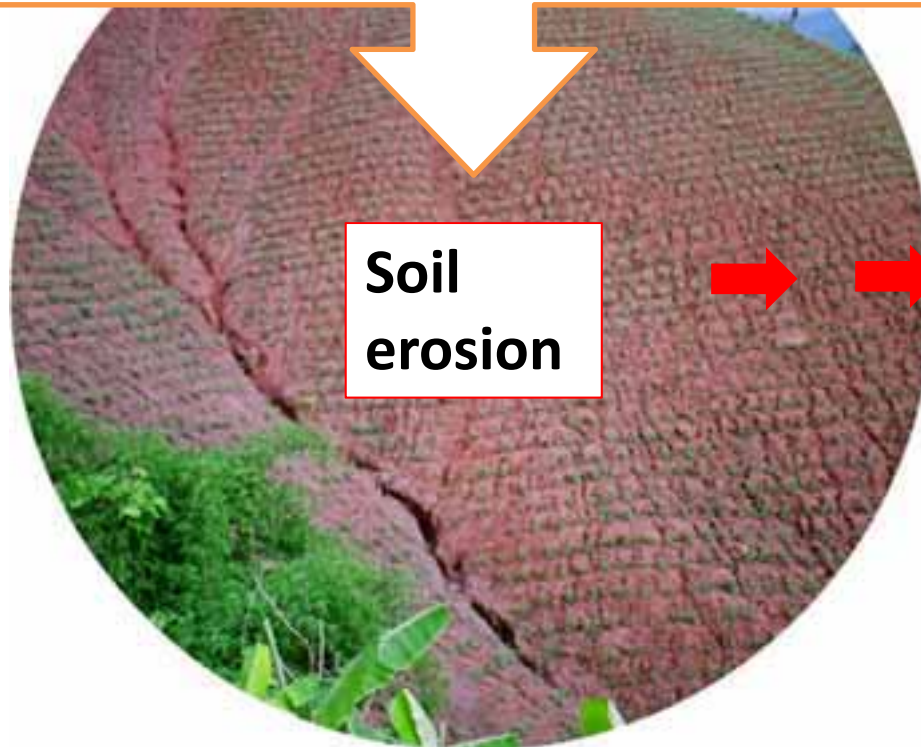


Introduction: Scientific question

DRIVEN
FORCES

- Hydropower dam building

- Agricultural use of sloping lands
- Climate force
- Population grown



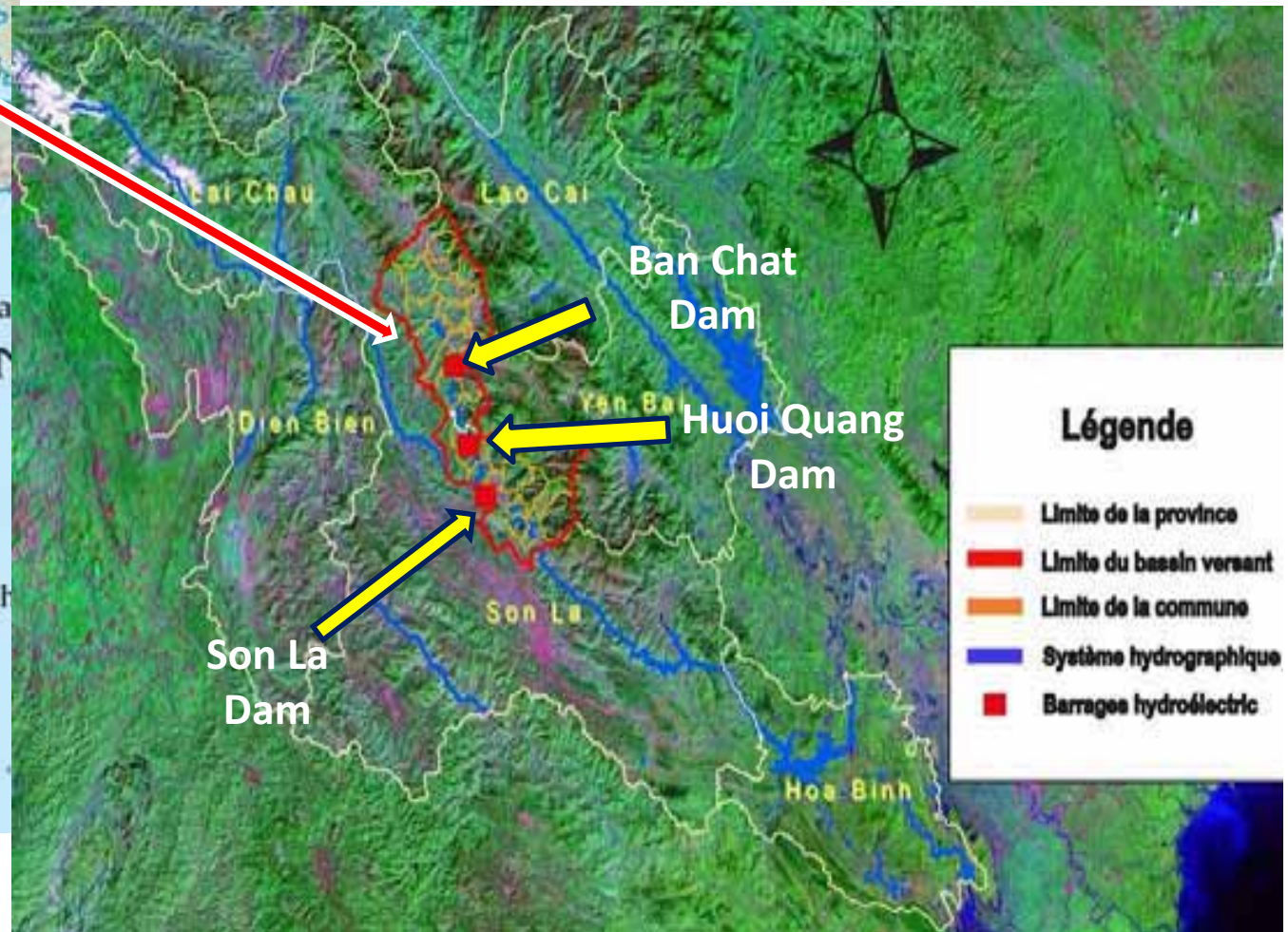
Soil
erosion

OUTPUTS ?

