Scaling changes in biogeochemistry of small streams to the regional landscape

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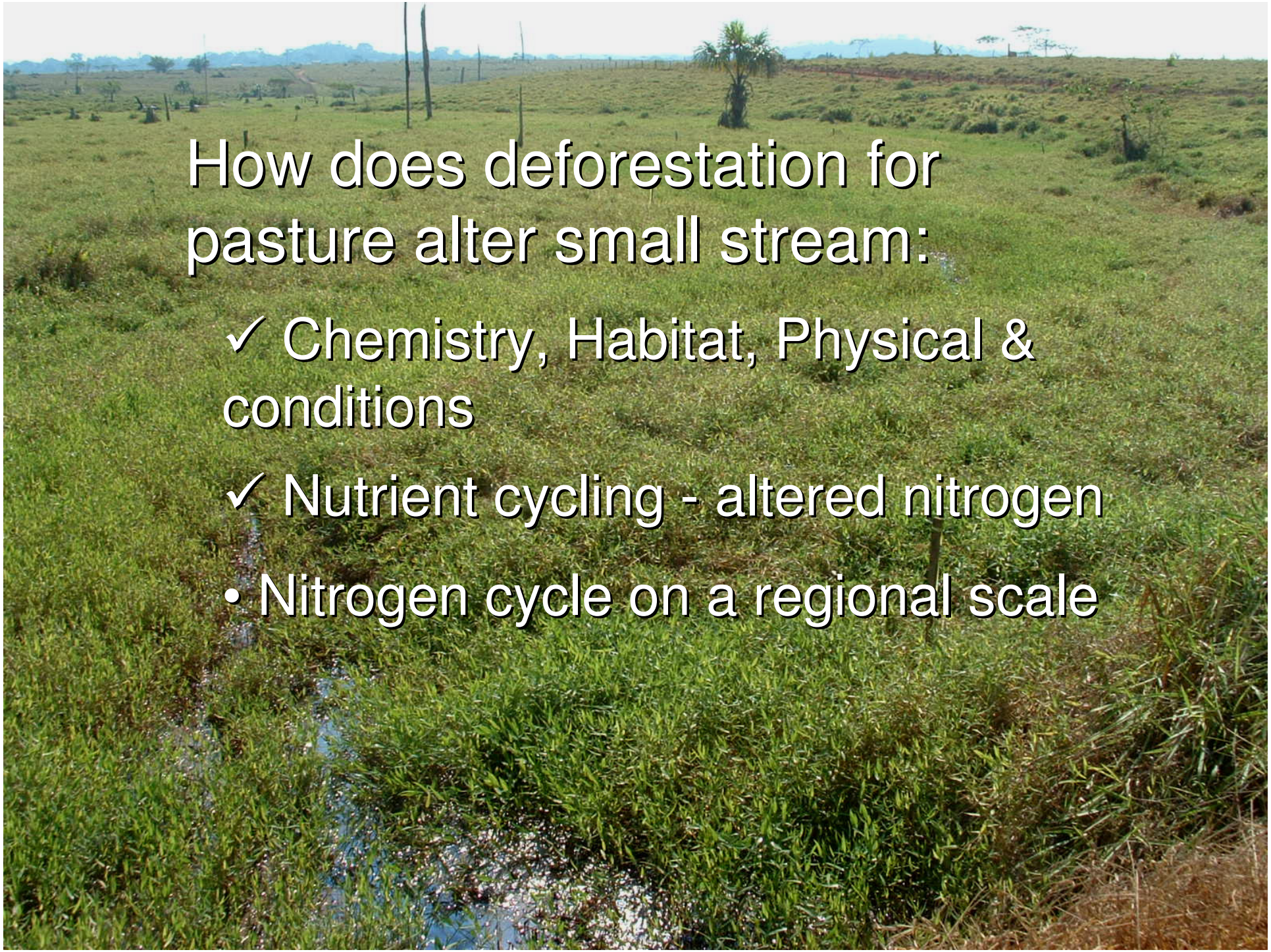
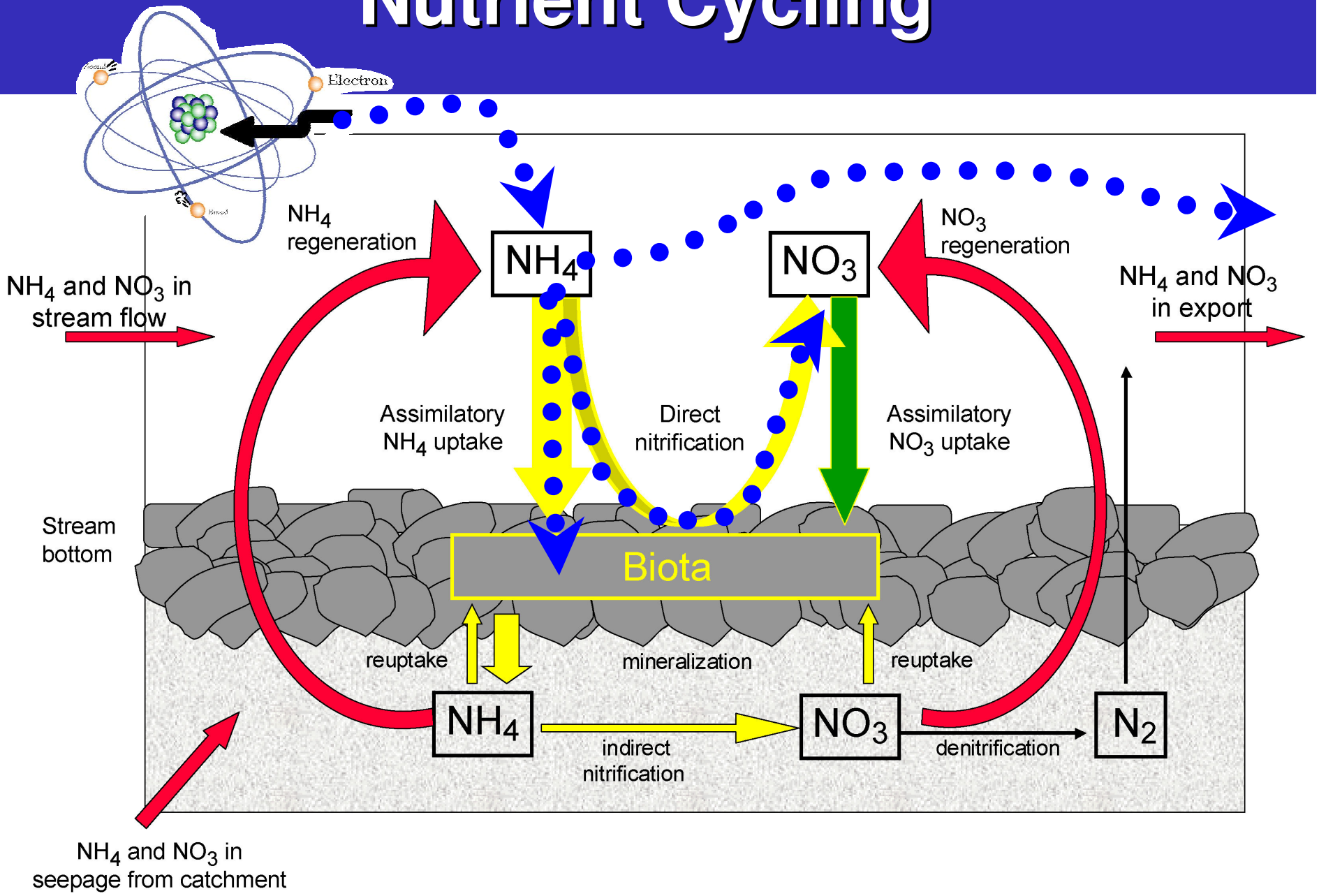