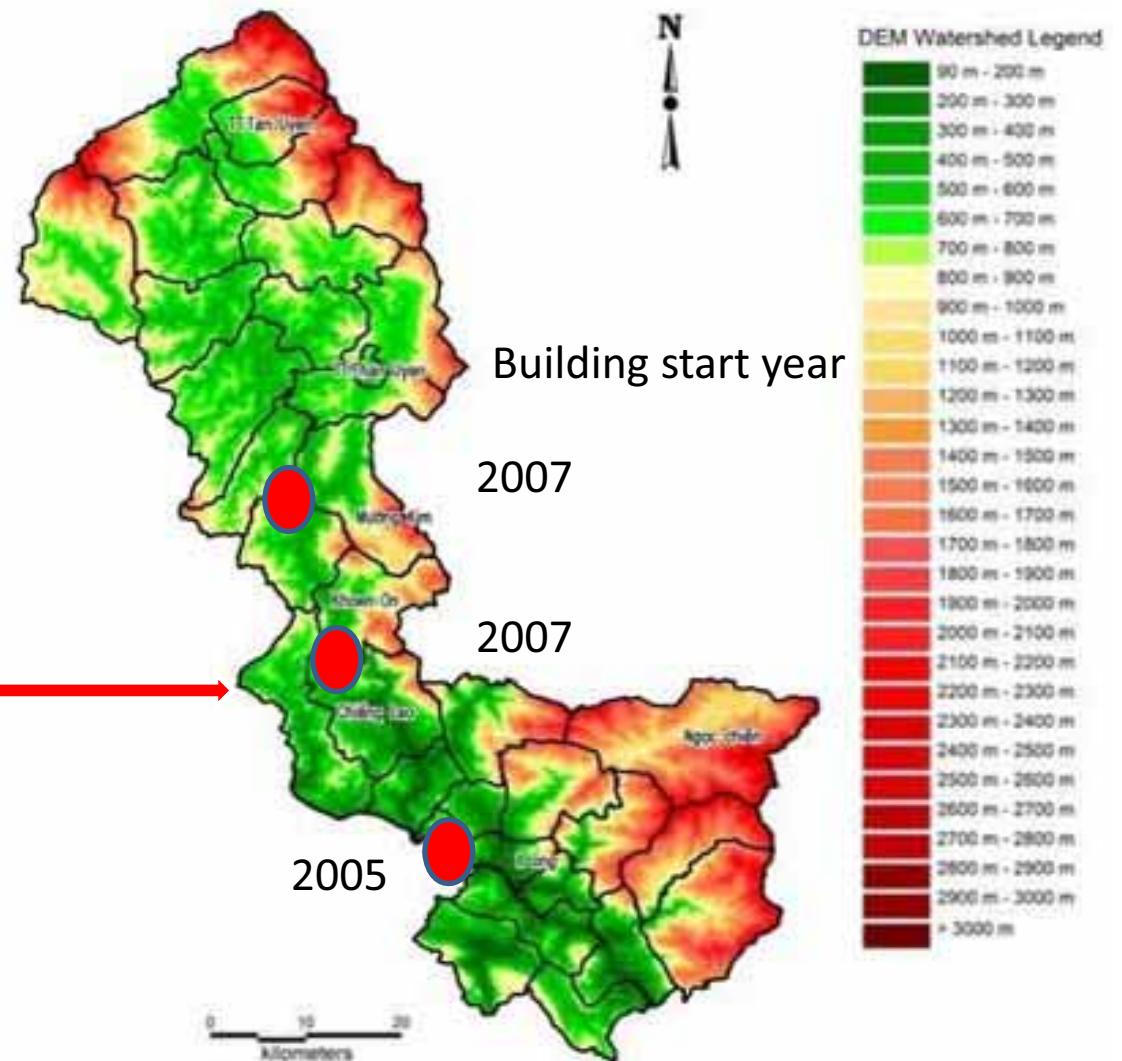
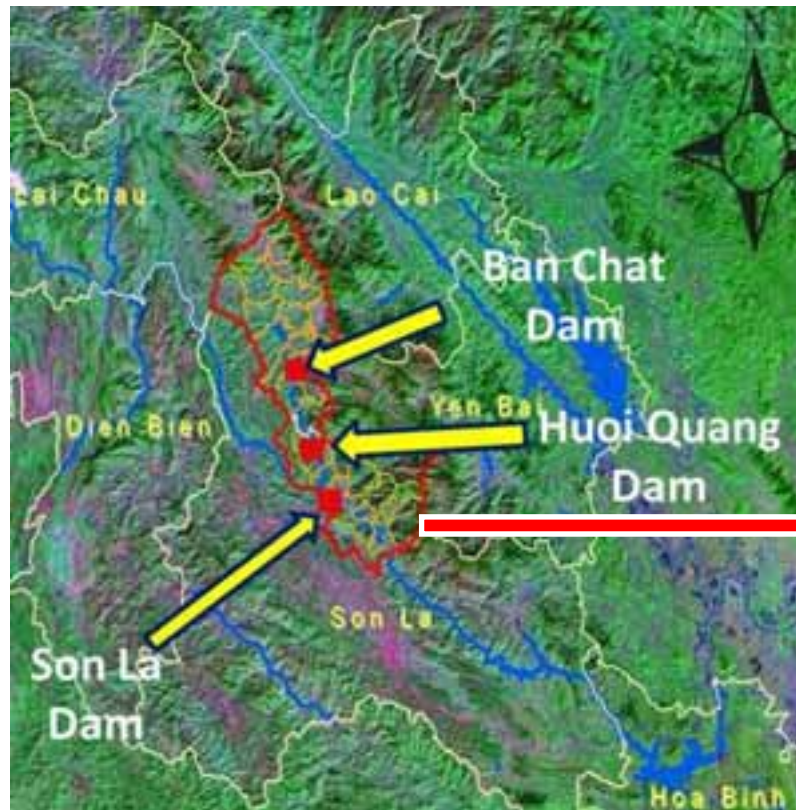
1. Livelihoods
2. Life span of HP dams

Introduction: Studied area

3 large hydropower dams in Son La Province in building from 2005



Introduction : Study area



Elevation map

Methodology: Erosion modelling

- **Diachronic analysis over 36 years through RUSLE modelling for : 1973, 1993, 2000, 2009**

Landsat MSS
1973



Landsat TM
1993



Landsat TM
2000

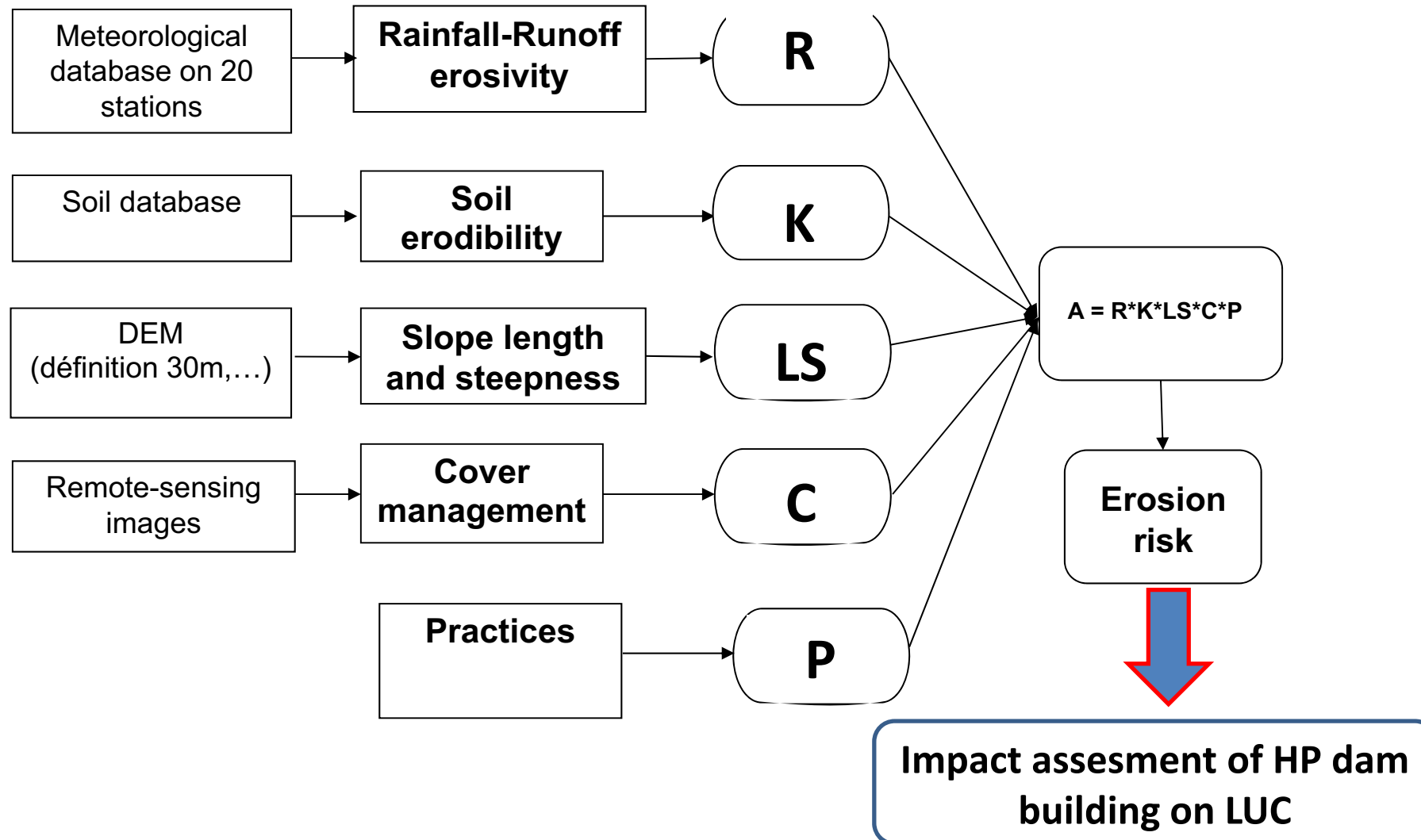


Landsat TM
2009



Methodology: Erosion modelling

RUSLE MODEL on 4 years: 1973, 1993, 2000, 2009

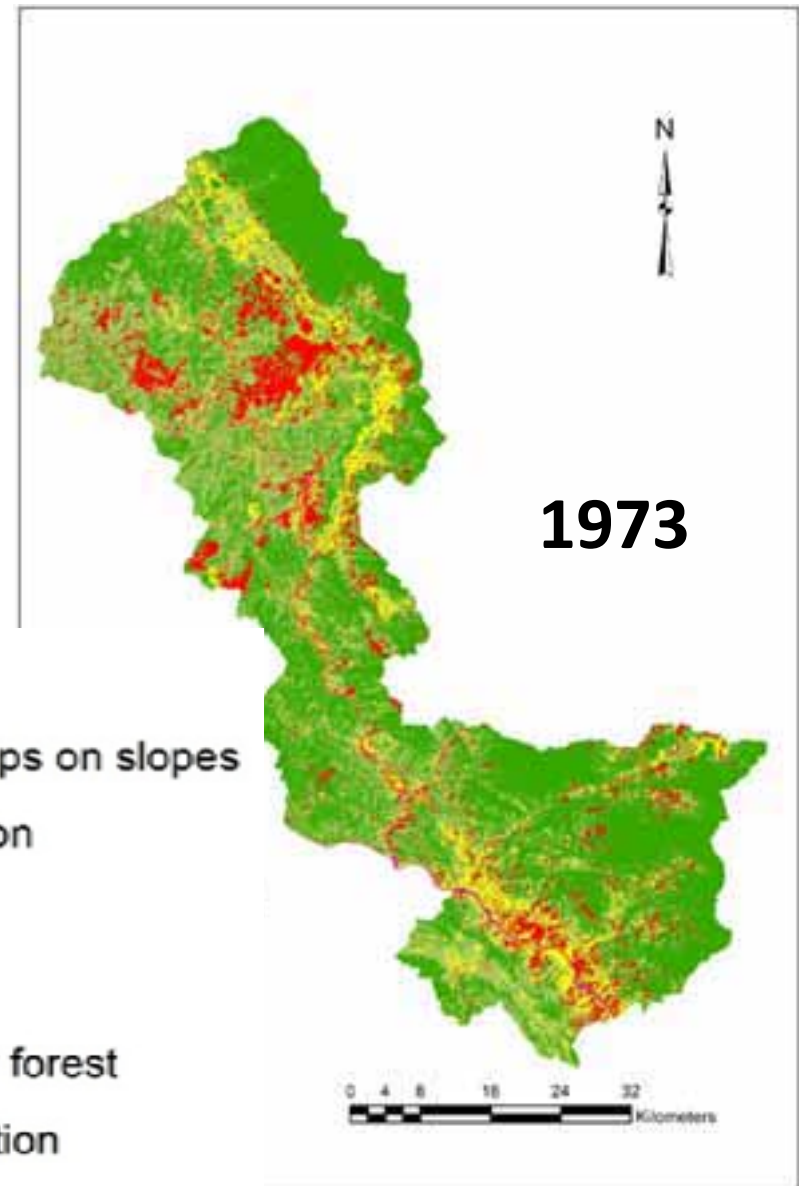


Results and Discussion: LU mapping

- 7 land-use categories got through:
 - A supervised classification of the Landsat images,
 - A NDVI analysis mapping from the Landsat images,
 - A comparison with the land-use data from the Districts.

Legend

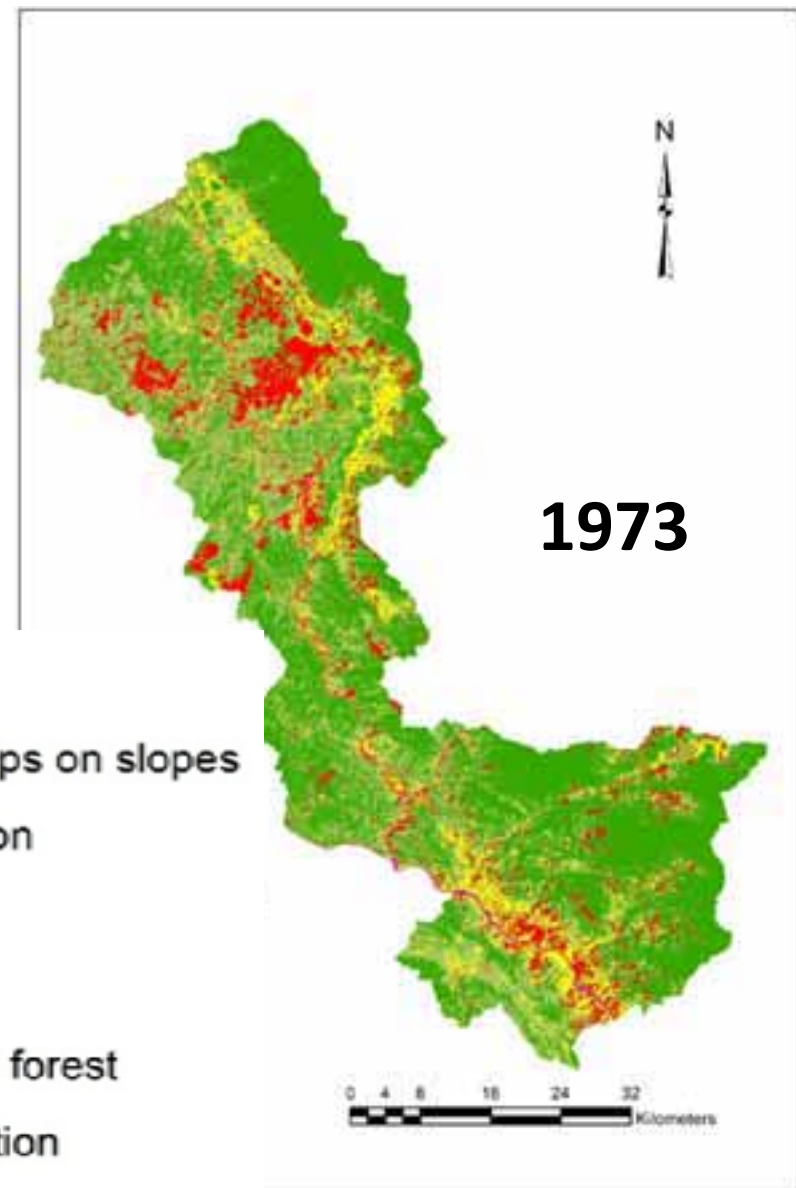
- Annual crops on slopes
- Urbanization
- Shrubs
- Forestry
- Secondary forest
- Tea plantation
- Flat lands



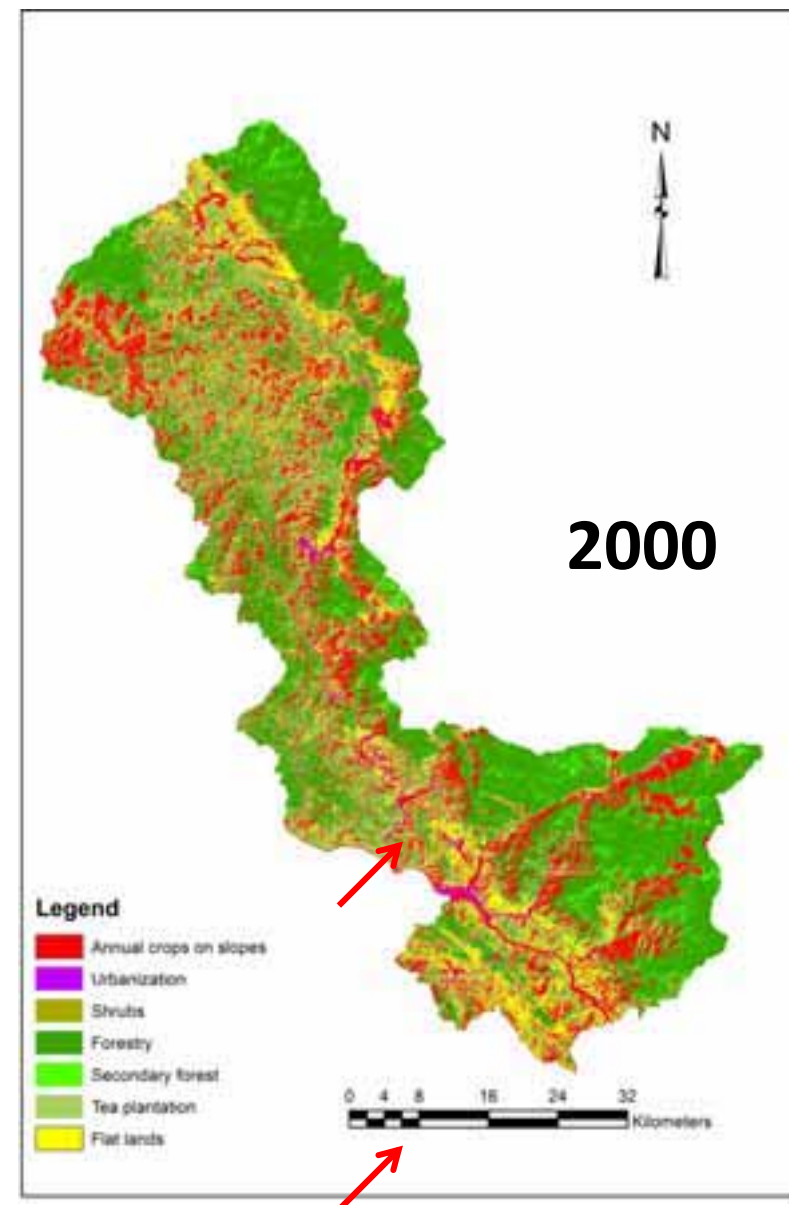
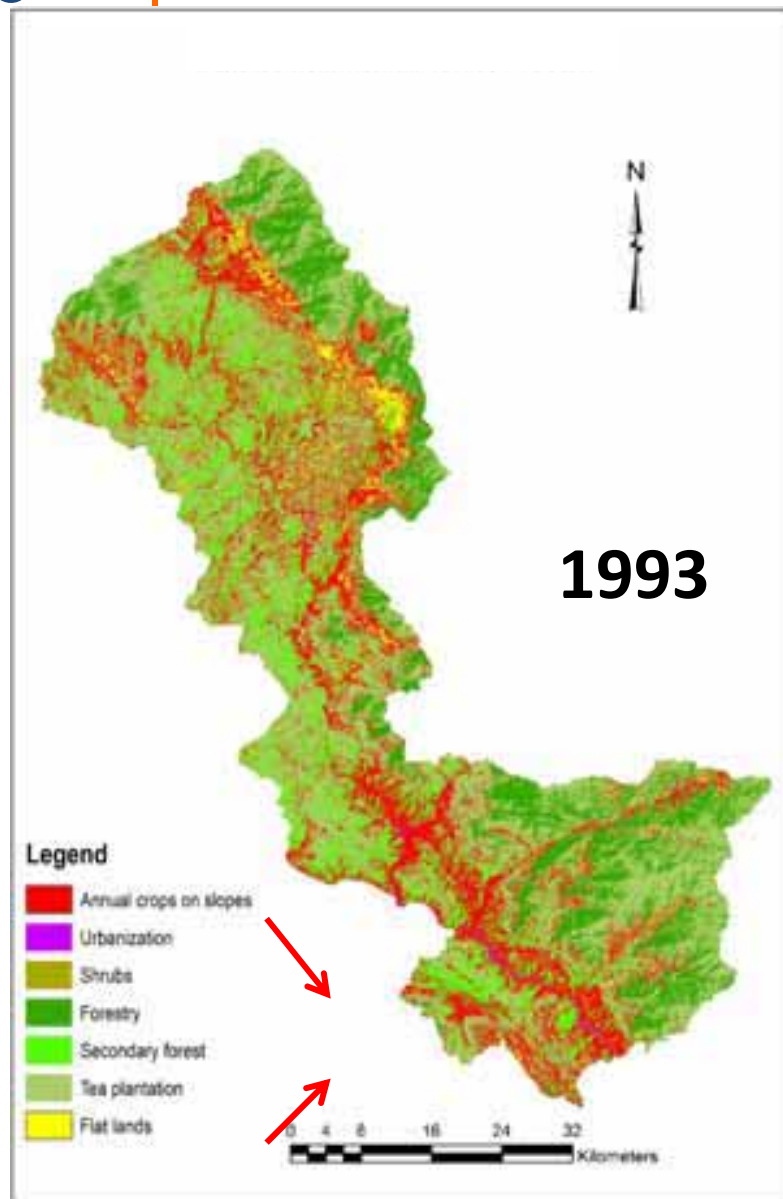
Results and Discussion: LU mapping