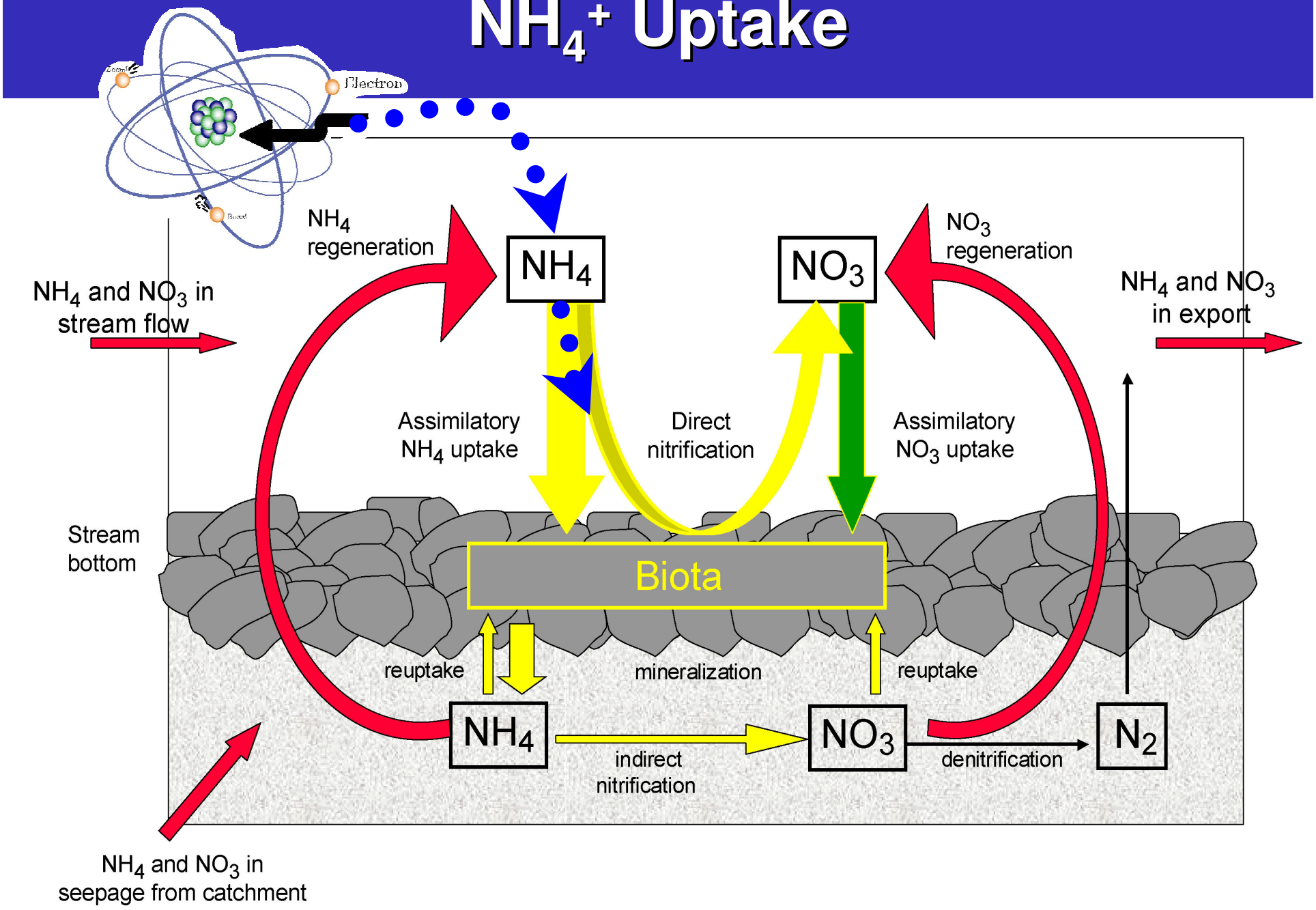
How does deforestation for pasture alter small stream:

- ✓ Chemistry, Habitat, Physical & conditions
- ✓ Nutrient cycling - altered nitrogen
- • Nitrogen cycle on a regional scale

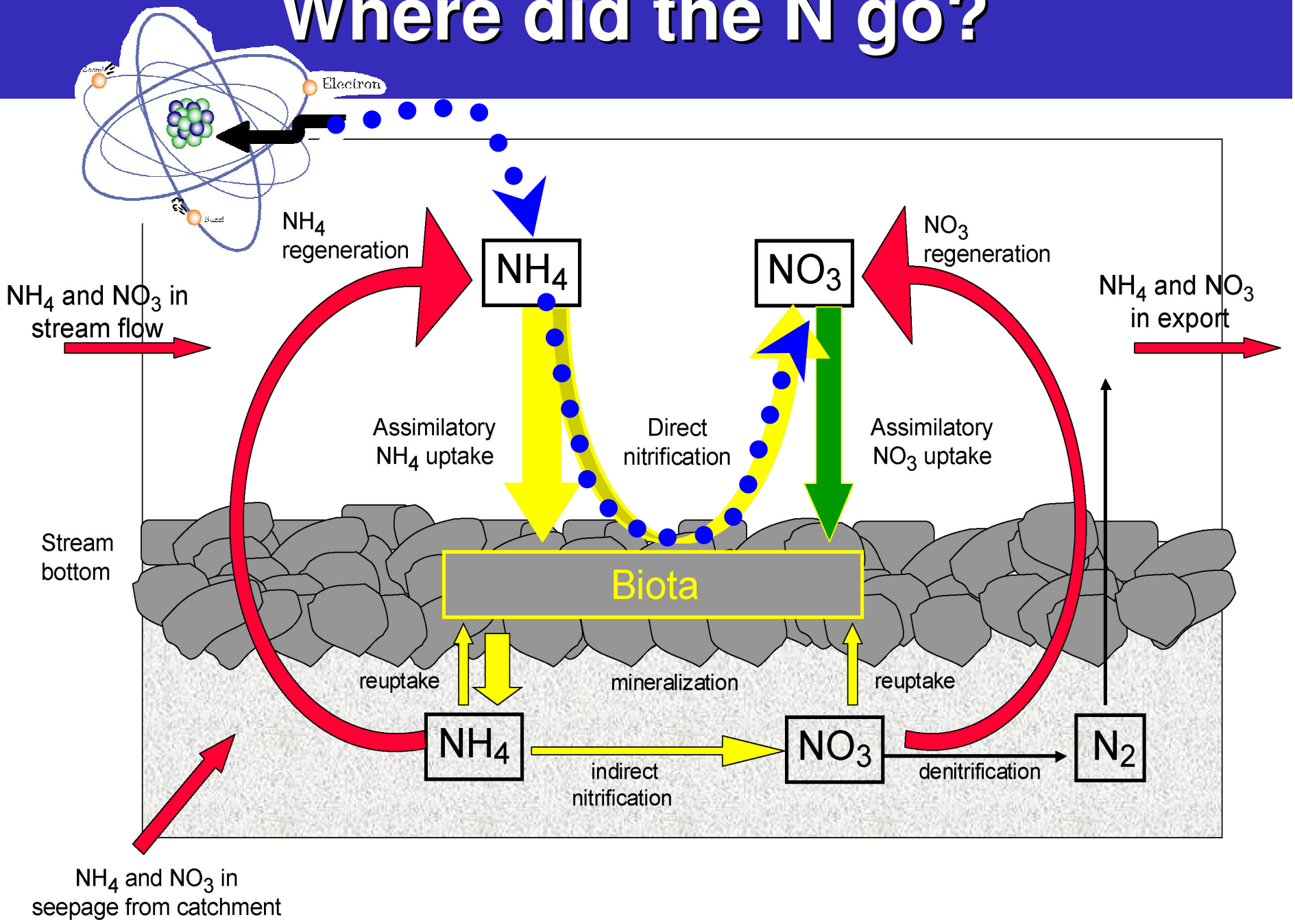
Nutrient Cycling



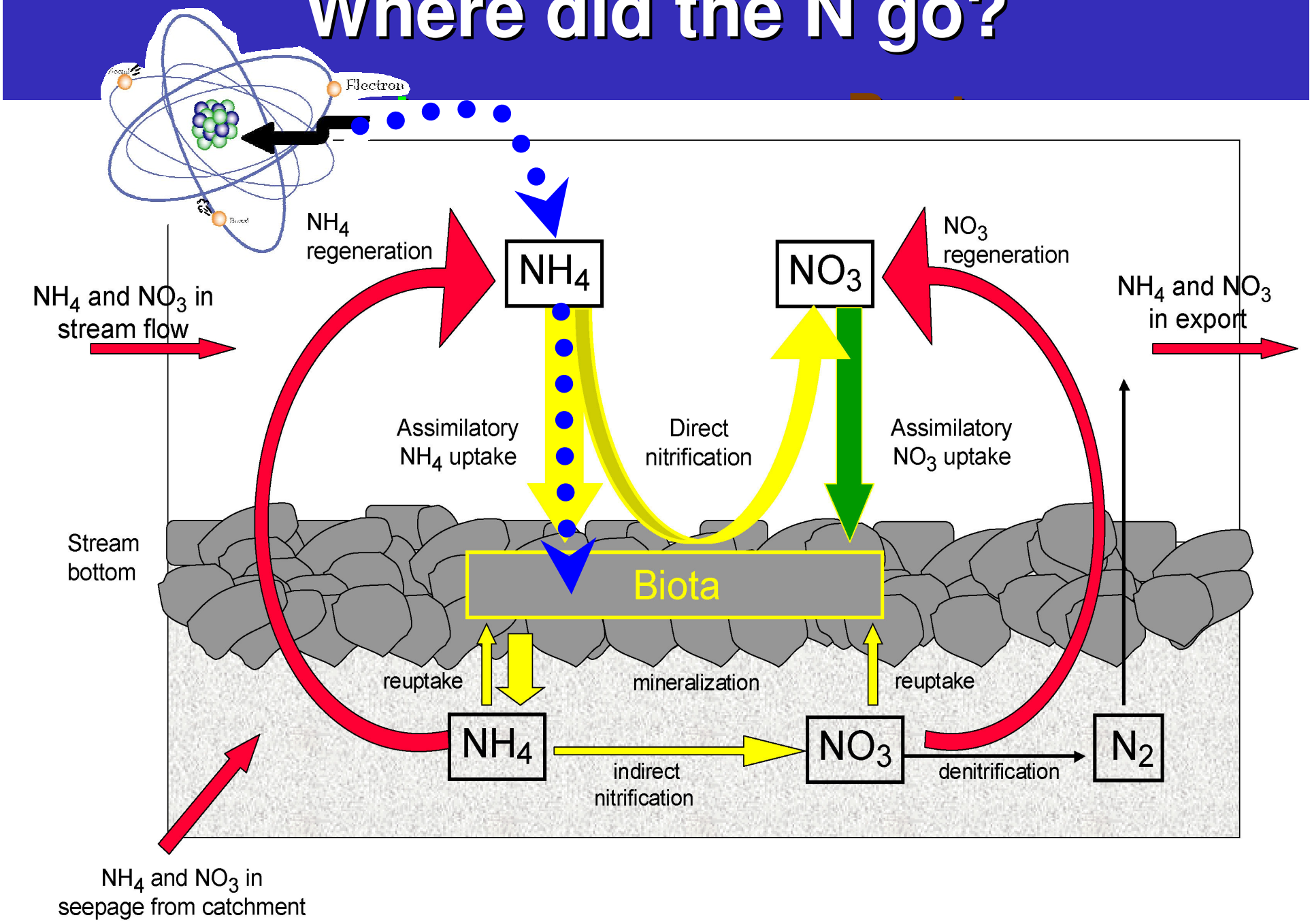
NH_4^+ Uptake


Electron
NH4 regeneration
NH4
NO3
NO3 regeneration
NH4 and NO3 in stream flow
NH4 and NO3 in export
Assimilatory NH4 uptake
Direct nitrification
Assimilatory NO3 uptake
Stream bottom
Biota
reuptake
mineralization
reuptake
NH4
indirect nitrification
NO3
denitrification
N2
NH4 and NO3 in seepage from catchment

Where did the N go?



Where did the N go?