YEAR 1973	ha	%
Annual crops / slopes	24,800	8.0%
Planted forest	--	--
Tea plantation	--	--
Shrubs	197,500	63.5%
Forestry	78,000	25.1%
Flat Lands	11,000	3.5%
Urbanization	340	0.1%

Legend



Results and Discussion: LU mapping



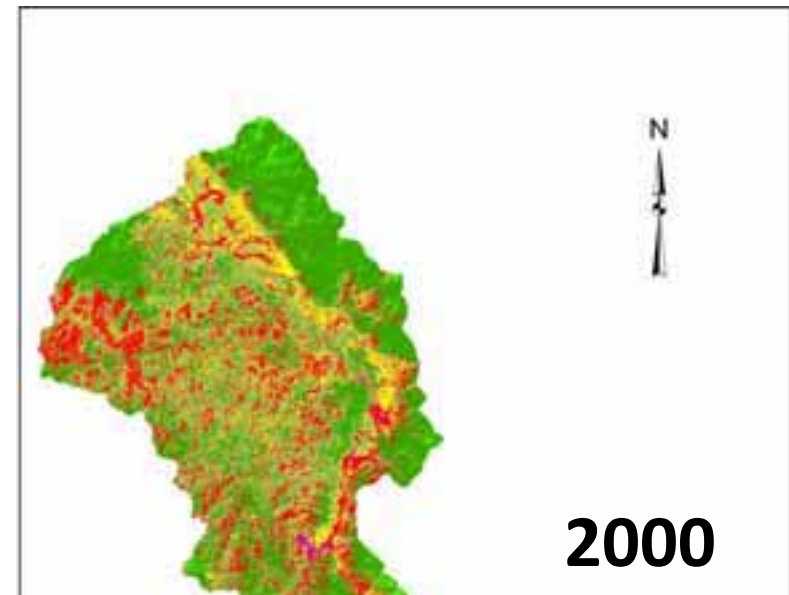
Results and Discussion: LU mapping

YEAR 1973	ha	%
Annual crops / slopes	24,800	8.0%
Planted forest	--	--
Tea plantation	--	--
Shrubs	197,500	63.5%
Secondary forest	78,000	25.1%
Flat Lands	11,000	3.5%
Urbanization	340	0.1%



1993

YEAR 1993	ha	%
Annual crops / slopes	21,500	6.9%
Planted forest	--	--
Tea plantation	--	--
Shrubs	175,000	56.2%
Secondary forest	75,350	24.2%
Flat Lands	39,000	12.5%
Urbanization	800	0.3%

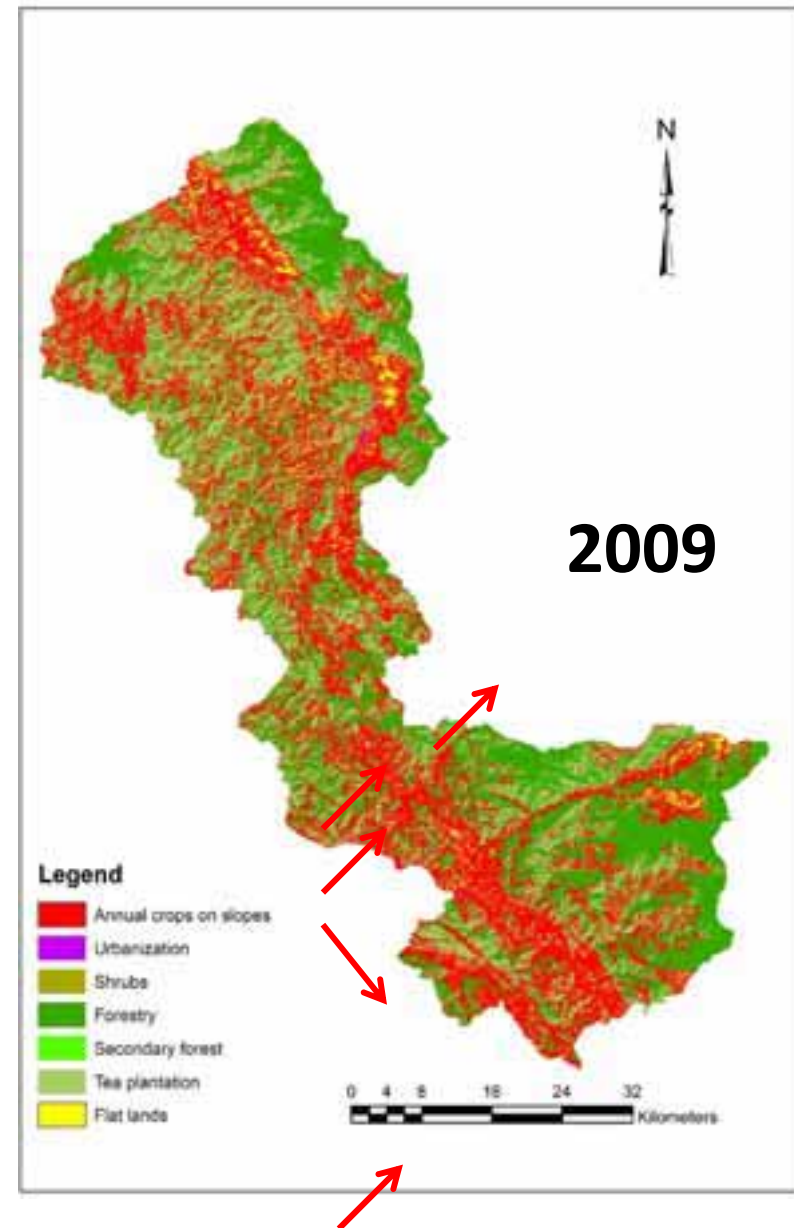
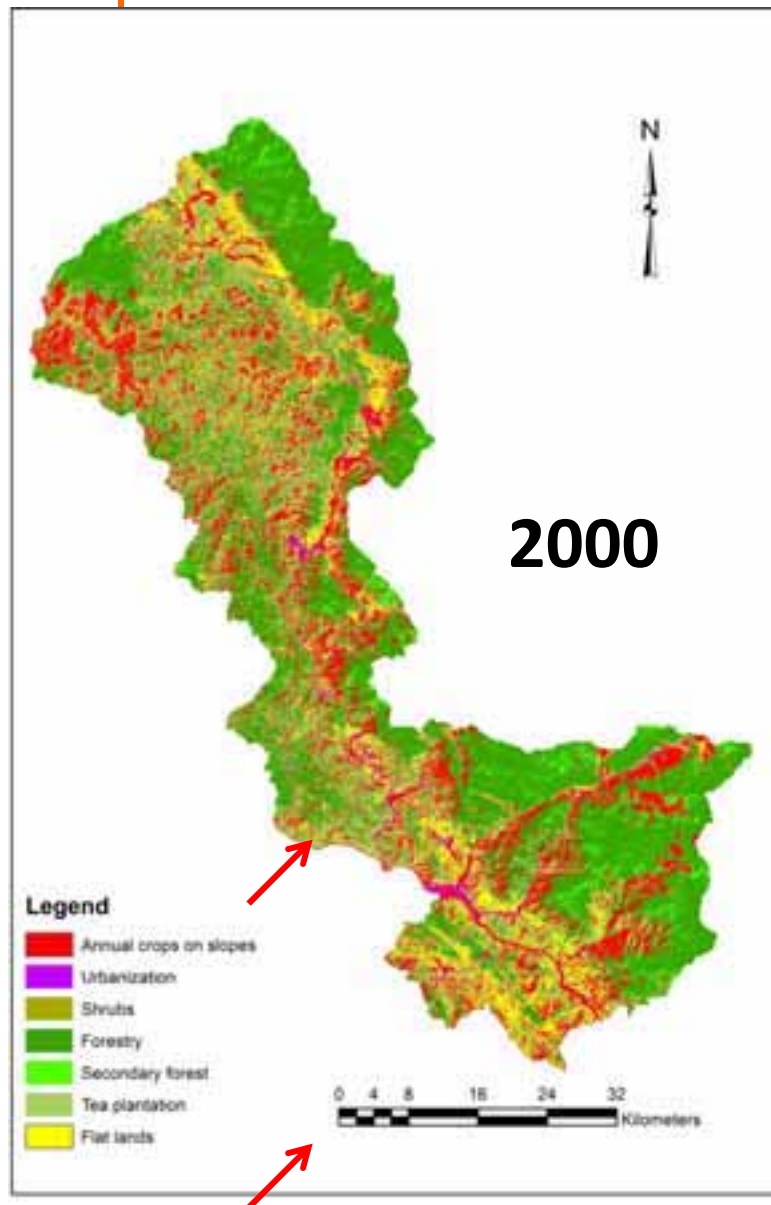