Change From Export to Storage

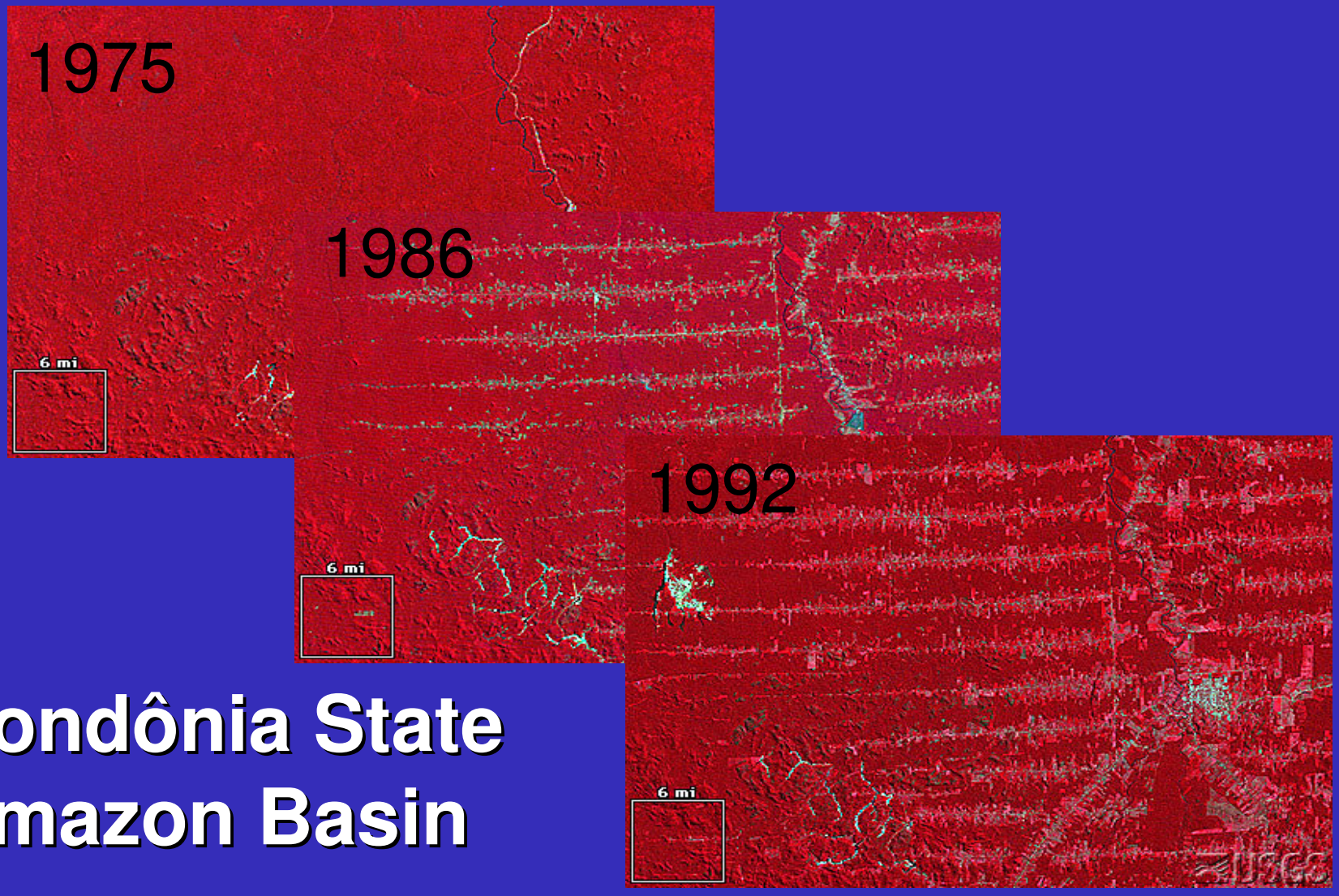
Forest streams have *very* long N travel distances and are P limited. Most N flows unchanged on to larger rivers.

	% OF N ADDED	
	Export	Storage
Forest	67	1
Pasture	21	58

Pasture streams disappear under grasses that fill in the channel and slow water movement, resulting in greater N uptake and retention.