2000

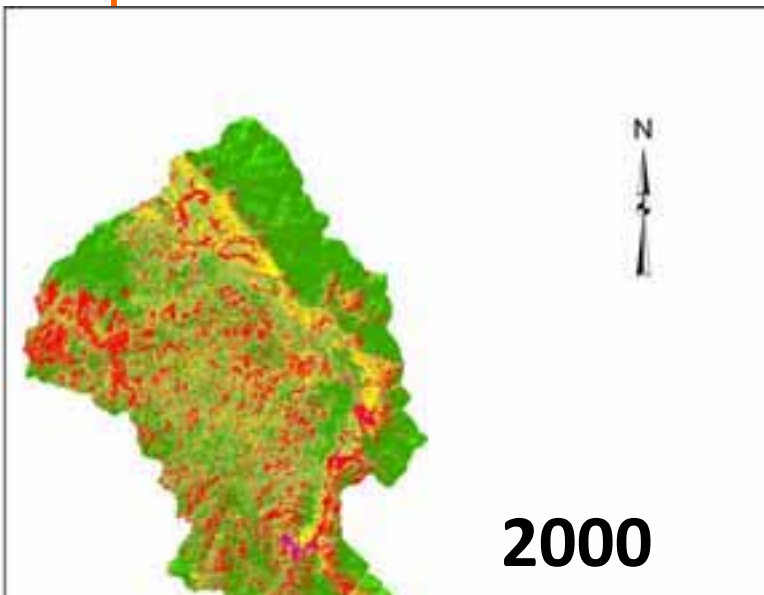
YEAR 2000	ha	%
Annual crops / slopes	29,300	9.4%
Planted forest	--	--
Tea plantation	9,300	3.0%
Shrubs	169,500	54.4%
Secondary forest	69,900	22.4%
Flat Lands	31,800	10.2%
Urbanization	1,900	0.3%

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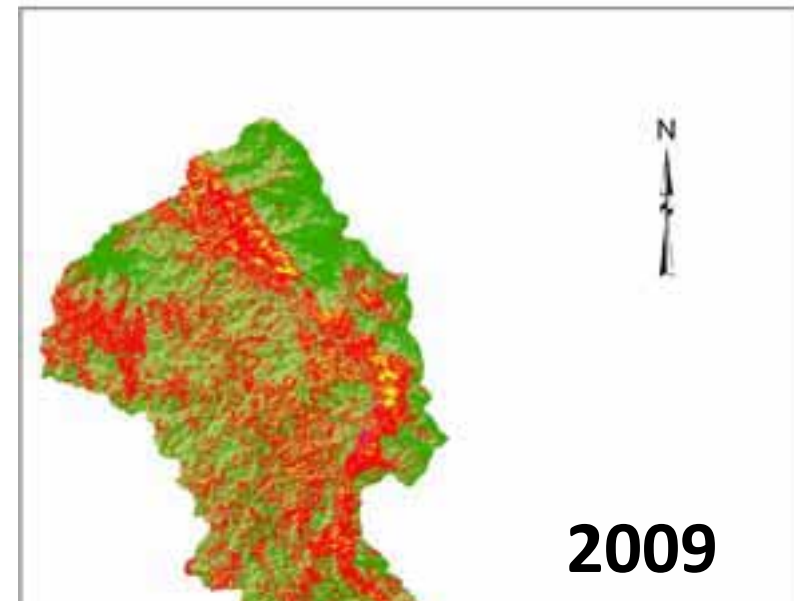
Results and Discussion: LU mapping



Results and Discussion: LU mapping



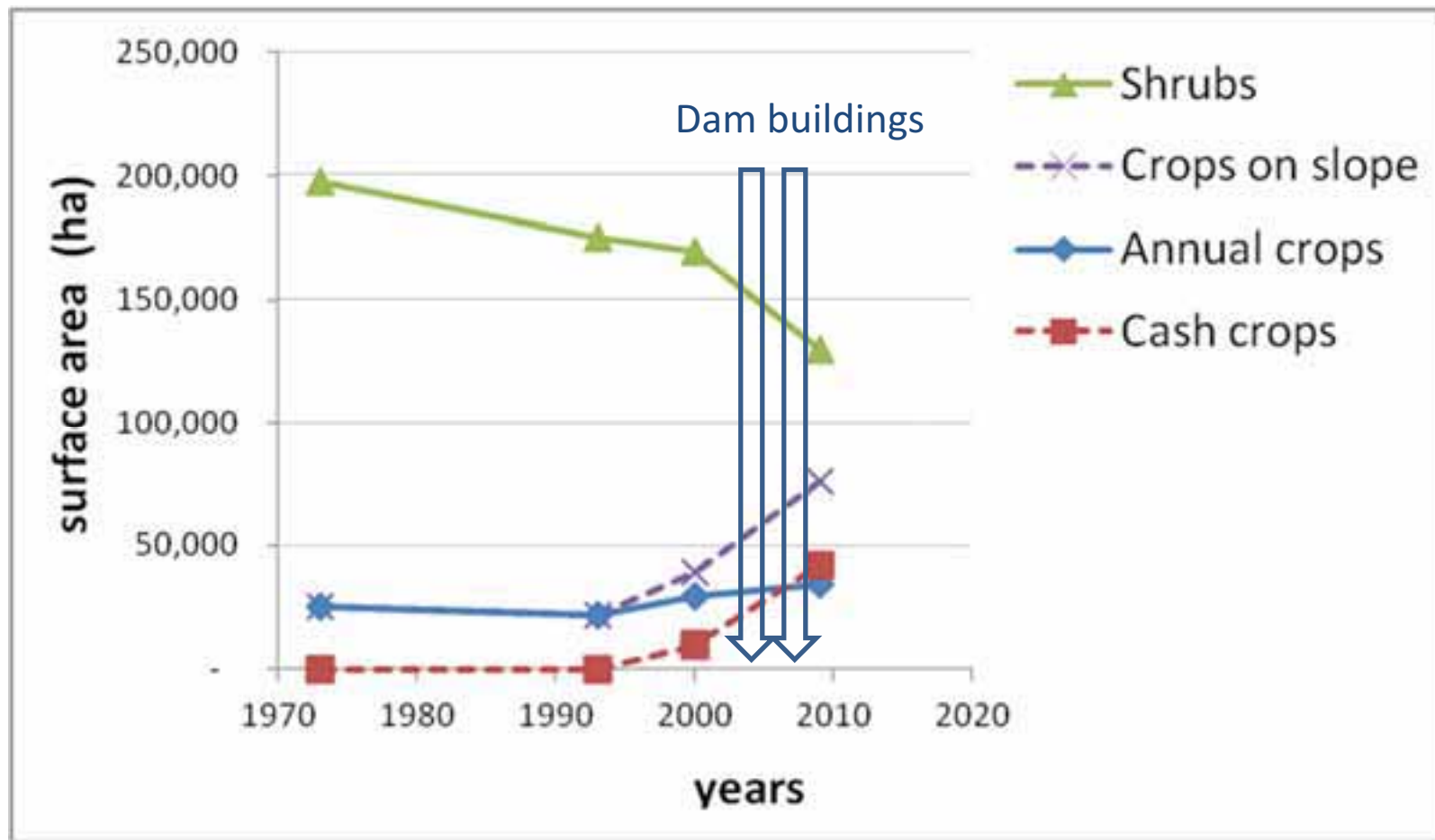
YEAR 2000	ha	%
Annual crops / slopes	29,300	9.4%
Planted forest	--	--
Tea plantation ↗	9,300	3.0%
Shrubs	169,500	54.4%
Secondary forest	69,900	22.4%
Flat Lands	31,800	10.2%
Urbanization ↗	1,900	0.3%