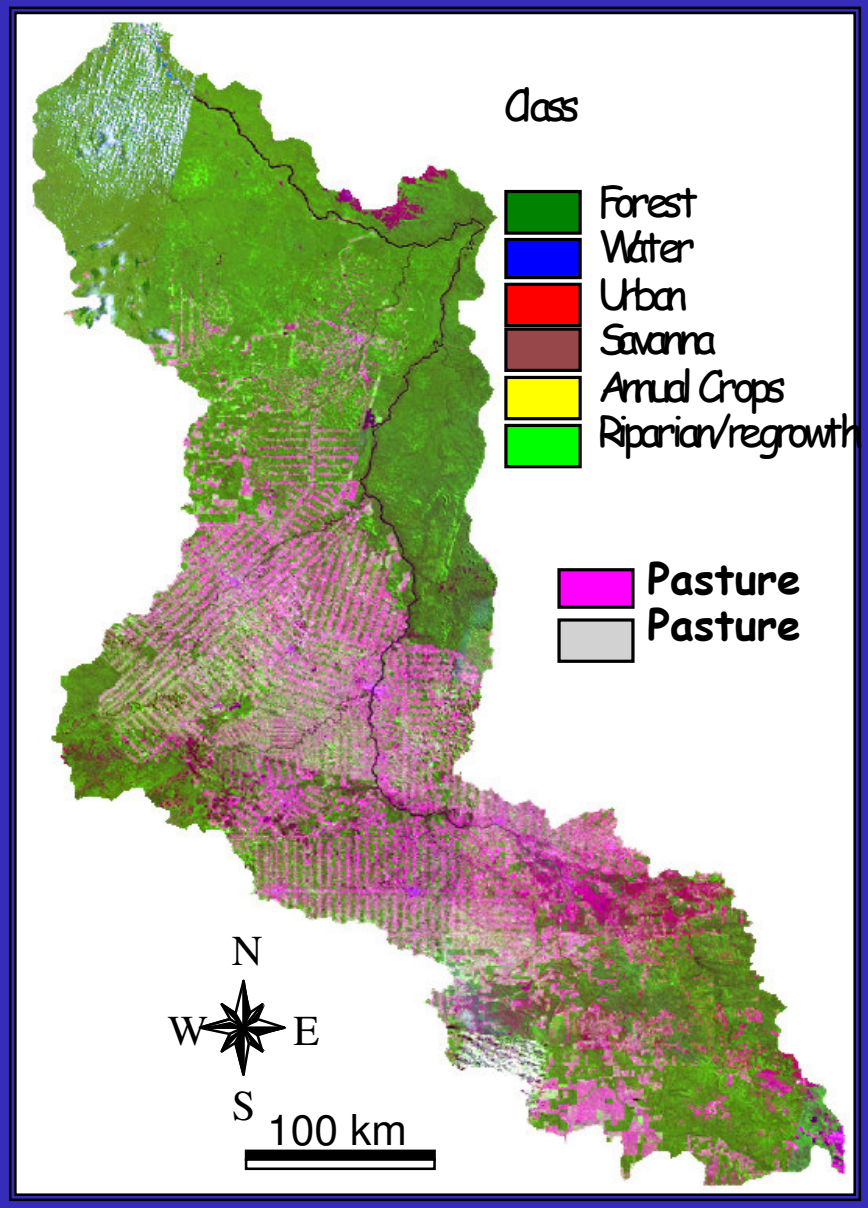
LBA III: Scaling up to larger region

Take process based measurements to the regional scale



Rondônia State
Amazon Basin

LBA III: Scaling up to larger region

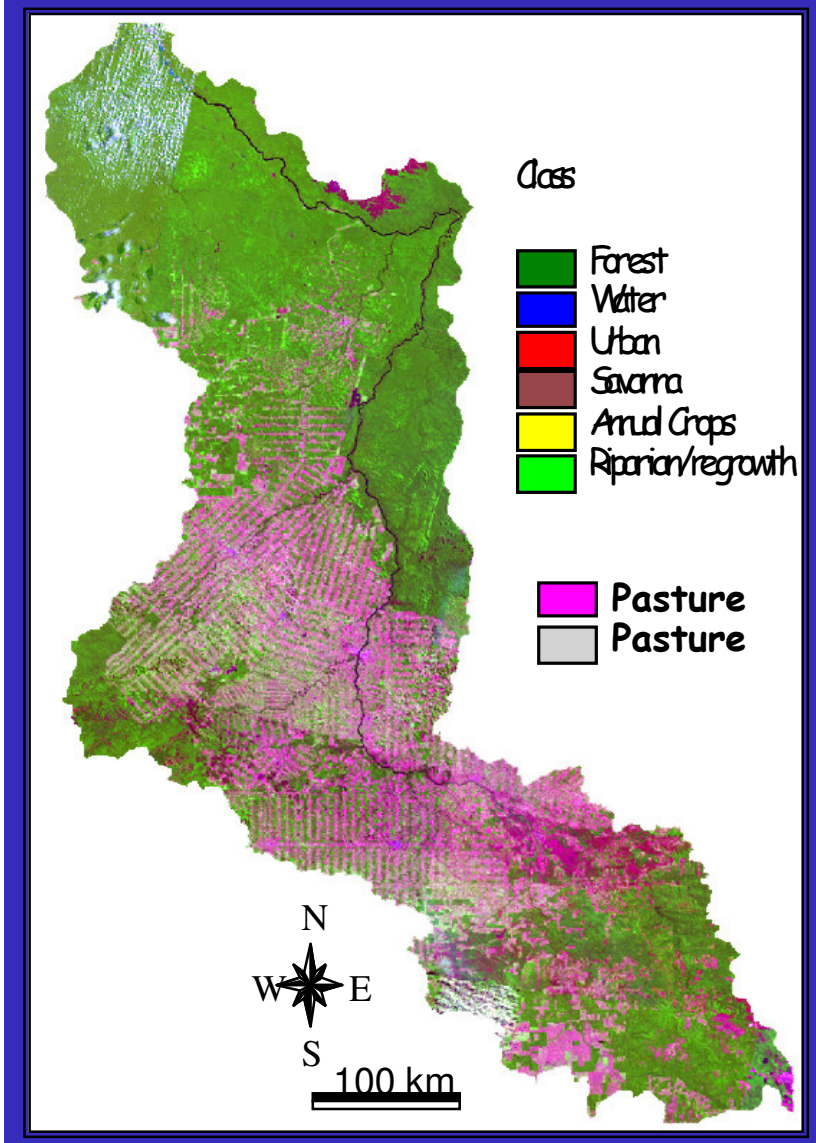


Ji Paraná River Basin, Rondônia

1) Determine land use for the watershed

2) Overlay river network, including new determination of 1st and 2nd order streams based on IKONOS images and a refined DEM