YEAR 2009	ha	%
Annual crops / slopes ↗	34,000	10.9%
Planted forest ↗	23,150	7.4%
Tea plantation ↗	18,600	6.0%
Shrubs ↘	130,000	41.7%
Secondary forest	71,000	22.8%
Flat Lands	28,000	9.0%
Urbanization ↗	6,900	2.2%

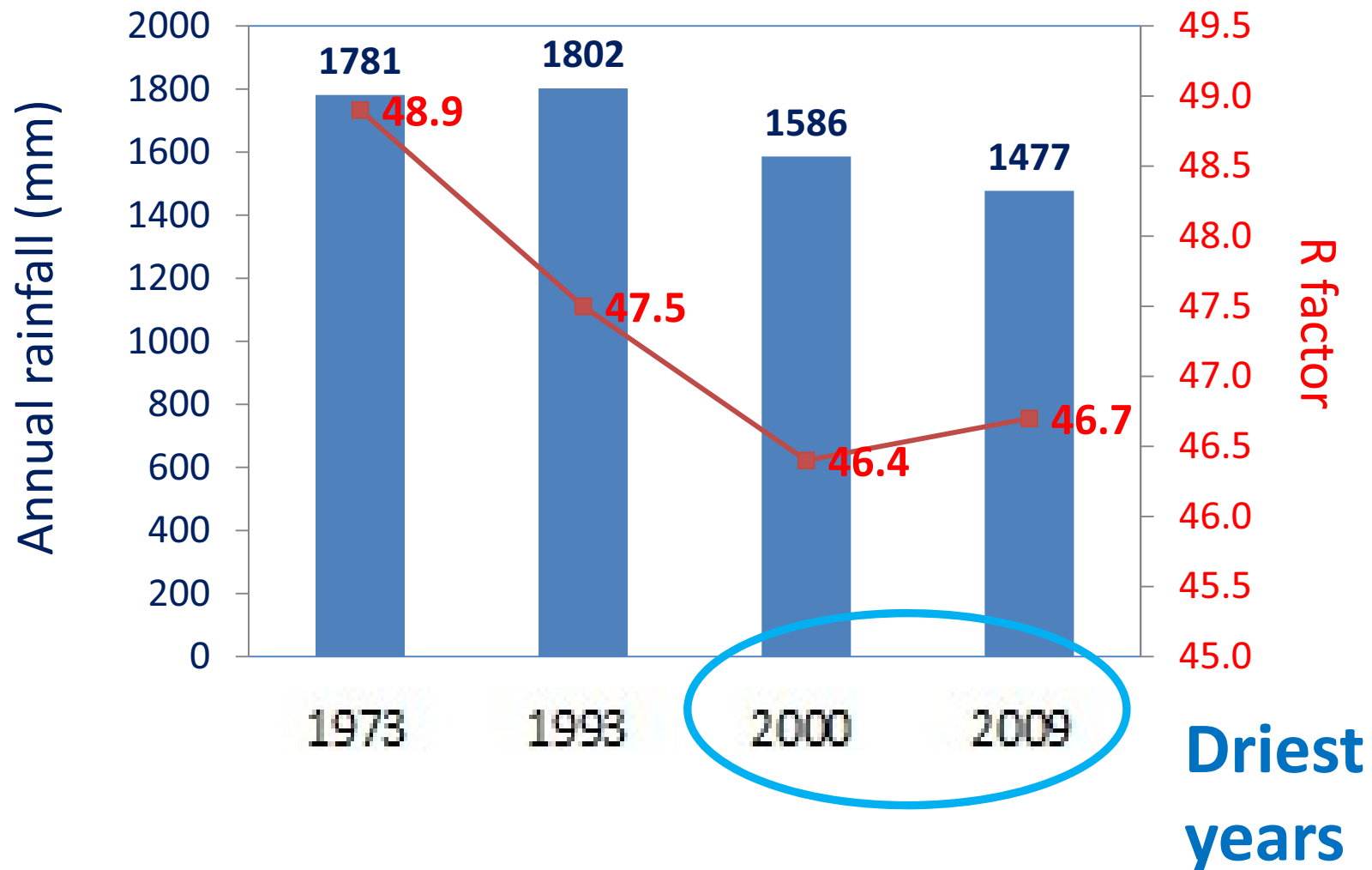
Results and Discussion: LU change

From before 2000 to 2009, there has been a rapid change in land-use as soon as the early 2000's, before the dam buildings.



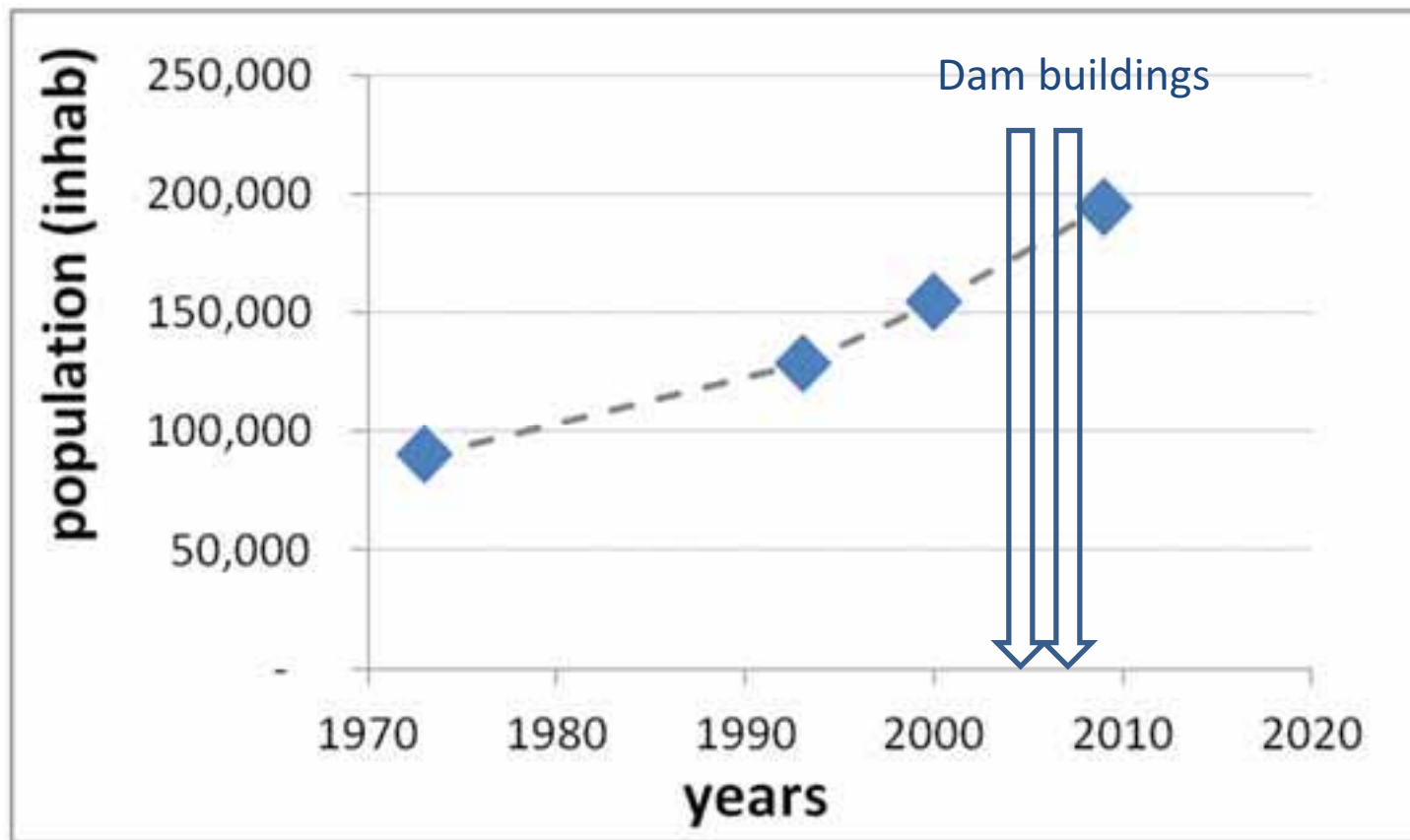
Crops on slope = Annual crops (Maize, Cassava) + Cash crops (Tea, Planted forest)