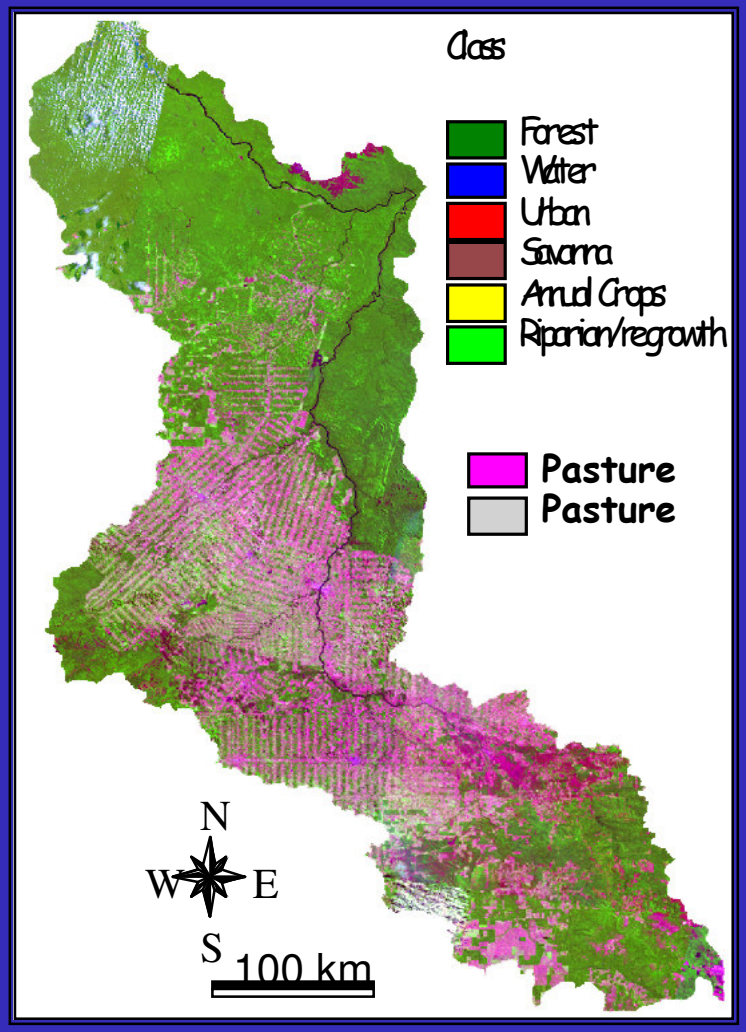
LBA III: Scaling up to larger region



Ji Paraná River Basin, Rondônia

% of area deforested	30
Km 1st and 2nd order streams altered	7,102

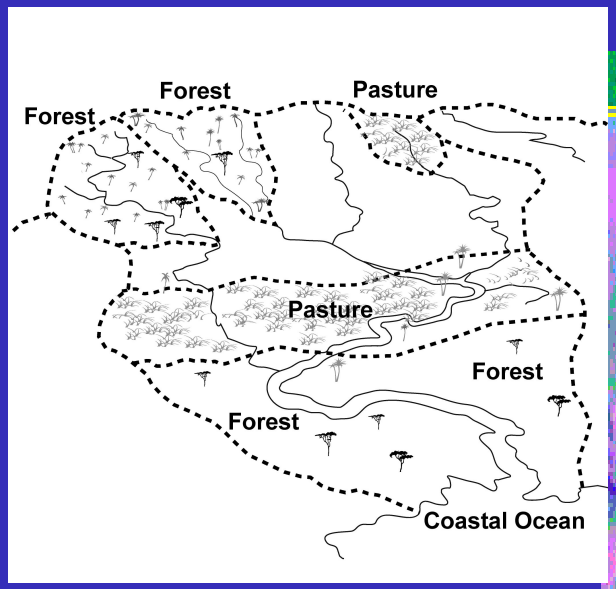
Small Stream Alteration has a Disproportionate Impact

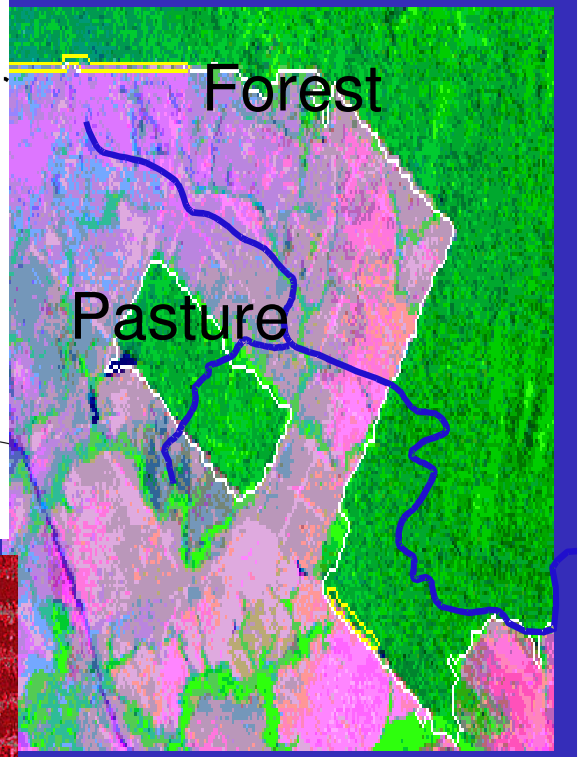


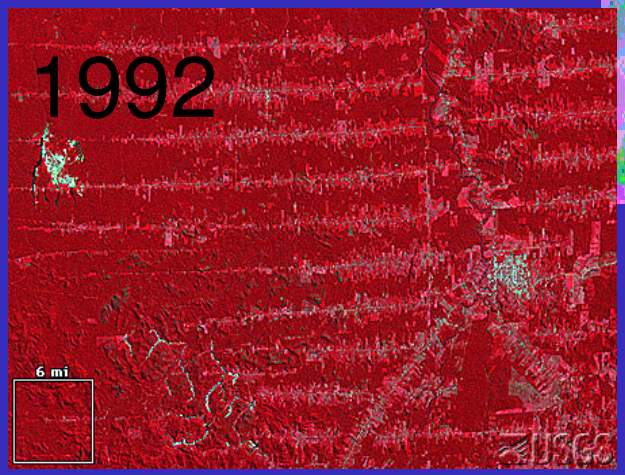
700% increase N retention
30% land altered