Résultats et Discussions: Climate Change



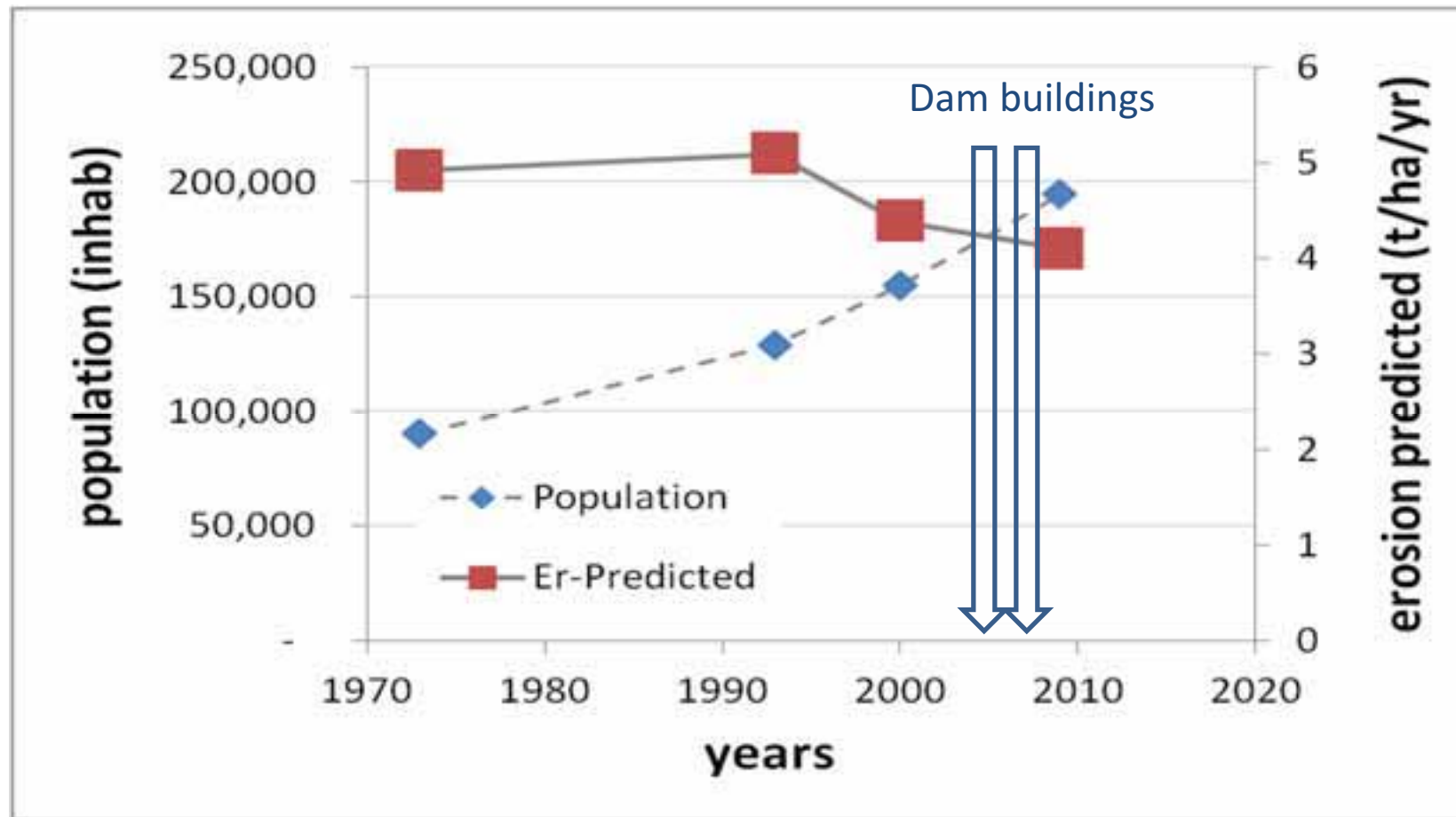
Results and Discussion: **Population growth**

The population has continuously growth from 1973 to 2009, with a small increase after 1993 and mainly after 2000.



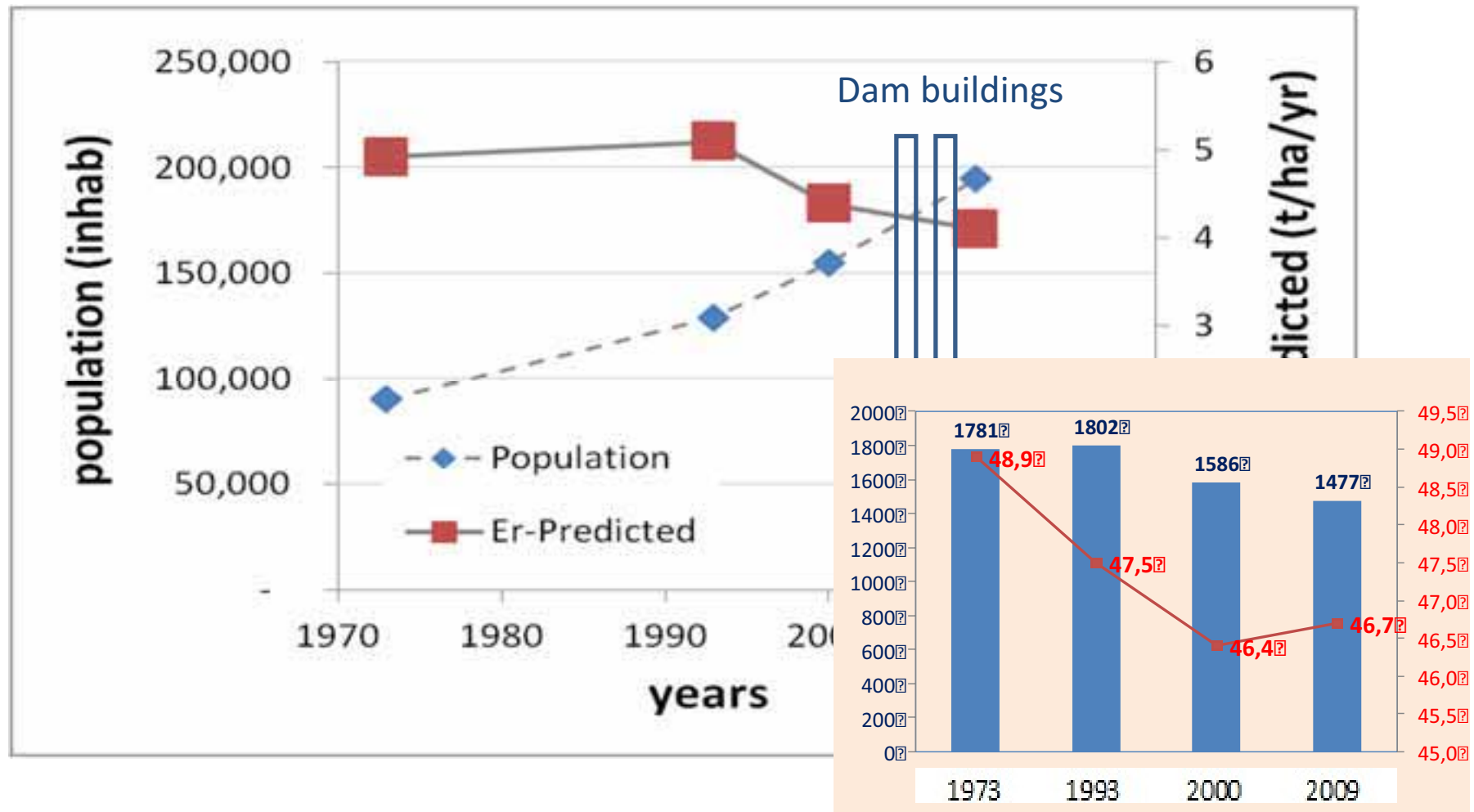
Results and Discussion: Erosion predicted

The erosion predicted by RUSLE is lower in 2000 and 2009 since the rainfall weakness of these last years.



Results and Discussion: Erosion predicted

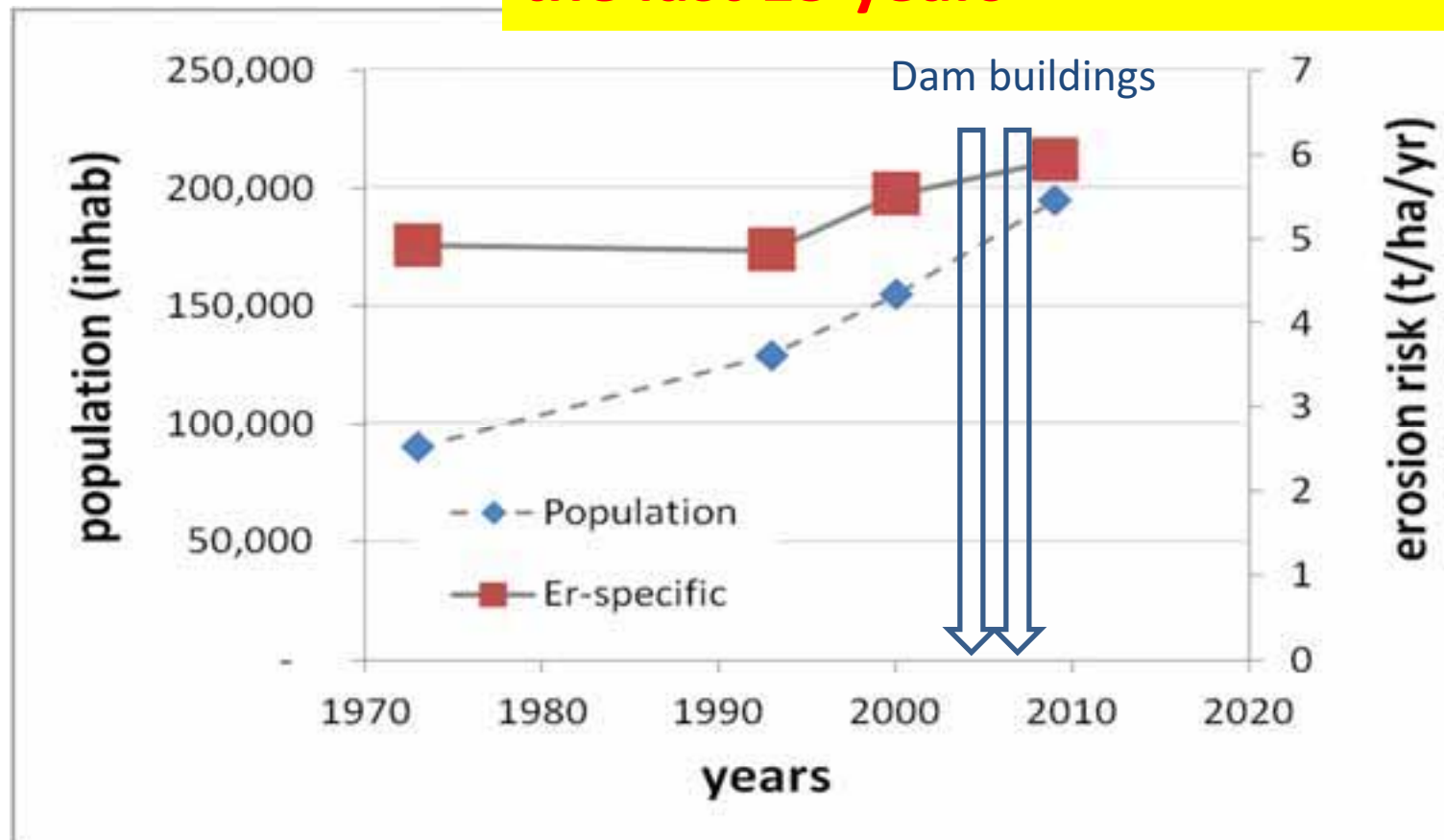
The erosion predicted by RUSLE is lower in 2000 and 2009 since the rainfall weakness of these last years.



Results and Discussion: Erosion risk

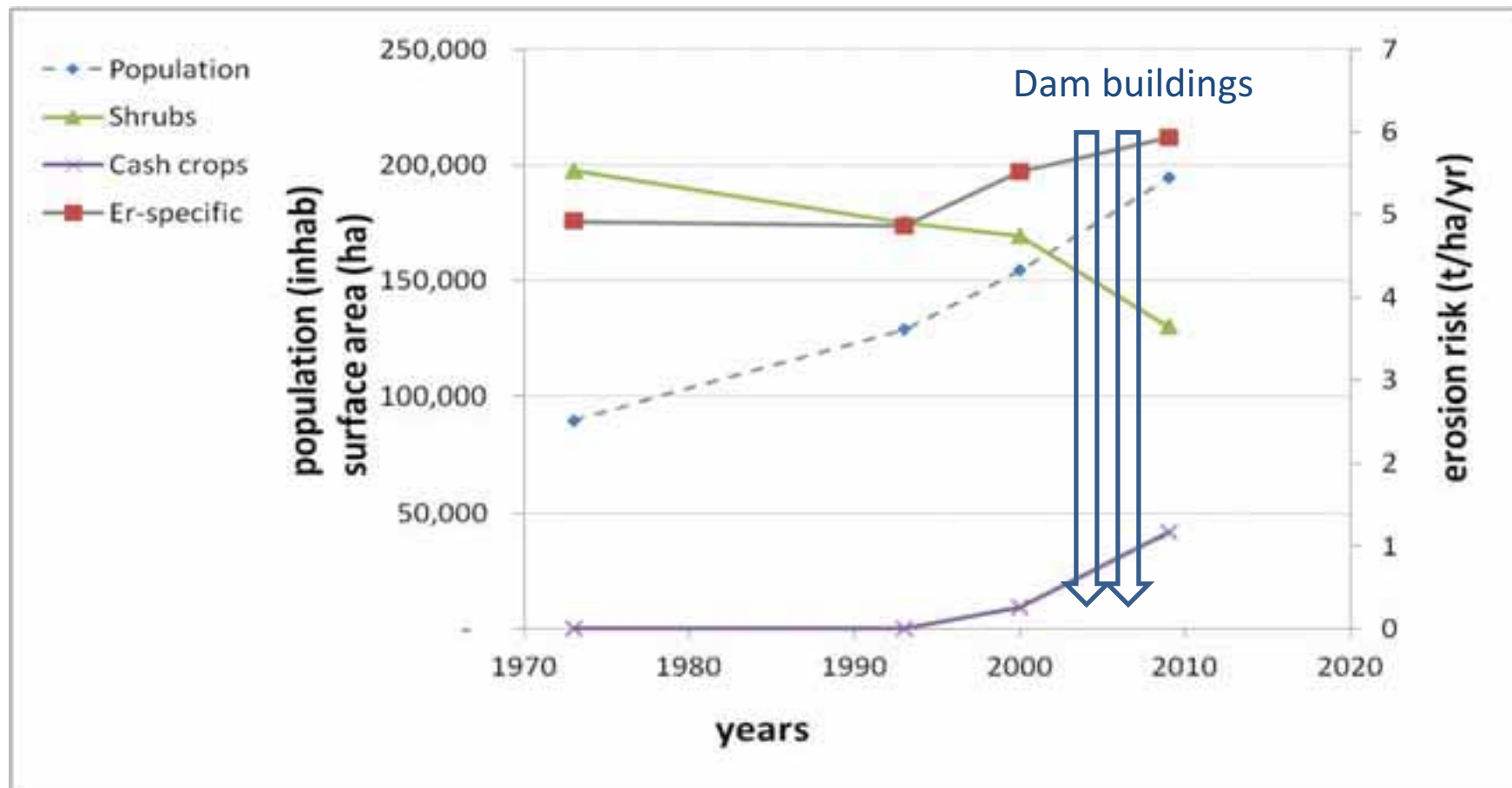
However the erosion risk is increasing from 2000, before the dam buildings.

Erosion risk increases of 20% on the last 15 years



Results and Discussion: Erosion risk


The increase of erosion risk is **driven by the population growth and the cash crops extension**, which forced the decrease of shrubs area.





Conclusion



1. The increase of the erosion has been more important between 1993 and 2000, than after, in spite of a biggest increase of the population during this last period. **It is due to the dramatic decrease of the rainfall amount from 2000.**
 2. However, for the same rainfall amount over the 36 years, the specific erosion increase from 2000, from 4.9 t/ha/yr to 5.9 t/ha/yr. **It means an increase of 21% over last 10 years.**
 3. The increase of erosion from 2000 is directly linked with **the population growth, the increase of cash crop cultivation assumed to be linked to the project of dam buildings.**
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Acknowledgement

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**THANK YOU
FOR YOUR ATTENTION**