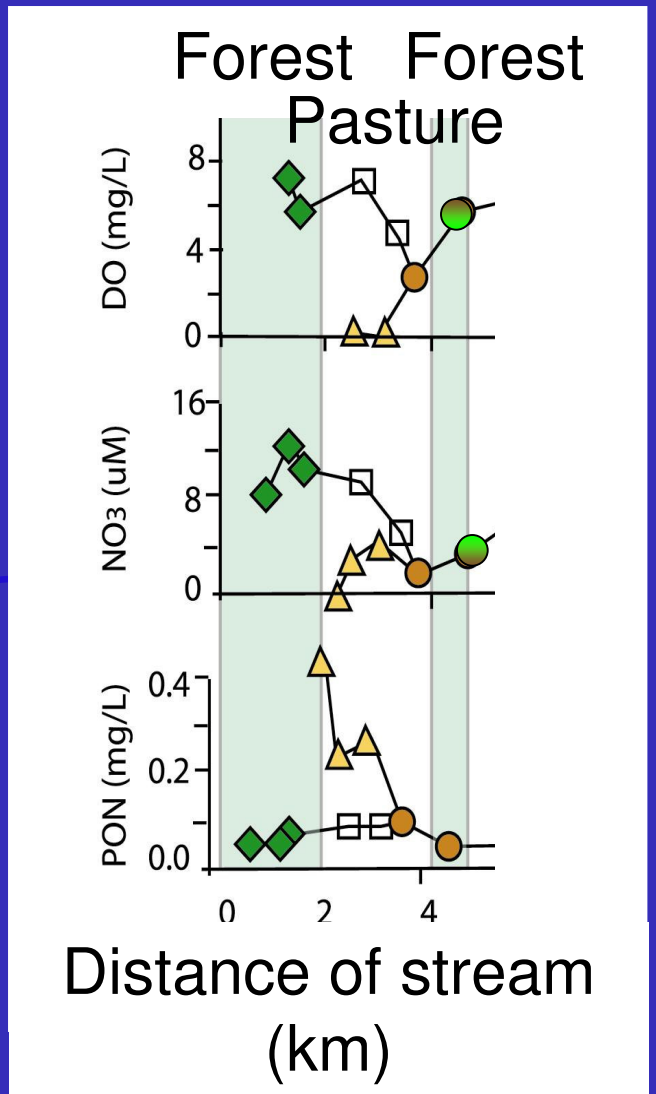
Total N Uptake by small streams in watershed

LBA III: Next step - Link land use mosaic to stream function at the regional scale







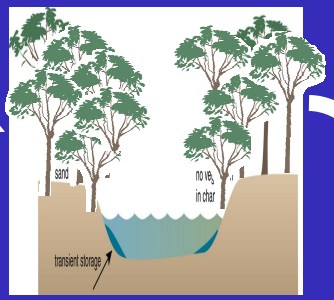


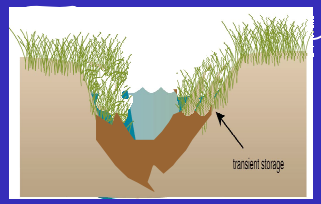
LBA III: Next step - Link land use mosaic to stream function at the regional scale

PROCESS MODELS

Terrestrial (TEM)

Stream (Model developing using ^{15}N addition)





REGIONAL LANDSCAPE

Spatially explicit land use and river network

Predict N & C delivery to Larger Rivers

Disappearing Streams

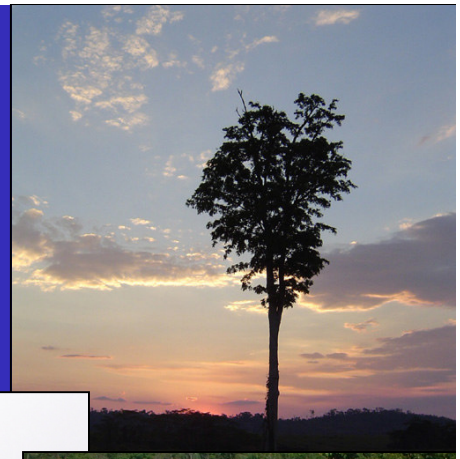
Small streams fill with pasture grass
Cascading effects - high plant debris, low oxygen, slow water movement

Disappearing ecosystem function

- **Loss of animal diversity and productivity**
- **Complete switch in nutrient cycling**
  - ✓ **Change limiting nutrient P to N**
  - ✓ **Change from export to retention of N**

Change to a more N retentive landscape?

Thank you



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  - Chris Neill, Suzanne Thomas, Christie Haupert, Jerry Mellilo, Paul Steudler
- CENA-USP, Piracicaba, Brazil:
  - Alex Krusche, Victoria Ballester, Reynaldo Victoria, Alaide Gessner, Jean Ometto, Cristiane Tumang Frare, Adriana Bonilla, Sergio Neto
- Nova Vida Ranch
- NSF and NASA LBA-ECO program